Review of Kinder Morgan Pipeline Expansion Project Application

Human Health Impact Assessment

Expert Report

Completed for:

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1 Summary

My analysis focused on public health concerns regarding Kinder Morgan's (KM) Trans Mountain Expansion Project (TMEP) with an emphasis on the human health risk and impact assessment performed by KM and its consultants. I examined KM's analysis of the human health impacts that are likely to arise from (1) fugitive emissions from normal operations of the pipeline, terminal and tankers; (2) a pipeline rupture or release occurring along the pipeline route through the Fraser Valley and Metro Vancouver; (3) a rupture, release or spill occurring at the terminal; and (4) a release or spill occurring on the tanker route within Burrard Inlet and Juan de Fuca/Haro Straits. My examination included materials prepared for the TMEP as well as KM's responses to relevant Information Requests.

For both routine emissions and accidental releases, the human health risk and impact assessments completed for the TMEP do not provide the information needed to assess human health risks. Due to the many significant omissions and use of flawed methods and analyses, the assessments completed do not provide accurate predictions of the potential health effects that might result from fugitive emissions, ruptures, releases and spills at the terminals, along the pipeline, or on waterways; rather, the completed assessments underestimate the potential risks. The human health risk and impact assessments completed for the TMEP do make it clear, however, that both routine operations as well as accidental spills and releases have the potential to cause significant chemical exposure and harm public health.

2 Introduction

2.1 Scope of Work

I have been retained by Living Oceans Society to review the application of Kinder Morgan for its Trans Mountain Expansion Project (TMEP) with respect to the human health impact assessment, in particular, assessments of the human health impacts likely to arise from (1) fugitive emissions from normal operations of the pipeline, terminal and tankers; (2) a pipeline rupture or release occurring along the pipeline route through the Fraser Valley and Metro Vancouver; (3) a rupture, release or spill occurring at the terminal; and (4) a release or spill occurring on the tanker route within Burrard Inlet and Juan de Fuca/Haro Straits.

2.2 Statement of Qualifications

My analyses and opinions in this report are based on my years of experience as an environmental health scientist and engineer studying air pollutants, pollutant exposures, health impacts and health risks. My research interests and expertise includes exposure science, risk assessment and epidemiology in community, occupational and environmental settings, especially dealing with air pollutants. My laboratory specializes in trace measurements in biological and environmental samples and conducts a wide range of laboratory and field studies, as well as modeling and statistical analyses. I lead the Exposure Assessment Core of the NIEHS P30 Center at the University of Michigan (UM), and I am center director of the NIOSH T42 UM Center for Occupational Health and Safety Engineering. I lead and participate in other research examining exposures in homes, schools, workplaces, communities and other settings, and I examine linkages between exposures and diseases. I serve or have served on various state and federal panels, including Michigan's Air Toxics Committee, and have provided expert reports and testimony in the USA, Canada, and South Africa. I have supervised or co-directed over 70 research projects, several education and training programs, mentored over 35 pre-doctoral and postdoctoral students, and published over 165 peer-reviewed journal articles and 300 abstracts, reports and proceedings. I teach environmental impact assessment and hazardous substances management at the graduate levels at UM and have provided instruction and seminars on these and other topics in the US and internationally for over 30 years.

In addition to my experience and education, I considered the available data and other information in conducting my analysis and forming my opinions, and have cited key references in footnotes in this report. A copy of my current curriculum vitae is attached as Appendix 1 that summarizes my education, training and experience, and which provides a list of my publications.

2.3 Documents Reviewed

Documents reviewed for this review include, but are not limited to, the following:[1]

- B001 – Trans Mountain Pipeline ULC – Trans Mountain Expansion Project - Volume 1: Application Summary. File: A3S0Q7. Folder: A55987.
- B002 – Trans Mountain ULC – Trans Mountain Expansion Project - Volume 4A: Project Design and Execution – Engineering. Files: A3S0Y8 to A3S1F2. Folders: A55999 and A56000.
- B005 – Trans Mountain ULC – Trans Mountain Expansion Project - Volume 5B: Environmental And Socio-Economic Assessment For The Trans Mountain Pipeline ULC Trans Mountain Expansion Project. Files: A3S1R5 to A3S1T0. Folder: A56004.
- B006 – Trans Mountain ULC – Trans Mountain Expansion Project - Volume 5C – Part 1: Air Quality and Greenhouse Gas Technical Report for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project. Files: A3S1U0 to A3S1U7. Folder: A56006.
- B018: Trans Mountain ULC – Trans Mountain Expansion Project - Volume 7: Risk Assessment and Management of Pipeline and Facility Spills. Files: A3S4V5 to A3S4V6. Folder: A56025
- B018: Trans Mountain ULC – Trans Mountain Expansion Project - Volume 8A: Marine Transportation. Files: A33S4X3 to A3S4Z0 Folder: A56025.

[1] Most TMEP documents were obtained from the NEB site.

- B019: Trans Mountain Pipeline ULC – Trans Mountain Expansion Project – Volume 8B. TR 8B-7: Ecological Risk Assessment of Marine Transportation Spills. Files: A3S4K7 to A3S4R0 Folder: A56022.
- B107: Intrinsik, Human health risk assessment of Westridge Marine Terminal. Technical report for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project, June 2014 SREP-NEB-TERA-00003, Calgary, Alberta. Files: A3Y1F4 to A3Y1F5. Folder: A61084.
- B088: Intrinsik Environmental Sciences. 2014. Human Health Risk Assessment of Pipeline Spill Scenarios for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project. SREP - NEB - TERA - 00005. June 2014. Calgary, Alberta. File: A3X6U1. Folder: A60834.
- B106: Intrinsik, Human health risk assessment of facility and marine spill scenarios. Technical report for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project. June 2014, SREP-NEB-TERA-00006, Calgary, Alberta. Files: A3Y1E9 to A3Y1F2. Folder: A61083.
- B279: Trans Mountain Pipeline ULC – Redacted Emergency Management Program documents, October 17, 2014. Files: A4D3E8 to A4DD3F4. Folder: A63573.
- C214: Trans Mountain Pipeline ULC Trans Mountain Expansion Project NEB Hearing Order OH-001-2014 Responses to Information Request from Living Oceans Society.

2.4 Provisions

My opinions in this expert report are based on my education, professional experience, information and data available in the scientific literature, as well as information and data about this application. I continue to review available information, and I reserve the right to modify or supplement this report and the opinions contained herein on the basis of any subsequently obtained material information.

2.5 Selected Acronyms

The report uses the following acronyms.

AEGL Acute Exposure Guideline Levels
AAAQO Alberta Ambient Air Quality Objectives
CLWB Cold Lake Winter Blend (oil)
COPC chemicals of potential concern
CWC credible worse case
ERA ecological risk assessment
ERPGs Emergency Response Planning Guidelines
HHRA human health risk assessment
HSDA Health Service Delivery Area
KM Kinder Morgan
MTBE methyl tert butyl ether
MPOI maximum point of impingement
NO_2 nitrogen dioxide
NO_x oxides of nitrogen
O_3 ozone
$PM_{2.5}$ particulate matter below 2.5 microns in diameter
RSA Regional Study Area
RMLBV remote main line block valve
TMEP (Kinder Morgan) Trans Mountain Expansion Project
TMPL Trans Mountain Pipe Lines (refers also to associated facilities)
US EPA U.S. Environmental Protection Agency
VOC volatile organic compound

3 Assessment of Human Health Impacts

3.1 Fugitive emissions from normal operations of the pipeline, terminal and tankers

3.1.1 The assessment of human health effects associated with short- and long-term chemical exposures at the Westridge Marine Terminal and other terminals under routine operating conditions completed in the refined human health risk assessment (HHRA)[2] followed a conventional HHRA paradigm that involves the following steps: problem formulation, exposure assessment, toxicity assessment, risk characterization, and uncertainty analysis. The TMEP assessment focused on air emissions.

3.1.2 *The evaluation of inhalation risks performed for terminal emissions compares "cases" that are misleading and not comparable, with the effect of significantly underestimating Kinder Morgan's impacts*.

The "base case" uses existing conditions in the Air Quality Regional Study Area (RSA), including the current chemical emissions from the existing Westridge Marine Terminal and the existing marine vessel traffic in the Air Quality RSA. Importantly, the base case includes current emissions from the existing tank

[2] Intrinsik, Human health risk assessment of Westridge Marine Terminal. Technical report for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project, SREP-NEB-TERA-00003, June, 2014 (A3Y1F4 to A3Y1F5), and Technical Report 5D - 7 in Volume 5D, Screening Level Human Health Risk Assessment of Pipeline and Facilities Technical Report (A4S2L1) (Intrinsik Environmental Sciences Inc. December 2013).

terminals and other sources at the KM Westridge Marine Terminal that are under the control of the applicant, although they are not considered part of the TMEP. For this reason, concentrations attributable to KM-associated operations should be clearly identified.

The "application case" is defined using "existing conditions" in the Air Quality RSA, plus the emissions associated with the Westridge Marine Terminal expansion and the Project-related increase in marine vessel traffic within the Air Quality RSA.[3] However, unlike the base case, the application case also includes the anticipated changes in future marine fuel regulations and the more stringent NO_x emission requirements.[4]

The approaches used to define the base and application cases are not comparable and thus the difference between these cases does not show the incremental impact of the proposed TMEP. Instead, this comparison has the effect of significantly lowering the reported impacts due to KM and TMEP operations since the application case uses the assumed fuel regulations and more stringent NO_x emission requirements that are assumed to come into effect, rather than the higher current emission rates that define the base case.

The appropriate comparison would use the same marine fuel regulations and the same NO_x emission requirements in both cases. This would show the incremental impact of the TMEP.

In addition, the HHRA states neither the quantitative reduction in emissions nor the timeframe for the emission reductions that are assumed to result from new regulations and new NO_x controls. Nor does the assessment explicitly differentiate between the emissions and impacts of current operations and those that would come from the TMEP.

In summary, the result of the analyses provided by KM significantly underestimates the true impact of the TMEP's operations on air quality in the Westridge Marine Terminal area and environs.

3.1.3 There is no plan for environmental monitoring or health surveillance to verify the assumptions, predictions, and conclusions in the HHRA. The application should consider monitoring key environmental parameters, beyond the usual compliance-oriented monitoring, to ensure that the assessment is protective of health and the environment. For example, *KM should consider establishing air quality monitors for $PM_{2.5}$, NO_x, SO_2 and other pollutants at hotspot locations.*

3.1.4 The refined HHRA found that the predicted short-term inhalation exposures of the respiratory irritants mixture exceeded the exposure limit by 40% at the maximum point of impingement (MPOI). The HHRA then indicates this exceedance is largely due to nitrogen dioxide (NO_2) followed by sulphur dioxide (SO_2), two gases that are primarily emitted from the existing tugs, and to a lesser extent, the main engines of the existing tankers. However, even with the limitations imposed by the way the cases are compared (as noted in 3.1.2 above), *KM and TMEP project emissions constitute a significant fraction of the risk*, approximately half of the risk (or exceedance).[5] Thus, it is important that emissions from KM and TMEP operations be decreased to lower exposures and inhalation risks.

3.1.5 Tug and tanker emissions, implicated in the exceedance of air quality limits discussed in 3.1.4 above, will occur all along the tanker route, and thus will produce plumes that potentially affect long sections of coastline. The assessment focuses only on a single location, the MPOI, and does not indicate the magnitude of concentrations along the coastline, at other potentially affected areas, and at sensitive

[3] Intrinsik, Human Health Risk Assessment of Westridge Marine Terminal. Technical report for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project, Section 3.2.2: Exposure Assessment,SREP-NEB-TERA-00003, June 2014 (A3Y1F4) at PDF page 30

[4] Intrinsik, Human Health risk assessment of Westridge Marine Terminal. Technical report for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project, Section 3.2.2.1: Inhalation Assessment, SREP-NEB-TERA-00003, June 2014 (A3Y1F4) at PDF page 31

[5] Human Health Risk Assessment of Marine Westridge Terminal, Figure 5.1: Acute Inhalation Risk Quotients for the Respiratory Irritants Mixture , SREP-TERA-00003, June 2014 (A3Y1F4) at PDF page 94

receptors that are expected with both current and future tanker and tug traffic and other emissions associated with KM and TMEP. *Instead, the analysis should indicate the maximum hourly concentrations along the coastline and other areas*, using maps and other means to identify the region and population potentially affected, including vulnerable populations.

3.1.6 Figure 5.1 (A3Y1F4, page 93) shows that urban dwellers also approach and possibly exceed the exposure limit for the acute respiratory irritants mixture, and *TMEP project-associated emissions are responsible for about half of the exposure*. Again, as stated in 3.1.5, it is important to reduce emissions from KM and TMEP operations to lower exposures and inhalation risks.

3.1.7 The assessment indicates that the respiratory irritant mixture will exceed the exposure limit 0.9% of the time or 74 hours per year in the base case, and 79 hours per year under the application case.[6] These are frequent and regular occurrences, i.e., it represents 79 times per year that the exposure limit is exceeded.

3.1.8 Assuming the new regulations come into play (i.e. what is assumed in the application case), Figure 5.1 (A3Y1F4, page 93) indicates that there would no exceedances of the exposure limit for the acute respiratory irritants mixture without the TMEP. As noted in 3.1.7 above, with the TMEP, there will be 79 hours per year when this exposure limit will be exceeded in the application case. In effect, this analysis demonstrates that TMEP-associated emissions will lead to regular degradation of air quality that would not otherwise occur if TMEP was not approved.

3.1.9 The assessment indicates that 1-hour NO_2 concentration of 210 µg/m³ exceeds the Metro Vancouver Ambient Air Quality Objective (AAQO) of 200 µg/m³ and the US EPA National Ambient Air Quality Standard (NAAQS) of 188 µg/m³ (ACY1F4, page 60). *The analysis demonstrates a serious degradation of ambient air quality with respect to NO_2 due to TMEP-associated emissions.*

3.1.10 The air quality modeling in Volume 5 Section 5.3.1.4[7] for the combined Burnaby and Westridge Marine Terminals show exceedances of the $PM_{2.5}$ Metro Vancouver Objectives (MVO, 25 ug/m^3), and the 1-hr NO_2 Alberta Ambient Air Quality Objectives (AAAQO, 200 ug/m^3). Predicted $PM_{2.5}$ concentrations are nearly twice the MVO. Both pollutants are associated with a range of serious cardiovascular and respiratory impacts including asthma and other chronic diseases, as well as death. $PM_{2.5}$ is one of the most important pollutants in terms of the mortality and morbidity associated with even low concentrations, including concentrations below the MVO.

3.1.11 Had the national Ambient Air Quality Objectives for benzene been applied (curiously, this was omitted although other national standards were inserted into Table 5.21)[8], the 1-hr benzene concentration (30 ug/m^3) would also be exceeded. Benzene can cause several types of cancer. *The analysis demonstrates that TMEP-associated emissions degrade air quality with respect to $PM_{2.5}$, NO_2 and benzene, and causes exceedances of air quality standards for these three pollutants.*

3.1.12 There are numerous other limitations and omissions regarding the methods and interpretations of the HHRA.

3.1.12.1 Background concentrations used in the HHRA are not necessarily conservative. This applies to both short-term estimates, derived as the 98th percentile of one-hour, 8-hour or 24-hour ambient air concentrations at local monitoring sites, as well as the annual average background air, derived as the median of hourly concentrations at ambient monitoring sites. Other concerns regarding background determinations include the representativeness of local background concentrations and the adequacy of monitoring network, including the presence of only a single volatile organic compound (VOC) monitoring site and data collected not more recently than 2009.

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[6] Human Health Risk Assessment of Westridge Terminal, Table 5.5: Frequency of Respiratory Irritants Mixture Exceedances at the Maximum Point of Impingement, SREP-TERA-00003, June 2014 (A3Y1F4) at PDF page 60

[7] RDWI Consulting Engineers & Scientists, RWDI#1202006 December, 2013 (A3S1U1) at PDF page 125

[8] RDWI Consulting Engineers & Scientists, RWDI#1202006 December, 2013 (A3S1U1) at PDF page 127

3.1.12.2 The report discusses multiple reasons why NO_2 and SO_2 concentrations and exposures are not expected to cause health effects, but it does not discuss the many reasons why estimated results may not be conservative. These include: the multiple occurrences above the exposure limit at a particular location; multiple consecutive hours above the exposure limit; the ability of dispersion modeling to represent dispersion conditions above water; the variation and uncertainty in meteorology and emission rates; the representativeness of local background concentrations (Section 3.1.10.1); the temporal and spatial variability of emissions; and the role of NO_2 and SO_2 pollutants in forming secondary aerosols, which represent a portion of $PM_{2.5}$. This means emissions of NO_2 and SO_2, in addition to increasing ambient levels of these pollutants, will also add to $PM_{2.5}$, which is already a problem, as discussed in 3.1.10.

3.1.12.3 The report does not provide any assessment of respiratory health of individuals living near the terminal, including the number and locations of individuals who have chronic disease that increases their sensitivity to air pollutants. This information is needed to estimate health impacts from NO_2, SO_2, and particulate matter.

3.1.12.4 The report and table[9] describing health effects associated with short-term NO_2 exposure continues to cite mostly older information. It excludes one of the most definitive assessments: U.S. EPA, Integrated Science Assessment for Oxides of Nitrogen – Health Criteria (Final Report). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-08/071, 2008, that provides an in-depth discussion of the consistency of the epidemiologic studies between short-term NO_2 exposures and respiratory symptoms and hospitalization or emergency room visits in areas where concentrations range from 3 to 70 ppb for 24 hour averages. This range is highly relevant to the TMEP application given the higher emissions it would cause.

3.1.13 TMEP's screening-level HHRA examining fugitive air emissions associated with the working and standing losses at the Edmonton, Sumas and Burnaby terminals focused on expected air emissions, and then concluded that adverse health effects from these emissions were not expected, thus no further analysis was conducted for these terminals. Most of these emissions were VOCs from storage tanks for light crude (e.g., 14.7 tons/year at the Burnaby Terminal, total VOC emissions of 27 tons/year at this terminal).[10] This assessment had several important omissions.

3.1.13.1 The screening-level HHRA at the Edmonton, Sumas and Burnaby terminals did not consider potential health impacts that may result from discharges from stormwater collection and storage systems at the terminals, including spills at the terminals. General information regarding some precautions was provided in the application, but this was not linked to possible human health impacts.[11] TMEP's relevant Information Request response[12] only states that "Trans Mountain anticipates that there will be no measurable hydrocarbons in the storm water flows leading to the oil/water separators." The assessment does not describe systems for detecting and monitoring oil or other contaminants that may be present in the storm water prior to discharge, nor does it describe the performance requirements of these systems. The assessment does not describe the protocols to be followed by operations personnel during storm events. There is no description of the performance of controls and the potential issues with compliance of discharge rules. This is an omitted exposure pathway that warrants evaluation.

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[9] Human Health Risk Assessment of Westridge Terminal, Table 5.6: Potential Acute Health Effects Associated with short-term NO2 Exposure, SREP-TERA-00003, June 2014 (A3Y1F4) at PDF page 60

[10] B006- Trans Mountain Pipeline ULC – Trans Mountain Expansion Project Volume 5C Part 1: Air Quality and Greenhouse Gas Technical Report, Section 5.2.4, SREP-NEB-TERA-00003, December 2013, (A3S1U1) at PDF, page 119.

[11] B002- Trans Mountain Pipeline ULC – Trans Mountain Expansion Project Volume 4A Part 1: Project Design and Execution – Engineering, Sections 3.4.2.2.1, 3.4.3.2.1 and 3.4.4.2.1, December 2013 (A3S0Y8) at PDF, pages 90, 99 and 117.

[12] Responses to Information Request from Living Oceans Society, IR No. 1, 1.28: Air Quality and Human Health: Storm Water (A3Y2T4) at PDF, Page 47

3.1.13.2 The screening-level HHRA at the Edmonton, Sumas and Burnaby terminals did not consider potential health impacts that may result from wastewater discharges. This is an omitted exposure pathway that warrants evaluation.

3.1.14 Conclusions of peer review - Fugitive emissions from normal operations of the pipeline, terminal and tankers

3.1.14.1 *The assessment does not provide the information needed to adequately assess the human health risks presented by the project*.

3.1.14.2 The approach used to compare "base" and "application" cases is flawed and does not allow for a fair evaluation of the impacts in the terminal area and environs. *The approach used in the TMEP assessment significantly underestimates the impact of KM and TMEP operations on air quality.*

3.1.14.3 *The scope of analyses considered in the HHRA is narrow and some of the methods are flawed*. The assessment does not account for all exposure pathways. The summaries and descriptions in the assessment omit important information and include misleading or incorrect statements, regarding, for example, the impact of the facility in causing exceedances of exposure limits for $PM_{2.5}$, benzene and the respiratory irritants mixture. *The HHRA and air quality modeling results are not necessarily conservative.*

3.1.14.4 *The analyses presented indicate that emissions associated with the TMEP will degrade ambient air quality and result in concentrations of SO_2, NO_2, $PM_{2.5}$ and the respiratory irritant mixture that exceed exposure limits and/or standards and that have the potential to cause adverse health effects*. *TMEP-associated emissions are responsible for a substantial fraction of the exceedances of several pollutants over exposure limits and standards, and thus these emissions should be mitigated to improve air quality and reduce human health risks.*

3.2 Pipeline Rupture or Release Occurring along the Pipeline Route through the Fraser Valley and Metro Vancouver

3.2.1 The assessment of potential human health effects associated with possible oil spill scenarios along the pipeline[13] examined two similar hypothetical scenarios assumed to occur in the metropolitan area. For each scenario, the assessment follows an approach adapted from conventional human health risk assessments (HHRA) procedures that consists of five steps: problem formulation, exposure assessment, toxicity assessment, risk characterization, and uncertainty analysis. The design of the TMEP assessment is stated to identify potential health consequences associated that could occur under the two scenarios. Unlike most HHRAs, however, the KM assessment uses a hazard approach that does not define the likelihood of scenarios that might lead to exposure, the exposures themselves, and the affected populations. The assessment does not utilize the likelihood or probabilities of any scenarios, either "worst-case" or otherwise, that would increase the realism of results.

3.2.2 The selection of the scenarios is a key concern. The selected scenarios[14] were defined as a breach of the pipeline caused by third-party damage during the summer season that resulted in a credible worst case assumed to be 1,558 m³ of oil or 1,012 m³ for smaller spills. These spill volumes were determined as the 95th percentile and average spill volumes, respectively, estimated for on-land locations along the pipeline segment within Metro Vancouver (i.e., from RK 1137.5 to RK 1181.7). The TMEP scenarios further assumed that the spill would be released over a 1-hr period on level terrain and the liquid would form a uniform pool of 10 cm depth, giving a 70 m pool radius for the larger spill and 57 m for the smaller.[15] Further assumptions included a single wind speed (3 m/s), temperature (21 C), and neutral atmospheric stability. The PHAST and AERSCREEN models were used to predict airborne concentrations of VOCs (e.g., benzene). *The TMEP assessment does not represent a conservative credible worst-case scenario of pipeline ruptures for many reasons elaborated below; moreover, the analyses uses highly simplified and flawed approaches that are inconsistent with the approaches taken elsewhere in the HHRA, and they underestimate concentrations, affected areas, and health risks.*

3.2.2.1 *The spill volume used in the scenarios is not conservative and does not represent the maximum credible release*. Spill volume was estimated by considering the expected response time for initiation and completion of valve closure upon detecting a leak and the distance between valve locations. The estimated spill volume includes both the volume of oil that would be released under pressure before the valves close, as well as the drain-down volume for the pipeline between valve locations.

The rationale for the selection of 95th percentile and average statistics is not specified. The difference between the 95th percentile and maximum spill volume, and other large spill volume estimates in the metropolitan area, is very large. For example, TMEP's analyses[16] show a maximum outflow volume within Metro Vancouver of approximately 3100 m^3, and there are numerous locations where the estimated outflow volumes exceed 2500 m^3. These are all credible spill volumes that were not analyzed in the TMEP assessment.

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[13] RWDI AIR Inc. 2014. HHRA Urban Pipeline Spill Consequence Modelling for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project, Supplemental Submission, Section 4.1.4: Identification of Receptors, SREP-NEB-TERA-00005 RWDI # 1202006, May 16, 2014 (A3X6U1) at PDF, page 26.

[14] RWDI AIR Inc. 2014. HHRA Urban Pipeline Spill Consequence Modelling for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project, Supplemental Submission, Section 4.1.1: Identification of Project Components, SREP-NEB-TERA-00005 RWDI # 1202006, May 16, 2014 (A3X6U1) at PDF, page 21.

[15] RWDI AIR Inc. 2014. HHRA Urban Pipeline Spill Consequence Modelling for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project, Supplemental Submission, Section 4.2.1: Oil Spill Modelling, SREP-NEB-TERA-00005 RWDI # 1202006, May 16, 2014 (A3X6U1) at PDF, page 28-29.

[16] B018: Trans Mountain Pipeline ULC – Trans Mountain Expansion Project Appendix B, Volume 7 – Risk Assessment and Management of Pipeline and Facility Spills. Oil Spill Outflow Model Results (A3S4V7)

A volume of 3100 m^3 would be a better estimate of the maximum credible spill volume, however, even this volume assumes efficient spill detection and rapid valve shut-off procedures. Spill volume could be larger in the event these systems did not perform optimally.

3.2.2.2 *The analyses apply only to the new construction proposed for Line 2*. The analyses excluded the existing Line 1 and all other existing pipelines and loops, both active and deactivated, including portions that will be upgraded to increase capacity possibly the materials to be transported, and/or modified in terms of flow rates. The older line may be more likely to fail.

3.2.2.3 *The assessment focuses on the direct air inhalation as the exposure pathway*. Direct physical contact with the spilled oil was considered possible during the early stages of the modeled incident, but it was then omitted from the analysis.[17] The assessment states that the "time that the oil might remain in contact with the skin would be expected to be limited since as part of the emergency response measures, people would be advised to remove any oiled clothing and/or wash any exposed skin with soap and water" and that "these measures would limit the opportunity for the chemical components of the oil to penetrate the skin." Even brief periods of contact can lead to exposure, and dermal uptake is not linear with exposure time. Moreover, many individuals in the general public will rescue materials, pets and wildlife in the event of an oil spill with only limited regard to precautions, remedial measures, and other actions.

3.2.2.4 The report also indicates "in some cases, exposure of people might reasonably be expected to be self-limiting owing to the irritant properties of a number of the hydrocarbon components of the spilled oil as well as the odours that might be noticed" (A3X6U1, page 27). This statement and approach that uses or depends on such behaviors contradicts good management and planning practices that would understand the nature of the population and sensitive receptors (see, for example, 3.1.5), the ability and willingness of all members of the public to evacuate (including the elderly, infirm, etc.), and the behaviors actually undertaken in the event of a release (see 3.2.2.3).

3.2.2.5 The meteorological conditions used in the HHRA[18] were neutral stability and a wind speed of 3 m/s. These do not follow US EPA guidance for the Risk Management Program,[19] contrary to statements in the report. In particular, the US EPA guidance for meteorological conditions for the worst-case scenario are atmospheric stability class F (stable atmosphere) and a wind speed of 1.5 meters per second. The guidance permits higher wind speeds if the minimum wind speed at the site has always been higher than 1.5 m/s, or other stability conditions if atmosphere stability has always been less stable than class F. Neither of these cases applies. As a result, the parameters selected for TMEP do not represent worst-case conditions. They do not represent, for example, releases occurring at night when stable conditions are likely and the resulting concentrations would be much higher. Also, at night, detection, mitigation and emergency response activities (like notification, evacuation) would be much more difficult.

The use of appropriate worst-case meteorological parameters would very substantially increase concentrations (e.g., by a factor of 10), and would result in much larger hazard zones (where concentrations exceed exposure limits) than results shown in the TMEP assessment for ruptures in the metropolitan area. This is important for both community impacts and its implications for emergency response, including the ability to shelter in place or evacuate large numbers of people that could be in the hazard zone.

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[17] RWDI AIR Inc. 2014. HHRA Urban Pipeline Spill Consequence Modelling for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project, Supplemental Submission, Section 4.1.4: Identification of Receptors, SREP-NEB-TERA-00005 RWDI # 1202006, May 16, 2014 (A3X6U1) at PDF, page 26.

[18] RWDI AIR Inc. 2014. HHRA Urban Pipeline Spill Consequence Modelling for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project, Supplemental Submission, Section 3.2: Dispersion Scenarios and Meteorology, SREP-NEB-TERA-00005 RWDI # 1202006, May 16, 2014 (A3X6U1) at PDF, page 54.

[19] General Risk Management Program (RMP) Guidance, Chapter 4: Offsite Consequence Analysis, US EPA, April 2004.

3.2.2.6 In addition to not following US EPA guidance, the atmospheric modeling approach used for the TMEP spill analysis is inconsistent with analyses performed elsewhere in the HHRA (e.g., marine spill, terminal spill, etc.) where a considerably more detailed simulation approach was used (e.g., multiple years of actual meteorology were modeled). In contrast, the spill analysis approach was to simply select a single hypothetical and presumably "representative" hour of meteorology and use a screening level model. *The assessment does not represent a credible worst-case assessment given the selection of model inputs*.

3.2.2.7 Emissions would continue far longer than one hour and so longer exposure periods should be considered. For example, considering benzene releases and the larger spill, the stated emission rate of 138 g/s would result in 497 kg of benzene emitted in one hour (the first hour). This represents only about 16.5% of the benzene present in the larger spill (based on a spill volume of 1,558 m^3; 0.85% benzene mole fraction; 0.28% mass fraction; and density of 0.926).[20] The remaining 83.5% of the benzene would continue to be emitted in subsequent hours (although some might be lost to seepage and sorption in soils). This shows the likelihood of concentrations and exposure lasting considerably longer than one hour. The assessment should consider multi-hour exposure periods and use the appropriate exposure limits.

3.2.2.8 The assumption of a 10 cm depth for the entire spill area is not necessarily conservative, particularly if the spill occurs on sloping land, impervious surfaces, and other surfaces that increases the wetted area from which volatilization can occur. Volatilization from a larger surface area can result in much higher concentrations than the assumed scenario.

3.2.2.9 The assumption of flat terrain is highly simplified. It does not account for topography, cold air drainage, and other factors that can greatly increase concentrations. Much of the terrain in along the pipeline path has a significant grade.

3.2.2.10 Spills of other products with potentially more volatile and toxic fractions are not considered, and the assessment omits consideration of Line 1. Both lines have the potential to spill materials, and portions of existing lines will be utilized due to the construction and operation of Line 2 and thus should be considered.

The TM assessment considers spill and ecological consequences of only Cold Lake Winter Blend (CLWB) on only Line 2. It does not consider other materials potentially transported by Line 2, e.g., potentially light and synthetic crude, refined products and MTBE.

The application does not consider any spills on Line 1, which may include crude, synthetic and refined materials. Spills of such materials are of significant environmental and health concern. The application should consider all types of materials that may be transported over the lifetime of Lines 1 and 2. This is particularly important since recent spills at TMPL facilities have included diesel fuel, jet fuel, MTBE, waste oil, and other materials.

3.2.3 For the scenarios considered, estimated one-hour concentrations exceed the health-based limits for four groups of compounds (i.e., aliphatic C1-C4, aliphatic C5-C8, benzene, and toluene) at distances up to 1,050 m from the pool (spill) edge, and estimated concentrations exceeded the 1-hr limits for three mixtures (i.e. eye irritants, respiratory irritants, and neurotoxicants) for distances up to 750 m. Maximum concentrations in the scenarios greatly exceeded exposure limits, e.g., the benzene concentration was 100 times the limit. [21] Xylene may also have exceeded limits, however, this chemical seems to have been omitted in Table 5-4; it approaches the exposure limit in Table 5-5.

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[20] RWDI AIR Inc. 2014. HHRA Urban Pipeline Spill Consequence Modelling for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project, Supplemental Submission, Appendix A, SREP-NEB-TERA-00005 RWDI # 1202006, May 16, 2014 (A3X6U1) at PDF, page 47

[21] RWDI AIR Inc. 2014. HHRA Urban Pipeline Spill Consequence Modelling for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project, Supplemental Submission, Tables 5-3 to 5-6, SREP-NEB-TERA-00005 RWDI # 1202006, May 16, 2014 (A3X6U1) at PDF, pages 37 and 39.

3.2.4 *The assessment does not consider many site-specific factors that can affect the results of the HHRA*, including the location and size of the populations potentially affected, sensitive and vulnerable individuals, populations that are difficult to evacuate (e.g., schools, prisons, hospitals, elder care facilities, etc.), evacuation routes, and the resources available for management and mitigation.

3.2.5 Conclusions of peer review - Pipeline rupture or release occurring along the pipeline route through the Fraser Valley and Metro Vancouver

3.2.5.1 *The assessment does not provide the information needed to assess the human health risks presented by a pipeline rupture in the metropolitan area*.

3.2.5.2 *The combined effects of omissions, flawed methods and inconsistencies in the HHRA and other TMEP assessments make it impossible to predict the potential health effects that might result from ruptures, releases and spills along the pipeline or at the terminals*.

3.2.5.3 *The two scenarios evaluated in the HHRA for pipeline ruptures represent a subset of possible failures, environmental conditions, and other factors that affect human health, and do not represent the magnitude of health impacts that might reasonably occur and endanger public health from a credible worst-case event*.

3.2.5.4 *The analysis does not represent a maximum credible spill scenario, and the selected parameters and simplified modeling analyses underestimate the potential for adverse health effects*. The analysis should have used the maximum credible spill volume and models that represent worst-case or near worst-case dispersion conditions, which would have resulted in much higher concentrations, larger threat zones that encompass larger populations, and higher health risks. The analysis does not represent best practices for planning or assessment. *These are serious limitations of the TMEP assessment.*

3.2.5.5 Even considering the limitations of the two scenarios evaluated, *the TMEP analysis shows that ruptures in the metropolitan area would pose inhalation risks to nearby populations,* as well as the potential for significant dermal exposure.

3.3 Rupture, Release or Spill Occurring at the Westridge, Edmonton, Sumas and Burnaby Terminals

3.3.1 The TMEP report[22] assessing potential human health effects associated with possible oil spill scenarios at the Terminals again follows an approach adapted from conventional human health risk assessments (HHRAs) procedures that consists five steps: problem formulation, exposure assessment, toxicity assessment, risk characterization, and uncertainty analysis. The assessment is designed to identify potential health consequences associated that could occur under the different scenarios. Unlike most HHRAs, however, the analysis again uses a hazard approach that does not define the exposure or the likelihood of scenarios that might lead to exposure.

The first step in the approach is the problem formulation, which lays out the scope and boundaries, including project components to be examined, identification of exposure scenarios, identification of the chemicals of potential concern (COPC), identification and characterization of the human “receptors" that might be exposed, and identification of exposure routes and pathways. Two scenarios at the terminal are considered (summarized in Table E1): a spill of 160 m^3 of Winter Cold Lake Blend (CLB) during tanker loading at berth in which 20% of the oil escapes containment; and a smaller 10 m^3 spill of CLB, in which all of the oil is assumed to be completely contained within the containment boom. Both result in vapor emissions.[23] The larger spill volume is stated to represent a credible worst case (CWC).

[22] Intrinsik, Human health risk assessment of facility and marine spill scenarios. Technical report for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project, SREP-NEB-TERA-00006, June 2014, (A3Y1E9 to A3Y1F2)

[23] Intrinsik, Human health risk assessment of facility and marine spill scenarios. Technical report for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project, SREP-NEB-TERA-00006, June 2014, (A3Y1E9 to A3Y1F2) at page 4.

3.3.2 *There are many deficiencies in the problem formulation*. *Release scenarios that are neither conservative nor comprehensive*. The analysis of spills utilize scenarios that focus on Cold Lake Winter Blend (CLWB), modest spill volumes, high containment efficiencies, conditions that produce maximum airborne concentrations over water, and factors affecting population susceptibility and vulnerability are not considered. Only a very general discussion of these factors is provided, and no details relating to the application case are given. These scenarios do not represent worst-case credible conditions for emissions, concentrations and human health risks.

3.3.2.1 The definition of the scenarios is critical as the potential human health risk depends on the scenario definition, including the spill size, location, timing, season, meteorology, mitigation responses, etc.

3.3.2.2 *The two scenarios do not represent the maximum credible release*. Other possible and potentially worse scenarios include larger spills into the open water, ruptures and containment failures, terrestrial spills, and spills of materials other than Cold Lake Winter Blend (CLWB) that might be handled by TMEP. The scenarios also do not represent potentially more frequent but less severe releases.

3.3.2.3 The seasonal variability of the materials transported (including CLWB) was not evaluated, although volatility and emission rates from spills will vary seasonally, as does outdoor activity of people and other factors that affect exposure. The variability of the volatile components in CLWB, and particularly the risk drivers of the volatile component (e.g., benzene) are not documented, although this can span a large range.

3.3.2.4 The report did not investigate scenarios involving spills of other materials that may have a higher volatility and toxicity than CLWB and may present a greater human health risk, including other products that might be handled by TMEP, e.g., higher volatility or more toxic material.

3.3.2.5 Terrestrial spills were not investigated. Such releases can contaminate soil, groundwater, surface water, and air and involve multiple exposure pathways, e.g., direct contact, inhalation, and ingestion.

3.3.2.6 The assessment states that human receptors include members of the general public found near the Westridge Terminal, specifically: i) people on the water in fishing boats, kayaks, and other pleasure craft; ii) people on shore; iii) people living in adjacent communities; and, iv) first responders. However, contrary to standard emergency planning practice, the report and emergency management plan[24] does not identify or characterize critical receptors near the Edmonton, Sumas and Burnaby terminals (e.g., within a 2 to 5 km radius). Critical receptors can include homes, schools, health care, elderly and convalescing facilities, recreational facilities, and other locations where people may be exposed, exhibit enhanced vulnerability to exposure, and have reduced ability to be evacuated in a safe and timely fashion in the event of a release or spill. *Customary and good practice would be to develop threat maps showing potentially affected areas for a maximum credible release and the locations of critical receptors and emergency resources.*

3.3.2.7 As noted in 3.3.2.6, identifying critical receptors/individuals is important since such individuals can have difficulty responding to emergency measures. In contrast, the assessment[25] states that "...exposure of people might reasonably be expected to be self-limiting owing to the irritant properties of a number of the hydrocarbon components of the spilled oil as well as the odours that might be noticed. Both of these properties would provide warning of the presence of the chemicals such that individuals could take action to remove and/or distance themselves from the source, thereby limiting the amount and duration of any exposure." This approach that uses or considers such behaviors to minimize harm contradicts good management and planning practices

[24] B279-4 - Attachment 2.2 Westridge Marine Terminal Emergency Response Plan (ERP), July 2014 (A4D3F1)

[25] Responses to Information Request from Living Oceans Society IR No. 1, Section 1.57: Air quality and Human Health: Oil Spill Scenarios at PDF, page 102.

that would understand the nature of the population and sensitive receptors (discussed at 3.3.2.6), the ability and willingness of all members of the public to evacuate (including the infirm, etc.), and the behaviors actually undertaken in the event of a release, e.g., many individuals will rescue materials, pets and wildlife in the event of an oil spill with only limited regard to precautions and other advisories.

3.3.3 The second step in the assessment of potential human health effects associated with possible oil spill scenarios at the terminals is exposure assessment. Here, predictive air dispersion modeling is used to estimate chemical concentrations for the two exposure scenarios. The report is stated to focus on areas where exposure to COPC might be expected to be greatest and/or where particularly sensitive receptors may be located. *The assessment has many limitations in its assessment of potential exposures and human health risks.*

3.3.3.1 The presentation of the dispersion modeling analysis reports on a single one-hour period that produced the highest hourly airborne concentration. For this period, northerly winds produced the highest concentration over water. *The report should show the highest hourly concentration at each receptor that may result for any hour of the year* (or multiyear period modeled), not just a single hour. The lack of this information, which is a standard part of hazard analyses, is an important deficiency in understanding the potential for adverse health effects.

3.3.3.2 The report does not provide a quantitative assessment of potential exposures to terrestrial populations and critical receptors.

3.3.3.3 The report notes that exposures may exceed short-term exposure limits for multiple hours, but uses only a one-hour assessment. Exposure limits for longer periods, e.g., three, eight and 24 hours, should be considered.

3.3.3.4 In open waters, oil films can be much thinner and volatilization rates much more rapid than those derived from the Gainford Study experiments used to estimate release rates.[26] If oil escaped the boom or if the spill occurred in open waters, this would have the effect of significantly increasing concentrations and footprints where exposure limits are exceeded.

3.3.4 The third step in the assessment of potential human health effects associated with possible oil spill scenarios at the terminals is the toxicity assessment. Here, the assessment developed "Exposure Limits" for COPCs, designed to be protective of public health, by reviewing a number of guidelines, objectives and standards. The Exposure Limits were adjusted to one-hour levels. In addition, the assessment referred to benchmarks such as the Acute Exposure Guideline Levels (AEGLs) and the Emergency Response Planning Guidelines (ERPGs), and considered exposure to several sets of chemical mixtures.

3.3.4.1 As noted earlier, the assessment is premised on one-hour exposures. However, spills and releases can result in multi-hour exposure periods, specifically up to 13 hours for benzene.[27]

3.3.5 The fourth step in the assessment of potential human health effects associated with possible oil spill scenarios at the terminals is risk characterization. Risk characterization is limited to a comparison of potential exposures to exposure limits. The larger spill scenario at the Westridge Marine Terminal produced concentrations that exceeded the acute (1 hr) Exposure Limits for a number of toxic constituents (i.e. aliphatic C1-C4, aliphatic C5-C8, and aromatic C9-C16 groups, benzene, toluene, and xylenes). *The maximum concentrations significantly exceeded the exposure limits, e.g., by seven times for the aliphatic C5-C8 group, and by 20 times for benzene*. Moderately dangerous adverse impacts are expected to individuals exposed to these levels.

3.3.5.1 As noted above, the report fails to provide information regarding potential exposures or health effects at critical terrestrial receptors. This is an important deficiency.

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[26] Witt O'Briens, Polaris Applied Sciences & Western Canada Marine Response Corporate, "A Study of Fate and Behavior of Diluted Bitumen Oils on Marine Waters – Dilbit Experiments – Gainford, Alberta", 22 Nov 2013.

[27] Intrinsik, Human health risk assessment of facility and marine spill scenarios, Section 5.1.1.1.3: Duration of Exceedances, SREP-NEB-TERA-00006, June 2014 (A3Y1E9) at PDF, page 45

3.3.6 The final step in the assessment of potential human health effects associated with possible oil spill scenarios at the terminals is uncertainty analysis. This step is noted to be important in that it increases awareness and understanding of the possible health-related consequences of the spills.

3.3.6.1 *The uncertainty assessment is qualitative in nature, and cursory*. It argues that the assessment incorporates a high degree of conservatism due to the assumptions made to accommodate uncertainties. There is no attempt at a quantitative assessment of uncertainty.

3.3.6.2 As noted above, there is no evaluation of or inadequate emphasis on the many factors that might affect and potentially increase human health risks. The most prominent gaps in the uncertainty analysis include factors that might alter the release/spill size and its location, the fraction of toxic constituents in released materials, emission/volatilization rates from releases, the possibility of multi-hour exposures, and the vulnerability of critical receptors.

3.3.7 Conclusions of peer review - rupture, release or spill occurring at the Westridge, Edmonton, Sumas and Burnaby Terminals

3.3.7.1 *The assessment does not provide the information needed to assess the human health risks presented by the project*.

3.3.7.2 *The combined effects of omissions and flawed methods in the HHRA and other TMEP documents make it impossible to predict the potential health effects that might result from ruptures, releases and spills at the terminals*. The assessment excludes critical information that should be considered in evaluating the magnitude of health risks, including mapping of the highest concentrations and the identification of critical receptors.

3.3.7.3 *The two scenarios evaluated in the HHRA for terminal spills represent a subset of possible failures and do not represent the magnitude of spills or releases that might reasonably occur and endanger public health*.

3.3.7.4 Even considering the limitations of the two scenarios evaluated, *spills at the terminal pose potential inhalation risks to nearby populations*.

3.4 Release or Spill Occurring on the Tanker Route within Burrard Inlet and Juan de Fuca/Haro Straits

3.4.1 As in the other sections, a modified HHRA was carried out that focused on direct inhalation risks for two scenarios for spills resulting from a grounding of a laden tanker on Arachne Reef. Two spill volumes were considered: 16,500 and 8,250 m^3 of CLWB.[28] As before, the assessment used a hazard approach with no estimates of the probability of releases, spills, exposures or health risks. The scenario selection is critical.

The selected scenarios do not necessarily represent conservative and worst-case credible scenarios with regards to human health impacts.

3.4.2 *The acute inhalation exposure limits were significantly exceeded for both spill volumes at both marine and terrestrial locations*. *The area where limits were exceeded was large* and included marine and terrestrial locations with the possibility of affecting appreciable numbers of people. The affected persons were stated to include members of the general public, including people on the water in fishing boats, tour boats, sailboats, motorboats, and other pleasure craft; people living on or frequenting nearby, island communities; and first responders. Exceedances occurred immediately after the spill and then 20-30 hours later. Because exposures can vary significantly, a result of different concentrations within the plume; its movement by wind; and because of the variation in an individual's location, movement and susceptibility, it is difficult without additional information to estimate the nature of health outcomes. However, for the scenarios predicted it is likely that moderately dangerous acute exposures could occur with a range of respiratory, cardiovascular, neurological and psychological outcomes.

[28] Intrinsik, Human health risk assessment of facility and marine spill scenarios, SREP-NEB-TERA-00006, June 2014, (A3Y1E9)

3.4.2.1 Concentrations exceeded exposure limits for the aliphatic C1-C4 VOC group (by a factor of 1.3 over the exposure limit), the aliphatic C5-C8 group (by a factor of 9), the aromatic C9-C16 group (by a factor of 42), benzene (by a factor of 30), toluene (by a factor of 2), and xylenes (by a factor of 4).

3.4.2.2 Multiple hours of exposure above exposure limits are reported, e.g., Figure 5.33 shows 23 hours when benzene concentrations exceed exposure limits. Most exceedances occur within 30 hours of the spill, however, exposure limits were exceeded long after the spill for some compounds (e.g., aromatic C9-C16 resulted in exceedances 50 hours following the spill.[29]

3.4.2.3 The spills affected very large areas, e.g., Figure 5.27 shows a region where benzene exceeded the exposure limit was over 20 km in length.[30]

3.4.2.4 Comparisons to Acute Exposure Guideline Levels (AEGLs) and other exposure limits should be used to account for the duration of the exposure. For example, AEGLs (proposed) for benzene exist for one-, four- and eight-hour periods (AEGL-1 values for these three averaging times are 52, 18 and 9 ppm, respectively).[31] Since exposure can be prolonged, suitable averaging periods should be calculated to allow comparison with these levels.

3.4.2.5 A number of chemicals and mixtures do not have AEGLs[32] or Emergency Response Planning Guidelines (ERPGs) for comparison.

3.4.3 The problem formulation, as noted earlier, identifies the scope and boundaries, including project components to be examined; exposure scenarios; chemicals of potential concern (COPC); human "receptors" that might be exposed; and exposure routes and pathways.

There are many deficiencies in the problem formulation here. As noted earlier, the assessment focuses on direct air inhalation as the exposure pathway. Direct physical contact is likely during various stages of the incident. Even brief periods of contact can lead to exposure, and dermal uptake is not linear with exposure time. Moreover, many individuals in the general public will rescue materials, pets and wildlife in the event of an oil spill with only limited regard to issued precautions and other actions. Furthermore, a large spill can affect a large region, and the assessment relies on institutional controls, e.g., closure of commercial and recreational fisheries, beach closures, forced evacuation of people offshore and/or on-shore, which will not be completely effective.

3.4.3.1 In open waters, oil films can be much thinner and volatilization rates much more rapid than represented in the Gainford Study experiments used to estimate release rates.[33] This would have the effect of significantly increasing concentrations and footprints where exposure limits are exceeded. *The representativeness and limitations of the laboratory tests used to estimate source parameters should be discussed*. This should detail the conditions that may decrease their representativeness, particularly those conditions where the tests can underestimate emissions or affect other fate and transport parameters with the effect of increasing risks and/or the difficulty and cost of remediation.

3.4.3.2 *The assessment omits the ingestion exposure pathways*, with the assumption that the issuance of fish, shellfish or other seafood consumption advisories will be fully effective. The analyzed scenario was in large part selected due to the length of shoreline oiled, which would likely increase the potential for dermal and ingestion exposure, pathways omitted in the analysis.

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[29] Intrinsik, Human health risk assessment of facility and marine spill scenarios, Section 5.2.1.1.3: Duration of Exceedances, SREP-NEB-TERA-00006, June 2014 (A3Y1E9) at PDF, page 50

[30] Intrinsik, Human health risk assessment of facility and marine spill scenarios, SREP-NEB-TERA-00006, June 2014, (A3Y1E9), page A-33.

[31] Acute Exposure Guideline Levels (AEGLs) Program. U.S. Environmental Protection Agency, Washington DC. USA.

[32] Emergency Response Planning Guidelines, American Industrial Hygiene Association, Falls Church, VA, USA.

[33] Witt O'Briens, Polaris Applied Sciences & Western Canada Marine Response Corporate, "A Study of Fate and Behavior of Diluted Bitumen Oils on Marine Waters – Dilbit Experiments – Gainford, Alberta", 22 Nov 2013.

3.4.3.3 The assessment claims that the number of individuals exposed might be self-limited due to the irritant properties and odors of spill releases. Of course, individuals are already exposed at this point; moreover, some individuals may be unable to take appropriate and timely actions to remove and/or distance themselves. Moreover, many individuals in the general public will rescue materials, pets and wildlife in the event of an oil spill with only limited regard to precautions and other actions.

3.4.3.4 *Many other scenarios could result in different and potentially more adverse outcomes*. For example, a tanker grounding or other event resulting in a large spill could occur in numerous places, any seasons, under different meteorological conditions, under different water temperature and wave action, etc. This could easily alter key conclusions from the modeled scenario that states that most exceedances will occur predominantly over water.[34] Such results depend entirely on the scenario, including the prevailing meteorological conditions. In addition, spill volumes could be larger and could include other materials that would have higher volatility and toxicity resulting in greater human health risks.

While the assessment notes that a large number of simulations were used in the "stochastic" analysis, only one simulation is selected for analysis. It would have been more representative, conservative and informative to evaluate results of the top 10 or so simulations, and to produce threat maps and other outputs showing areas that may experience health risks.

3.4.3.5 Direct inhalation exposure to combustion products from spill-related fires or explosions should be considered as a scenario.

3.4.3.6 As highlighted earlier, *no information is provided regarding potentially susceptible and vulnerable populations living, working or recreating near the shoreline*. Many fishers, for example, would be expected to be older individuals who might be susceptible to adverse impacts.

3.4.4 Conclusions of peer review - Release or spill occurring on the tanker route within Burrard Inlet and Juan de Fuca/Haro Straits

3.4.4.1 *The assessment does not provide the information needed to assess the human health risks presented by a release occurring on the tanker route within the Burrard Inlet and Juan de Fuca/ Haro Straits.*

3.4.4.2 *The combined effects of omissions and flawed methods in the HHRA and other TMEP documents make it impossible to predict the potential health effects that might result from a major tanker release*.

3.4.4.3 The two scenarios evaluated in the HHRA for tanker releases represent a very small subset of possible failures, environmental conditions, and other factors that might affect human health. *The scenarios analyzed do not represent the magnitude of human health risks that might reasonably occur from a maximum credible worst-case spill*.

3.4.4.4 Even considering the limitations of the two scenarios evaluated, *releases modeled pose inhalation risks to nearby populations*, as well as the potential for significant dermal and ingestion exposures.

[34] Intrinsik, Human health risk assessment of facility and marine spill scenarios, Section 6.1: General Observations, SREP-NEB-TERA-00006, June 2014 (A3Y1E9) at PDF, page 56

Appendix 1: CV

STUART A. BATTERMAN

Curriculum Vitae

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4 ADDRESS

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5 EDUCATION

1986	Ph.D., Water Resources and Environmental Engineering, Department of Civil Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts.
1981	M.S., Technology and Policy Program, Department of Civil Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts.
1979	B.S., Water and Air Pollution Program, Department of Environmental Science, Rutgers University, New Brunswick, New Jersey.

6 RESEARCH AND PROFESSIONAL EXPERIENCE

2014	Visiting Professor, Department of Energy, Politecnico di Torino, Torino, Italy. (sabbatical).
2013-4	Visiting Scholar, The International Council on Clean Transportation, Washington, DC. (sabbatical)
...2011-	Leader, Exposure Assessment Core, The University of Michigan NIEHS P30 Core Center: Lifestage Exposures and Adult Disease.
2010-	Director, Center for Occupational Health and Safety Engineering, University of Michigan, Ann Arbor, MI.
2007-10	Director, Pilot Project Research Program, NIOSH Education and Research Center, University of Michigan, Ann Arbor, MI.
2006-	Professor of Mechanical Engineering. Faculty of Science and Technology, Universidade de Coimbra, Coimbra, Portugal (sabbatical 2006-7).
2006-	Professor of Civil and Environmental Engineering. College of Engineering, University of Michigan, Ann Arbor, MI.
2002-	Professor of Environmental Health Sciences. School of Public Health, University of Michigan, Ann Arbor, MI.
2002	Acting Head, Environmental Health Program. School of Public Health, University of Michigan, Ann Arbor, MI.
2000-2005	Associate Chair. Department of Environmental Health Sciences, School of Public Health, University of Michigan, Ann Arbor, MI.
1996-7	Visiting Professor. Technical Research Center of Finland, Espoo, Finland; Technical University of Helsinki (Mechanical Engineering), Espoo, Finland; and University of Kuopio (Environmental Sciences), Kuopio, Finland (sabbatical).
1995-2002	Associate Professor of Environmental Health Sciences with Tenure. Department of Environmental and Industrial Health, School of Public Health, University of Michigan, Ann Arbor, MI.
1989-1995	Assistant Professor of Environmental and Industrial Health. Department of Environmental and Industrial Health, School of Public Health, University of Michigan, Ann Arbor, MI.
1993-present	Director, Hazardous Substances Academic Training Program. NIOSH Education and Research Center (formerly Educational Resource Center), University of Michigan, Ann Arbor, MI.
1989-92	Adjunct Assistant Professor of Environmental and Water Resources Engineering. Department of Civil Engineering, Texas A&M University, College Station, TX.
1987, 1988, 1990	Visiting Scientist. International Institute for Applied Systems Analysis, Laxenburg, Austria. (summers, August in 1990)

1986-9	Assistant Professor. Environmental and Water Resources Engineering Division, Department of Civil Engineering, Texas A&M University, College Station, TX.
1986 (May-Aug.)	Research Scholar. International Institute for Applied Systems Analysis, Laxenburg, Austria.
1981-5	Graduate Research Assistant. Energy Laboratory, Massachusetts Institute of Technology, Cambridge, MA.
1981-2	Intern. Massachusetts Port Authority, Boston, MA.
1980	Graduate Research Assistant. Center for Policy Alternatives, Massachusetts Institute of Technology, Cambridge, MA.
1980	Teaching Assistant. Department of Civil Engineering, Massachusetts Institute of Technology, Cambridge, MA.

7 DISTINCTIONS

1975-9	Dean's List and High Honors, Rutgers University, New Brunswick, NJ.
1981	Technology and Policy Fellowship, Massachusetts Institute of Technology.
1992-4	Chairman, U.S. Working Group on FTIR Spectroscopy, Measurement of Pollution, International Organization of Legal Metrology.
1995-7	Listed in Who's Who in American Education, published by A.N. Marquis.
1997	Outstanding Contribution to Justice and Environmental Safety Award, Flint Genesee United for Action.
2000	Excellence in Community Service Award, Ecology Center, Ann Arbor, MI.
2002-5	Associate Editor, ASCE *Journal of Environmental Engineering*
2003	International Coordinator, 13th Annual Conference, International Society of Exposure Analysis, Stresa, Italy, Sept. 2003
2004	Chair, Resolutions Committee, 8th World Congress on International Health, International Federation of Environmental Health, Durban, South Africa, Feb. 23-27, 2003.
2006	Professor, Faculty of Science and Technology, Universidade de Coimbra
2007	Delegate, Universities Council on Water Resources
2008	Faculty Associate, Program in the Environment, University of Michigan
2008	Editor, *Journal of Environment and Public Health*
2009-12	Honorary Professor, Department of Occupational and Environmental Health, Medical School, University of KwaZulu-Natal, Durban, South Africa
2011	Faculty Associate, Center for Global Health, University of Michigan.
2011	Fulbright Award for Portugal, J. William Fulbright Foreign Scholarship Board.
2014-17	Honorary Professor, Department of Occupational and Environmental Health, School of Nursing & Public Health, University of KwaZulu-Natal, Durban, South Africa

8 STATEMENT OF EXPERIENCE

I have been engaged with occupational and environmental research, teaching and service for over 25 years at several of the leading academic and research institutions. I have authored or co-authored over 300 papers, book chapters, proceedings and technical reports, and have obtained over 80 external research and training grants. I have served or currently serve as peer-reviewer for many scientific journals, governmental agencies, and other organizations. I have taught and continue to teach occupational and environmental health subjects in graduate courses at the premier educational institutions in Michigan, Texas, Finland, Portugal and South Africa, and have been the primary supervisor for over 20 Ph.D. and 60 Masters students. I have served and continue to serve as technical advisor, committee member or chair for various organizations dealing with these topics at local, county, regional, national at international levels, and I have provided outreach and expert testimony in the US and elsewhere.

9 RESEARCH SUMMARY

My current research addresses a wide range of topics in occupational, indoor and environmental settings that include: *exposure assessment* (especially for volatile organic compounds (VOCs) and traffic-related air pollutants); *emerging contaminants in occupational and environmental settings* (e.g., brominated flame retardants); *biological monitoring;*

air quality monitoring; indoor air quality (e.g., assessment and management); *air pollution control engineering* (e.g., vapor and particle air filtration)*; environmental and human health risk assessment*, and *environmental epidemiology*. Other research experience and interests include: *characterization of VOCs in air, soils and fuels, environmental impact assessment, health impact assessment, risk assessment, environmental statistics, uncertainty analysis; VOC measurement techniques* (including Fourier transform infrared spectroscopy, adsorbent collection/thermal desorption); *disinfection by-products in drinking water; hazardous waste/medical waste management; environmental justice; sustainable systems; urban scale air pollutant modeling; environmental impacts of energy production; life cycle analysis.* This research has been supported by government, industry and nonprofit organizations including the US National Institutes of Health, the National Science Foundation, the US Environmental Protection Agency, the American Society of Heating, Refrigeration and Air Condition Engineers (ASHRAE), and the World Health Organization, among others. Further details are provided under research support.

The range and scope of research activities are reflected in publications which have appeared in the following journals, (as well as in books, proceedings and reports): *American Journal of Public Health*, *Analytical Chemistry*, *Applied Occupational and Environmental Hygiene*, *Archives of Environmental Health*, *Atmospheric Environment*, *Environmental Research*, *Environmental Science and Technology*, *Environmental Health Perspectives*, *Human and Ecological Risk Assessment*, *Indoor Air*, *International Archives of Occupational and Environmental Hygiene*, *International Journal of HVAC&R Research*, *Journal of Applied Spectroscopy*, *Journal of Environmental Engineering*, *Journal of Environmental Management*, *Journal of Environmental Monitoring*, *Journal of Environmental Toxicology and Chemistry*, *Journal of Exposure Assessment and Environmental Epidemiology*, *Journal of Life Cycle Assessment*, *Journal of the Air and Waste Management Association*, *Journal of the American Industrial Hygiene Association*, *Systems Analysis Modeling and Simulation*, *The Science of the Total Environment*, *and Water Research*, *among others.*

10 PUBLICATIONS

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10.2 Peer-Reviewed Book Chapters and Proceedings

1. **S. Batterman**, T. Dzubay, R.E. Baumgardner, D.L. Johnson, "Sampling and Analysis of Soil and Street Dust in the Philadelphia Area," Paper 87-14.2, proceedings of the Annual Meeting of the Air Pollution Control Association, New York NY, June 22, 1987.
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4. **S. Batterman**, A. Kulshrestha, "Contaminant Fluxes at Waste Sites and Landfills: Modeling Temporal and Spatial Variation," Paper 91-109.3, proceedings of the Annual Meeting of the Air and Waste Management Association, Vancouver Canada, June 1991.
5. **S. Batterman**, N. Bartoletta, H. Burge, "Fungal Volatiles of Potential Relevance to Indoor Air Quality," Paper 91-62.9, proceedings of the Annual Meeting of the Air and Waste Management Association, Vancouver Canada, June 1991.
6. **S. Batterman**, B. McQuown, "A Passive Soil Gas Flux Sampler: Laboratory and Field Evaluation," Paper 91.13-7, proceedings of the Annual Meeting of the Air and Waste Management Association, Vancouver Canada, June 1991.
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8. **S. Batterman**, "Identification of Pollution Sources in HVAC Systems Using Continuous Monitoring," proceedings of the Annual Meeting of the American Society of Heating, Ventilating and Air Conditioning Engineers, Denver CO, June 28, 1993.
9. **S. Batterman**, C. Peng, P. Milne, "Sequential Extractive Sampling of Indoor Air Contaminants using FTIR Spectroscopy," proceedings of the International Symposium on Optical Sensing for Environmental Monitoring, Air and Waste Management Association, Atlanta GA, Oct. 11-14, 1993.
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13. **S. Batterman**, A. Franzblau, "Breath, Urine and Blood Measurements as Biological Exposure Indices of Short-term Inhalation Exposures of Methanol," proceedings of the International Symposium on Biological Monitoring in Occupational and Environmental Health, Sept. 11-13, 1996, Espoo, Finland.
14. **S. Batterman**, N. White, "Exposures and Health Effects from a Large Sulfur Fire in South Africa," proceedings of the Air and Waste Management Association Annual Meeting, St. Louis, MO, July, 1999.
15. Y.L. Huang*, **S. Batterman**, "Sustained Rainfall and Drought: Statistical Analysis and Implications for Risk Assessment," proceedings of the Air and Waste Management Association Annual Meeting, St. Louis, MO, Paper 99-791, July, 1999.

16. C-Y Peng*, **S. Batterman**, "Quantification and apportionment of building, occupant and HVAC related emissions: Mass balance methods and applications," proceedings of Indoor Air 99, Edinburgh, Scotland, Aug. 8-13, 1999.
17. **S. Batterman**, So-Young Lin, Igor Osak, "Semi-Continuous Particle Mass Measurements for Indoor Applications: Development and Application," proceedings of Indoor Air 99, Edinburgh, Scotland, Aug. 8-13, 1999.
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10.3 Publications Pending

10.3.1 Submitted Manuscripts

25. Michael S. Breen, Thomas C. Long, Bradley D. Schultz, Ronald W. Williams, Jennifer Richmond-Bryant, Miyuki Breen, John E. Langstaff, Robert B. Devlin, Alexandra Schneider, **Stuart A. Batterman**, Air Pollution Exposure Model for Individuals (EMI) in Health Studies: Evaluation for Ambient $PM_{2.5}$ in Central North Carolina, submitted to *Environmental Science & Technology*, March, 2015.
26. Michelle T Makamure, Poovendhree Reddy, Anil Chuturgoon, Rajen N. Naidoo, Graciela Mentz, **Stuart Batterman**, Thomas G .Robins, "Non-Ambient exposure, CD14 and respiratory outcomes: A gene-environment interaction", submitted to *Biomedical and Environmental Sciences*, March, 2015.
27. F-C. Su, PhD, S.A. Goutman, S. Chernyak, R. Das, B. Mukherjee, B.C. Callaghan, E.L. Feldman, **S. Batterman**. Pesticide Exposure Increases ALS Risk: A Case Control Study, submitted to *Neurology*, April 2015.
28. Chad Milando, Lei Huang, **Stuart Batterman**, Trends in $PM_{2.5}$ emissions, concentrations and apportionments in Detroit and Chicago and the growing share of traffic-related air pollutants, submitted to *Atmospheric Environment*, April 2015.
29. Sheena Martenies, Donele Wilkins, **Stuart Batterman**, Health impact metrics for air pollution management strategies, submitted to *Environmental Policy*. April, 2015.

10.3.2 In Preparation

30. Chunrong Jia, Stuart Batterman, Sergei Chernyak, "Active and Passive Sampling of 1, 3-Butadiene and Other VOCs using Thermal Desorption Tubes"
31. S. Batterman, C. Godwin, "The Use of Proximity Sensors to Interpret IAQ Monitoring Results."
32. SM. Jeebhay, R. Baatjie, E. Cairncross, S. Batterman, "A followup investigation from massive community exposure to sulfur dioxide."

33. C.A. Bradlee, S. Batterman, “Assessing the non-cancerous toxicity of solvent mixtures using an interaction-adjusted PBTK model.”
34. Parker, E., S. Batterman, T. Lewis, B. Israel, T. Robins. "Adult behaviors determine the effectiveness of an air filter intervention for children with asthma."
35. RN Naidoo, TG Robins, S Batterman, G Mentz, C Jack, Nasirumbi. "Ambient pollution and variability in respiratory outcomes among school children in Durban, South Africa"

10.4 Peer-Reviewed Book Chapters

1. **S. Batterman**, Contributor to several chapters; Editor--Chapter 2 “Operating Principles.” In: Hazardous Waste Incineration Calculations: Problems and Software, Reynolds, J., R. Dupont, L. Theodore, eds., J. Wiley and Sons, New York NY, 1990. .
2. **S. Batterman**, “Emergency Response to a Large Sulfur Fire.” In: Teachers Guide for Environmental Health Applications, M. Weinger, ed., World Health Organization, 1998.
3. **S. Batterman**, “Environmental Impact Assessment”, “Soil Contaminants, “Risk Assessment,” and other extended entries. In: The Encyclopedia of Environmental Science, D.E. Alexander, R.W. Fairbridge, eds. Kluwar Academic Pub., Boston, 1999.
4. E. Parker, T.G. Robins, B.A. Israel, W. Brakefield-Caldwell, K.K. Edgren, A. O'Tolle, D. Wilkins, **S. Batterman**, T. Lewis, Developing and Implementing Guidelines for Dissemination: The Experience of the Community Action Against Asthma Partnership. in B.A. Israel, E. Eng, A.J. Schulz, E.A. Parker. Methods for Community-Based Participatory Research for Health, John Wiley, San Francisco, 2013.

10.5 Papers and Abstracts

10.5.1 Papers Delivered at Professional Meetings

1. **S. Batterman**, D. Golomb, “Predicting Maximum Pollutant Concentrations Using Joint Probabilities of Meteorological Variables,” Joint Session on Probability and Statistics, presented at the American Meteorological Society Annual Meeting, Hot Springs AK, June, 1983.
2. **S. Batterman**, J.A. Fay, D. Golomb, “Incorporating Meteorological Data into Receptor Analysis,” presented at the Air Pollution Control Association Specialty Conference on Receptor Methods for Source Apportionment, Williamsburg VA, March 12-14, 1985.
3. **S. Batterman**, J.A. Fay, D. Golomb, “The Significance of Regional Sources of Fine Particles,” presented at the Annual Meeting of the Air Pollution Control Association, Minneapolis MN, June 14, 1986.
4. **S. Batterman**, M. Amann, J.P. Hettelingh, “Sulfur Emission Abatement Strategies Subject to Regional Deposition Target Levels in Europe,” presented at the Annual Meeting of the Regional Science Association, Athens Greece, August 20, 1987.
5. P. Patel*, **S. Batterman**, “Movement of VOCs Through the Vadose Zone,” poster presented at the Texas Water Pollution Control Association Annual Meeting, Austin TX, June 7-9, 1987.
6. **S. Batterman**, “Soil/Air Fluxes of Hazardous Substances at Treatment, Storage, and Disposal Facilities. Models and Measurements.” Proceedings of the Gulf Coast Hazardous Substance Research Center Second Annual Symposium: Mechanisms and Applications of Solidification/Stabilization. Beaumont, TX, USA. 1990. *Journal of Hazardous Materials*; 24, 2-3, 304-305, Sept 1990.
7. N. Fogel*, **S. Batterman**, "Gravimetric Differential Reactor System to Measure Sorption Processes for VOCs in Soils," presented at the Bioremediation: Fundamentals and Effective Applications, Gulf Coast Hazardous Substances Research Center, Lamar University, Beaumont TX, February 21-22, 1991.
8. A. Kulshrestha*, **S. Batterman**, "Investigation of Processes Affecting Transport of VOCs in Soils," Bioremediation: Fundamentals and Effective Applications, presented at the Gulf Coast Hazardous Substances Research Center, Lamar University, Beaumont TX, February 21-22, 1991.
9. **S. Batterman**, "Comparison of Hydrocarbon Vapor Transport in Clean and Contaminated Soil Systems," poster presented at the American Geophysical Union Spring Meeting, Montreal Canada, May 12-14, 1992.
10. N. Pirrone*, **S. Batterman**, "Accumulation and Removal Processes of Persistent Pollution in Urban Areas, presented at the IAQPRC Conference on Diffuse Pollution: Sources, Prevention, Impact and Abatement," Chicago, IL, Sept. 20-24, 1993.
11. **S. Batterman**, "NIST Panel--International Organization of Legal Metrology--Performance Requirements for FTIR Spectrometers," presented at the International Symposium on Optical Sensing for Environmental Monitoring, Air and Waste Management Association, Atlanta GA, Oct. 11-14, 1993.

12. **S. Batterman**, "Indoor Air Quality in Large Office Buildings," presented to the Michigan Chapter, American Society of Heating, Ventilating and Air Conditioning Engineers, Lansing MI, Jan. 21, 1993.
13. **S. Batterman**, "Identification of Pollution Sources in HVAC Systems," presented at the Annual Meeting of the American Society of Heating, Ventilating and Air Conditioning Engineers, Chicago IL, Jan. 25, 1993.
14. A. Franzblau, **S. Batterman**, H. Xiao, E. Lee, R. Schreck, J. Darcy, J. Santrock, "Biological Monitoring of Exposure to Water-Soluble Compounds Using Alveolar Air," presented at the American Industrial Hygiene Association Conference, Anaheim CA, May 21-27, 1994.
15. E. Zellers, M. Han, S. Patrash, W. Groves, **S. Batterman**, "SAW Microsensor Arrays for Selective Real-time Measurements of Organic Vapors and Vapor Mixtures," presented at the American Industrial Hygiene Association Conference, Anaheim CA, May 21-27, 1994.
16. M.G.D. Baumann, **S. Batterman**, G-Z. Zhang, A.H. Conner "Design and Performance of a VOC Analysis System for Measuring Emissions from Wood Composites," Invited paper, presented at the Forest Products Society South-East Section, Annual Meeting and Workshop on E nvironmental Quality, Atlanta GA, Nov. 16-17, 1994. Published in R. Brinker, K. Muehlenfeld, B. Stokes, R.C. Tang, eds., Proceedings of the 1994 Forrest Products Society Southeastern Section Workshop on Environmental Quality in Wood Processing, Forest Products Society, Madison, WI, pp. 74-82, 1996.
17. **S. Batterman**, "Recommendations for FT-IR Spectrometers," presented at the International Symposium on Optical Sensing For Environmental and Process Monitoring, McLean VA, Nov. 7-10, 1994.
18. **S. Batterman**, H. Burge, "Emission Sources in HVAC Systems: A fl Review," Invited paper presented at the Annual Meeting of the American Society of Heating, Air Conditioning and Refrigeration Engineers, Chicago IL, Jan. 30, 1995.
19. **S. Batterman**, "NIST Panel--International Organization of Legal Metrology--Performance Requirements for FTIR Spectrometers," presented at the International Symposium on Field Screening Methods for Hazardous Wastes and Toxic Chemicals, EPA/Air and Waste Management Association, Las Vegas, NV, Feb. 24, 1995.
20. **S. Batterman**, "NIST Panel--International Organization of Legal Metrology--Performance Requirements for FTIR Spectrometers," presented at the Measurement of Toxics and Related Air Pollutants, EPA/Air and Waste Management Association, Durham, NC, May 16-18, 1995.
21. A. Franzblau, **S. Batterman**, C. Stephen, B. Nakfoor, J.B. D'Arcy, N.E. Sargent, K.B. Gross, R.M. Schreck, "Evaluation of Methanol and Formate in Urine as Biological Exposure Indices of Methanol Exposure," Paper 145, presented at the American Industrial Hygiene Conference, Kansas City, MO, May 20-26, 1995.
22. **S. Batterman**, "Role of Universities in Solving Environmental Problems," presented at the International Conference on The Egyptian Universities Research and Its Role in Solving Developmental and Environmental Problems, Al-Azhar University, Cairo, Egypt, July 17-20, 1995.
23. D.W. Bowman, J. M. Brannon, S.BATTERMAN, "Evaluation of Polychlorinated Biphenyl and Polycyclic Aromatic Hydrocarbon Concentrations in Two Great Lakes Dredged Material Disposal Facilities," presented at the Annual COE meeting, Detroit, MI, Oct. 1996.
24. **S. Batterman**, A. Franzblau, "Dermal Exposures and Uptake of Methanol: Model and Experimental Results," presented at the American Industrial Hygiene Conference and Exposition, Washington, DC, May 18-24, 1996.
25. **S. Batterman**, E. Cairncross, "A Dispersion Model of the AECI-Macassar Sulfur Fire Plume," presented at SAIChE '97, 8th National Meeting of the South African Institution of Chemical Engineers, Cape Town, South Africa, April 16-18, 1997.
26. S.L. Daniels, **S. Batterman**, M.A. Klemp, A. Wood, "Continuous Monitoring of Volatile Organic Compounds (VOCs) Affecting Indoor Air Quality in Laboratory and Industrial Environments," presented at the 29th Central Regional Meeting of the American Chemical Society, Midland, MI, May 27-30, 1997.
27. C-Y. Peng, **S. Batterman**, "Static Chamber Estimates of Sorption Parameters for HVAC Filters and Dust," poster presented at the 2nd Biennial Engineering Solutions to Indoor Air Quality, Research Triangle Park, NC, July 21-23, 1997.
28. S.L. Daniels, S.A. **Batterman**, M.A. Klemp, A. Wood, "Continuous Monitoring of Volatile Organic Compounds (VOCs) Affecting Indoor Air Quality in Laboratory & Industrial Environments," presented at the 2nd Biennial Engineering Solutions to Indoor Air Quality, Research Triangle Park, NC, July 21-23, 1997.
29. **S. Batterman**, A. Franzblau, H. Xiao, E. Lee, R. Schreck, J. Darcy, "Short-Term Inhalational Exposures To Methanol: Measurement of Clearance and Half-Life Using Biological Monitoring In Volunteers," presented at the American Industrial Hygiene Association Conference, Atlanta GA, April 13-18, 1998.

30. S.L. Daniels, **S. Batterman**, W.C. White, A. Wood, "Analysis Of Microbial Volatile Organic Compounds (MVOCs) In Indoor Air Environments Using High-Speed Gas Chromatography, Paper 1166, Session 145 on High Speed Gas Chromatography, PittCon '98, New Orleans, LA, March 5, 1998.
31. **S. Batterman**, L. Zhang, S. Wang, K. Mancy, "Disinfection By-Products in Drinking Water Systems," presented at NSF/EPA Conference on Drinking Water Small Scale Systems, Washington, DC., May 10-13, 1998.
32. S.L. Daniels, **S. Batterman**, W.C. White, A. Wood, "Applications of High-Speed Gas Chromatography in the Analysis of VOCs and MVOCs in Indoor Air Environments," 13th Annual International Symposium on the Measurement of Toxic and Related Air Pollutants, Cary, NC Sept. 1-3, 1998.
33. **S. Batterman**, E. Cairncross, "Ambient Air Monitoring and Air Pollution Management: A Comparison of National Strategies for Particulate Matter and Application to South Africa", presented at the 11th World Clean Air Congress, Durban, South Africa, Sept. 13-18, 1998.
34. L. Zhang*, **S. Batterman**, S. Wang, K. Mancy, "Reduction in Disinfectant By-Product Formation Using Chlorine as a Primary Disinfectant and a Silver-Hydrogen Peroxide Formulation a Secondary Disinfectant," presented at the 21st Midwest Environmental Chemistry Workshop, Ann Arbor, MI, Oct. 16-18, 1998.
35. J. Warila*, **S. Batterman**, "A Probabilistic Model for the Bioaccumulation of Silver in Aquatic Systems," presented at the 21st Midwest Environmental Chemistry Workshop, Ann Arbor, MI, Oct. 16-18, 1998.
36. J. Warila*, **S. Batterman**, "A Probabilistic Tropic Level Model for Silver Bioaccumulation in Aquatic Systems," presented at the 19th Annual Meeting, Society of Environmental Toxicology and Chemistry, Charlotte, NC, Nov. 15-19, 1998.
37. **S. Batterman**, "Evaluation of the Efficacy of a New Secondary Disinfectant Formulation Using Hydrogen Peroxide and Solver and the Formation of Disinfection By-Products Resulting from Interactions with Conventional Disinfectants, STAR Grants Drinking Water Program Review Meeting, Washington, DC, Dec. 8-9, 1998.
38. S. Armijo*, **S. Batterman**, A. Franzblau, C. Godwin, W. Baker, "A Review and Critique of Questionnaires in SBS-Type Investigations," poster presented at the 1st NSF International Conference on Indoor Air Health: Impacts, Issues, and Solutions, Denver, CO, May 3-5, 1999.
39. **S. Batterman**, "Health Risk Assessment at the Facility Level," 2nd International Workshop on Environmental Systems Analysis and Management, Ann Arbor, MI, Nov. 19-20, 1999.
40. **S. Batterman**, E. Cairncross, "Faculty, Curriculum and Research Development Related to Cleaner Production Technologies and Advanced and Smart Materials, presented at the Annual Research Meeting of the Tertiary Education Linkage Program, Pretoria, South Africa, April 2-5, 2000.
41. **S. Batterman**, "Air Sampling Using Sorbents and Short-Path Thermal Desorption," presented at the 48th American Society of Mass Spectroscopy Conference, June 11- 15, 2000, Long Beach, CA.
42. **S. Batterman**, "Experiences Teaching Risk Assessment," presented at the Annual Meeting of the Air and Waste Management Assoc., Salt Lake City June 18-22, 2000.
43. **S. Batterman**, "Evaluating The Health Effects of Indoor Air Mixtures," presented at the NSF International Conference on Indoor Air Health, Miami, FL, Jan. 29-31, 2001.
44. C.A. Bradlee*, **S. Batterman**, C.C. Godwin, "Assessing Pollutant Mixtures in Commercial Building Indoor Air," poster presented at Application of Technology to Chemical Mixtures, Annual Symposium on Mixtures, Colorado State University, Jan. 9-11, 2001.
45. **S. Batterman**., "Evaluation of the Efficacy of a New Secondary Disinfectant Formulation Using Hydrogen Peroxide and Silver and the Formulation of Disinfection By-Products Resulting From Interactions with Conventional Disinfectants," presented at the US EPA Research Drinking Water Progress Review, Silver Spring, MD, Feb. 22-23, 2001.
46. **S. Batterman**, H. Bowles, B. Sun, "Progress in the UM-Pentech Tertiary Linkage Program, presented at the Global Partnership Meeting, UNCF, US AID Annual Meeting, Washington DC, April 2-4, 2001.
47. E.K. Barnett*, **S. Batterman**, P.J. Kalliokoski, T.A. Metts, C.A. Harms, "The Effect of Air Ionization and Area Ventilation on Indoor Air Quality at a Sheet-Fed Offset Lithographic Printing Facility," presented at the American Industrial Hygiene Conference & Expo, June 2 - 7, 2001, New Orleans, LA.
48. C. Ziehl*, **S. Batterman**, C. Godwin, M. Gardell, "Multipoint Monitoring and Assessment of CO_2, VOCs, NO_x and O_3 in an Office Building," presented at the American Industrial Hygiene Conference & Expo, June 2 - 7, 2001, New Orleans, LA.

49. C.A. Harms*, **S. Batterman**, E.K. Barnett, T. Metts, P. Kalliokoski, "Changes in Employee Perception at a Sheet-Fed Offset Lithographic Printing Facility Following Air Ionization and Area Ventilation," presented at the American Industrial Hygiene Conference & Expo, June 2 - 7, 2001, New Orleans, LA.
50. **S. Batterman**, "Linking Environmental Health Education to Engineering, Science, Economics and Management Using Spreadsheet (and other) Models," presented at the Environmental and Occupational Health Conference on Sustaining the Environmental Health Workforce, August 1-3, 2001, Seattle, WA.
51. **S. Batterman**, "Integration of MS and MPH Curricula in Environmental Health, Industrial Hygiene, Occupational Medicine, and Toxicology at the University of Michigan: A Risk-Based Approach," presented at the Environmental and Occupational Health Conference on Sustaining the Environmental Health Workforce, August 1-3, 2001, Seattle, WA.
52. T. Metts,* **S. Batterman**, P. Kalliokoski, E. Barnett, "Active and Diffusion Sampling of VOCs Using Thermal Desorption Tubes: Application at an Offset Printing Facility," presented at the International Symposium on Thermal Desorption in Occupational, Medicinal and Environmental Chemical Analysis, Birmingham AL (sponsored by U of Alabama, US Centers for Disease Control, and the US National Institute of Occupational Safety and Health, Oct. 9-10, 2001.
53. Chris Bradlee, **S. Batterman**, "Evaluation of Component-Based Chemical Mixtures Approaches for the Non-Cancer Health Risk Assessment of Indoor Air," presented at the 7th Annual Toxicology Research Symposium, University of Michigan, April 5, 2002, Ann Arbor, MI.
54. **S. Batterman**, T. Robins, G. Mentz, N. Bainjath, J Kistnasamy, "Air Pollution Exposure Measures for an Acute Epidemiological Study of Respiratory Effects in Children in Durban, South Africa," presented at the 12th Conference of the International Society of Exposure Analysis (ISEA); 14th Conference of the International Society for Environmental Epidemiology (ISEE), Aug. 11-15, 2002, Vancouver BC, Canada.
55. A-T Huang,* **S. Batterman**, "Formation of Trihalomethanes in Beverages and Foods," presented at the 12th Conference of the International Society of Exposure Analysis (ISEA); 14th Conference of the International Society for Environmental Epidemiology (ISEE), Aug. 11-15, 2002, Vancouver BC, Canada.
56. T. Robins, **S. Batterman**, G. Mentz, "Acute Symptoms And Disease Aggravation Among Primary School Students In Durban, South Africa Attributable To Air Pollution Exposures, presented at the 2nd Conference on Epidemiological Longitudinal Studies in Europe, June 12-14, 2002, Oulu, Finland.
57. **S. Batterman**, "Response and follow-up investigations related to a massive sulfur fire: A case study in disaster response and post-disaster evaluation," presented at Responding to a New Environment, Emergency Response at Schools of Public Health, ASPH, HRSA Conference, Pittsburgh, Sept. 9-10, 2002.
58. B. Hedgeman,* A. Sadeghnejad, J. Wirth, S Batterman, M Hultin, R Wahl, "The Impact of Maternal Exposure to Criteria Air Pollutants on Adverse Birth Outcomes: A Literature Review", presented at the Conference On Maternal Morbidity And Mortality, June 12, 2003, Lansing Michigan.
59. P. Kalliokoski, K. Owen, D. Leith, **S. Batterman**, "The predicted performance of activated carbon filtration for VOCs at indoor air concentrations, proceedings, The 7th International Symposium on Ventilation for Contaminant Control, Aug. 5-8, 2003, Sapporo, Japan.
60. A-T Huang,* **S. Batterman**, "Sorption of Trihalomethanes in Foods," 13th Conference of the International Society of Exposure Analysis (ISEA); Sept. 21-25, 2003, Stresa, Italy.
61. **S. Batterman,** Chris Godwin, Alfred Franzblau, Chunrong Jia, Swati Ellendula "VOC exposures among Among Teachers and Students in Schools and at Home," 13th Conference of the International Society of Exposure Analysis (ISEA); Sept. 21-25, 2003, Stresa, Italy.
62. **S. Batterman,** Chris Godwin, Alfred Franzblau, Chunrong Jia, Swati Ellendula, Richard Corsi, Vince Torres, Mark Sanders, "IAQ and Ventilation in Michigan and Texas Schools," 13th Conference of the International Society of Exposure Analysis (ISEA); Sept. 21-25, 2003, Stresa, Italy.
63. J. Kangas, J Laitinine, M Hautanmaki, M Hyttinen, P Pasanen, P Kalliokoski, **S Batterman**, "Solvent exposure in small offset plants," paper 117 presented at the American Industrial Hygiene Association Conference, May 8 – 13, 2003, Atlanta, GA.
64. **S. Batterman**, "Exposure Assessment in the Durban South Health Study," 8th World Congress on International Health, International Federation of Environmental Health, Durban, South Africa, Feb. 23-27, 2004.
65. **S. Batterman**, "Risk Assessment in the Durban South Health Study," 8th World Congress on International Health, International Federation of Environmental Health, Durban, South Africa, Feb. 23-27, 2004.

66. **S. Batterman**, "Review of Exposure Assessment in the Settlers School Study, Durban South Africa," 8th World Congress on International Health, International Federation of Environmental Health, Durban, South Africa, Feb. 23-27, 2004.
67. *R. Naidoo, T. Robins, **S. Batterman**, "Epidemiological Approaches investigating the impact of environmental pollutants on health of communities in the Durban Metro." World Congress on Environmental Health, Durban, South Africa, Feb. 23-27, 2004.
68. Naidoo R, Robins T.G., C. Jack, E. Irusen, G.B. Mentz, U. Lalloo, J. Kistnasamy, S. Batterman. Results of the Settlers' School Study into environmental pollution and respiratory outcomes. World Congress on Environmental Health, Durban, 2004 (invited speaker)
69. **S. Batterman**, S.A., Yungdae Yu, Chunrong Jia, Christopher Godwin, "In-Use Evaporative Emissions from Vehicle Fuel Caps," Air & Waste Management Association Conference, Indianapolis, IN June 2004.
70. **S. Batterman**, C. Jia, Chris Godwin, Alfred Franzblau. "Sources and Significance of VOC Exposures in Microenvironments: Schools, Offices, Residences, Outdoors, and Vehicles," presented at the Air & Waste Management Association Conference, Indianapolis, IN June 2004.
71. Wahl, Robert, Alireza Sadeqnejad, Mary Lee Hultin, **S. Batterman**, Michael Depa, Julie Wirth, "Investigating Preterm Births and Air Pollution in Michigan," poster presented at the Environmental Public Health Tracking Conference, March 24-26, Philadelphia, PA.
72. **S. Batterman**, J. Dikos, J. Wirth, M.L. Hultin, M. Depa, R. Wahl, "Speciation of PM2.5 collected in two areas of Michigan," paper submitted to the International Society of Environmental Epidemiology Annual Meeting, August 1-4 2004, New York, NY.
73. Sadeqnejad Akireza, M.L. Hultin, **S. Batterman**, M. Depa, J. Wirth, R. Wahl, "Investigating Adverse Birth Outcomes and Air Pollution In Michigan," paper submitted to the International Society of Environmental Epidemiology Annual Meeting, August 1-4 2004, New York, NY.
74. **S. Batterman**, "Exposure Assessment in Environmental Epidemiology and Risk Assessment: Experiences on Three Continents," presented at the Michigan Department of Community Health, Lansing, MI, Sept. 16, 2004.
75. Van DerMerwe, **S. Batterman**, Y Gounden, "PM Collocation Study Conducted At Wentworth, South Durban in 2004" presented at National Association for Clean Air Conference, October 7-8, 2004, Johannesburg, South Africa.
76. Jia, Chunrong, **S. Batterman**, Chris Godwin, "Levels and Sources of VOC Exposures in Microenvironments: A Monte Carlo Analysis", Philadelphia, PA, International Society of Exposure Analysis Annual Meeting, October 17-21, 2004.
77. **S. Batterman**, "Strategies and Tools for Sustainable Development and Environmental Management," invited keynote speach presented at The Pacific Regional Symposium on Environmental Management and Occupational Health, Chung-Hwa College of Medical Technology, Tainan, Taiwan, November 4-6, 2004.
78. Bradlee, Christopher A., **S. Batterman**, ME Andersen, "Assessing the Toxicity of n-Hexane, Toluene and Acetone Mixtures Using an Interactions-adjusted Physiologically Based Toxicokinetic Model," Fall 2004 Meeting of the Michigan Regional Chapter of the Society of Toxicology, East Lansing, MI., Nov. 13, 2004.
79. **S. Batterman**, "Environmental Health, Sustainable Development and Environmental Management," presented at National Taiwan University, Nov. 8, 2004.
80. TG Robins, C. Jack, E. Irusen, G.B. Mentz, U. Lalloo, J. Kistnasamy, **S. Batterman**, R. Naidoo "High Prevalence of Bronchial Hyperreactivity among School Children in Durban, South Africa", ATS International Conference, San Diego, CA, May 22-25, 2005
81. A. Sadeqnejad, H. Lee, M.L. Hultin, **S. Batterman**, M. Depa, J. Wirth, D. Cornell, R. Wahl, "Adverse Birth Outcomes and Air Pollution in Michigan", Michigan Epidemiology Conference, Ann Arbor, MI, March 11, 2005.
82. *Hien Q Le, Alireza Sadeghnejad, Julia J. Wirth, Mary Lee Hultin, Michael Depa, **S. Batterman**, Robert L. Wahl, "Association of Ozone with Low Birth Weight in Southeast Michigan, 1990-2001," presented at the Annual Meeting of the Council of State and Territorial Epidemiologists, Albuquerque, NM, June 5 – 9, 2005.
83. *Hien Q Le.; **S. Batterman**; Alireza Sadeghnejad; Julia J. Wirth; Mary Lee Hultin; Michael Depa; Robert L. Wahl, "Association of ozone with low birth weight in Michigan, 1990-2001, using multiple imputation method for missing ozone values," 17th Conference of the International Society for Environmental Epidemiology, Johannesburg, South Africa, Sept. 13-17, 2005.

84. **S. Batterman**, C Jia, C Godwin, G Hatzivasilis, "Distributions of Volatile Organic Compounds (VOCs) in Indoor and Outdoor Air among Industrial, Urban and Suburban Neighborhoods," presented at IAQ 05, Beijing, China, Sept. 4-9, 2005.
85. *****C Jia, **S. Batterman**, S Chernyak, "Development of a sensitive thermal desorption GC-MS method using selective ion monitoring for a wide range of VOCs," presented at IAQ 05, Beijing, China, Sept. 4-9, 2005.
86. **S. Batterman**, "Pollution, Health and Economic Development in South Durban," 17th Conference of the International Society for Environmental Epidemiology, Johannesburg, South Africa, Sept. 13-17, 2005.
87. *****Jafta N., Gqaleni N., **Batterman S**., Naidoo R., Robins T. and Jia C., "Indoor air quality of selected residences in South Durban compared to north Durban." 17th Conference of the International Society for Environmental Epidemiology, Johannesburg, South Africa, Sept. 13-17, 2005.
88. *****Y. Gounden, M. Van Der Merwe, **S. Batterman**, R. Naidoo, A. Mohamed, K. Govender, J. Chetty, "Exposure assessment in the Durban Health Study - conventional pollutants." 17th Conference of the International Society for Environmental Epidemiology, Johannesburg, South Africa, Sept. 13-17, 2005.
89. *****Jafta N., Gqaleni N., **Batterman S**., Naidoo R., Robins T. and Jia C., "Indoor air quality of selected residences in South Durban compared to north Durban." 17th Conference of the International Society for Environmental Epidemiology, Johannesburg, South Africa, Sept. 13-17, 2005.
90. **S. Batterman**, C. Jia, S. Chernyak, Y. Gounden, "Exposure assessment for toxic air pollutants in Durban, South Africa," *Epidemiology*. 16(5): S129-S130, September 2005. Also presented at the 17th Conference of the International Society for Environmental Epidemiology, Johannesburg, South Africa, Sept. 13-17, 2005.
91. Robins, TG; **Batterman S**, Mentz GB, Kistnasamy J; Jack C, Irusen E, Lalloo U, Naidoo R, Kistnasamy B, Baijnath N, Amsterdam H, "Respiratory health and air pollution in South Durban: the Settlers School study," 17th Conference of the International Society for Environmental Epidemiology, Johannesburg, South Africa, Sept. 13-17, 2005.
92. Naidoo, R; **Batterman, S**; Robins, T.; Gqaleni, N.; Kistnasamy, J; Gounden, Y; Van der Merwe, M; Jack, C. "Overview of the Epidemiological and Health Risk Study conducted under the Multipoint Plan," 17th Conference of the International Society for Environmental Epidemiology, Johannesburg, South Africa, Sept. 13-17, 2005.
93. T.G. Robins, C. Jack, E. Irusen, G.B. Mentz, U. Lalloo, J. Kistnasamy, **S. Batterman**, R. Naidoo, "High Prevalence of Bronchial Hyperreactivity Among School Children In Durban, South Africa," International Conference of the American Thoracic Society, San Diego, CA, May 22 – 25, 2005.
94. Huang, AT, **Batterman S**, "Risk Assessment for Trihalomethanes in Beverages and Foods," Society for Risk Analysis (SRA) Annual Meeting, Orlando FL, December 4-7, 2005.
95. **S. Batterman**, C. Jia, G. Hatzivasilis, Simultaneous measurement of air exchange and VOC concentrations: application in vehicles, houses and garages, submitted to the Air & Waste Management Association 99th Annual Conference & Exhibition, New Orleans, LA June 20-23, 2006.
96. **S. Batterman**, C. Godwin, C. Jia., "Biological monitoring for VOCs," presented at Workshop on the Interpretation of Biomonitoring Data and their relationship to Exposure Information, American Chemistry Council, Minneapolis, MN, July 26-27, 2006.
97. **S. Batterman**, C. Jia, C. Godwin, G. Hatzivasilis, "A Dominant Source of VOC Exposure: Attached Garages," presented at the International Conference on Environmental Epidemiology & Exposure, Sept. 2-6, 2006, Paris, France.
98. Le, H; **S. Batterman**, K. Dombkowski, R. Walh, J. Wirth, E. Wasilevich, M. Depa, "A Comparison Of Multiple Imputation And Optimal Estimation For Missing And Uncertain Urban Air Toxics Data," presented at the International Conference on Environmental Epidemiology & Exposure, Sept. 2-6, 2006, Paris, France.
99. Jafta N, Gqaleni N, **Batterman S**, Naidoo R, Robins T. Allergen levels in the residences and schools in primary school children in Durban, Paper presented at the 3rd National Public Health Conference, Johannesburg, South Africa, May 16-17, 2006.
100. Sikhosana N, Jafta N, Gqaleni N, Naidoo R, **Batterman S**, Robins T. "Indoor concentration of particulate matter and carbon monoxide in the south and north of Durban." Paper presented at the 3rd National Public Health Conference, Johannesburg, South Africa, May 16-17, 2006. [*Nominated new researcher presentation*]
101. *Gounden Y, Batterman S, Naidoo R. "The Durban south Health study: Exposure monitoring." Poster presented at the 3rd National Public Health Conference, Johannesburg, South Africa, May 16-17, 2006.

The preceding presentation received the Best New Researcher Poster Award.

102. Chernyak S, **Batterman S**, Gwynn E, Jia C, Begnoche L, "Temporal (1983-2005) and spatial trends of polybrominated diphenyl ethers in great lakes rainbow smelt and lake trout," to be presented at Dioxin 2006, Oslo, Norway, Aug. 21-5, 2006.

103. **S. Batterman**, S. Chernyak, Y Gounden, M Matooane, "Concentrations of persistent organic pollutants in ambient air in Durban, South Africa," to be presented at Dioxin 2006, Oslo, Norway, Aug. 21-5, 2006.

104. **S. Batterman**, C. Godwin, C. Jia, "Design and Evaluation of a New Breath Monitoring System for Volatile Organic Compounds," presented at the International Council of Chemical Association (ICC) Biomonitoring Workshop, Minneapolis, MN, July 26-7, 2006. Invited.

105. F. Freire, C.H. Antunes, M.C. Gameiro, **S. Batterman**, A.G. Martins, "Energy for sustainability (EfS): An initiative of the University of Coimbra, presented at the 10th meeting of the Alliance for Global Sustainability, Barecelona, Spain, March 18-21, 2007.

106. R. Poovendhree, R. Naidoo1, R. Naidoo, T.G. Robins, G. Mentz, S.J. London, **S. Batterman**, "Effect modification of respiratory responses to ambient air pollutants by GSTM1, GSTP1 and NQO1 polymorphisms," submitted to the American Thoractic Society International Conference, San Francisco, May 18-23, 2007.

107. **S Batterman**, S. Chernyak, W Wang, J Nriagu, "Organic and Metal Contaminants in Eurasian Caviar: Trends & Risks" SETAC Europe 17th Annual Meeting in Porto, May 20-24, 2007.

108. S Chernyak, **S. Batterman**, Y Youden, M. Matoonane, R. Naidoo, "Persistent and currently used pesticides in South African air, SETAC Europe 17th Annual Meeting in Porto, May 20-24, 2007.

109. S Chernyak, **S Batterman**, A Konoplev, A Kochetkov, C Godwin, C Jia, S Charles. "Fate of Brominated Flame Retardant Chemicals in Russian and US Buildings," SETAC Europe 17th Annual Meeting in Porto, May 20-24, 2007.

110. JY Chin, F Freire, J Malaca, **S Batterman**, "Incorporating local scale impacts into LCAs: Comparing conventional and ethanol fuels," SETAC Europe 17th Annual Meeting in Porto, May 20-24, 2007.

111. J Kistnasamy, TG Robins, **S Batterman**, G Mentz, R Naidoo, U Lalloo, E Irusen, C Jack. "The relationship between asthma and outdoor air pollution among primary school learners in Durban, South Africa," 4th International Conference on Children´s Health and the Environment, Vienna, Austria, June 10-12, 2007.

112. **S. Batterman**, "Management Systems for Health Care Waste. 1st Annual Infection Prevention and Control Meeting, Maputo, Mozambique. June 4, 2007.

113. N Jafta, N Gqaleni, R Naidoo, **S Batterman** and T Robins, "Characterization of biological pollutants (allergens and fungi) in low-to-medium income households in South Africa," Annual Meeting of the International Society for Environmental Epidemiology, Mexico City, Sept. 5-9, 2007.

114. Y. Gounden, **S. Batterman**, R. Naidoo, "Spatial and temporal trends of air pollutants in industrial and non-industrial communities," Annual Meeting of the International Society for Environmental Epidemiology, Mexico City, Sept. 5-9, 2007.

115. **S. Batterman**, Y. Gounden, R. Naidoo, S. Chernyak, T. Robins, "Exposures and health risks from toxic air pollutants in industrialized and non-industrialized communities," Annual Meeting of the International Society for Environmental Epidemiology, Mexico City, Sept. 5-9, 2007.

116. T. Robins, R. Naidoo, **S. Batterman**, G. Mentz, Y. Gounden, "Exposures and health risks from toxic air pollutants in industrialized and non-industrialized communities," Annual Meeting of the International Society for Environmental Epidemiology, Mexico City, Sept. 5-9, 2007.

117. **S. Batterman**, S. Chernyak, Y. Gounden, M. Matooane. "Concentrations of persistent organic pollutants in ambient air in Durban, South Africa," 27th International Symposium on Halogenated Persistent Organic Pollutants, Tokyo, Japan, Sept. 2-7, 2007.

118. **S. Batterman**, C. Jia, C. Godwin, "Determinants of VOC exposures and mixtures: Review of distributions of VOCs in indoor and outdoor air, factors affecting concentrations, and statistical analysis of high-concentration mixtures and their sources," International Society of Exposure Analysis (ISEA) 2007 Annual Meeting, Durham/Research Triangle Park, NC, October 14-18, 2007.

119. S. Chernyak, **S. Batterman**, E. Gwynn, C. Jia, L. Begnoche, "Temporal and Spatial Trends of Polybrominated Diphenyl Ethers in Great Lakes Rainbow Smelt and Lake Trout (1983-2005)", Dioxin 2007, 27th International Symposium on Toxic Halogenated Persistent Organic Pollutants, Tokyo, Japan, Sept. 2-7, 2007.

120. S. Chernyak, **S. Batterman,** C.Godwin, C. Jia, S. Charles, "Evolution Of Flame Retardant Chemicals In A Newly Constructed Building, Dioxin 2007, 27th International Symposium on Toxic Halogenated Persistent Organic Pollutants, Tokyo, Japan, Sept. 2-7, 2007.
121. Savinova T, **Batterman S**, Konoplev S, Savinov V, Gabrielsen GW, Alekseeva L, Kochetkov A, Pasynkova E, Samsonov D, Chernyak S, Koryakin A. "New environmental contaminants in seabirds from the Seven Islands Archipelago (Barents Sea, Russia)", Dioxin 2007, 27th International Symposium on Toxic Halogenated Persistent Organic Pollutants, Tokyo, Japan, Sept. 2-7, 2007.
122. J-Y Chin, **S. Batterman**, "Alternative Fuels – Emissions, Permeability and Potential Health Impacts, Alliance for Global Sustainability Annual Meeting 2008, Cambridge, MA, Jan 29-31, 2008.
123. **S. Batterman**, C. Jia, C. Godwin, "Indoor and Outdoor Concentrations of VOCs and their Determinants in Industrial, Urban and Suburban Neighborhoods," Indoor Air 08, Copenhagen, Denmark, Aug. 17-22, 2008.
124. **S. Batterman S.**, C. Chernyak, C. Jia, C. Godwin, "Evolution of brominated flame retardant chemicals in dust, air and HVAC filters in a newly constructed multi-use building," Indoor Air 08, Copenhagen, Denmark, Aug. 17-22, 2008.
125. S. Chernyak Sergei, A Konoplev, **S Batterman**, A Kochetkov, E Pasynkova, D Samsonov, C. Jia, "PBDEs In Ambient and Indoor Air in Different Locations in the Russian Federation," Dioxin 2008, 28th International Symposium on Toxic Halogenated Persistent Organic Pollutants, Birmingham, UK, Aug. 18-21, 2008.
126. **S Batterman**, S Chernyak, C Jia, S Charles, C Godwin, Trends and Mass Balance of Flame Retardant Chemicals in a New Building," Dioxin 2008, 28th International Symposium on Toxic Halogenated Persistent Organic Pollutants, Birmingham, UK, Aug. 18-21, 2008.
127. K. Zhang, **S. Batterman** "Estimating on-road and near-road exposures due to traffic congestion," 2008 Joint Annual Conference of the International Society for Environmental Epidemiology and the International Society of Exposure Analysis, Pasadena, CA, Oct. 12-16, 2008.
128. Hien Le, **S Batterman**, A Sadeghnejad, R Wahl, J W, ML Hultin, M Depa, K Hoggatt, "Air pollutant exposure and preterm and small-for-gestational-age births in Detroit, Michigan: Long-term Trends and Associations," 2008 Joint Annual Conference of the International Society for Environmental Epidemiology and the International Society of Exposure Analysis, Pasadena, CA, Oct. 12-16, 2008.
129. Stevanovic A, J Stevanovic, K Zhang, **S Batterman**, "Optimizing Traffic Control to Reduce Fuel Consumption and Vehicular Emissions: Integrated Approach with VISSIM, CMEM, and VISGAOST (09-1707)," Presented at the 88th Annual Meeting of the Transportation Research Board, Washington DC., Jan. 11-15, 2009.
130. ML Hultin, HQ Le, **SA Batterman**, RL Wahl, JJ Wirth, MP Depa, "The Influence Of Air Pollutant De-trending On Analyses Of Exposure And Adverse Birth Outcomes," Annual Meeting of the Air & Waste Management Association, Detroit MI, June 14-19, 2009.
131. **Batterman S**, T Robins, R Wahl, T Lewis, E Wasilevich, ML Hulton, M Depa, F Dion, E Parker, J Wirth, A Vette, T Bruff, B Mukhergee, "Investigations of near-road health effects in Detroit – three epidemiological approaches," Annual Meeting of the Air & Waste Management Association, Detroit MI, June 14-19, 2009.
132. Kai Zhang, **Stuart Batterman**, "In-cabin Measurements of Traffic Related Air Pollutants in Ann Arbor, Michigan," Annual Meeting of the Air & Waste Management Association, Detroit MI, June 14-19, 2009.
133. Chunrong Jia, **Stuart Batterman**, Christopher Godwin, Simone Charles, Jo-Yu Chin, "Air Exchange Rates and VOC Sources in Offices and Other Industrial / Commercial Settings," Annual Meeting of the Air & Waste Management Association, Detroit MI, June 14-19, 2009.
134. PI Johnson, Y Wang, TG Robins, RN Naidoo, GB Mentz, **SA Batterman**, C Jack, "Ambient Air Pollution and Decreased Lung Function in Children of Durban, South Africa," Annual Meeting of the Air & Waste Management Association, Detroit MI, June 14-19, 2009.
135. **S Batterman**, J Bulkley, J Eisenberg, R Hardin, M Kruk, MC Lemos, A Michalak, B Mukherjee, E Renne , H Stein, C Watkins, M Wilson, "Sustainable Control of Water-Related Infectious Diseases: A Review and Proposal for Interdisciplinary Health-Based Systems Research," Annual Conference of Universities Council on Water Resources, Chicago, IL, July 7-9, 2009.
136. **S Batterman**, C Jia, S Chernyak, C Godwin, "Concentrations and In-use Emissions of PBDEs from US Houses, Garages and Workplaces," BFR2009 - 11th Annual Workshop on Brominated Flame Retardants, Ottawa, Canada, May 19-20, 2009.
137. MF Miller, SM Chernyak, SE Domino, **SA Batterman**, R Loch-Caruso, "Concentrations and speciation of polybrominated diphenyl ethers (PBDEs) in human amniotic fluid," presented at Dioxin 2009, 29th

International Symposium on Toxic Halogenated Persistent Organic Pollutants, Beijing China, Aug. 23-28, 2009.

138. AT Huang, KP Cantor, **S Batterman, "**Estimation for Reduced Trihalomethane Exposure through Ingestion from Heated Tea and Drinking Water," International Society for Exposure Assessment, Annual Meeting, Dublin, Ireland, Aug. 24-29, 2009.

139. H. Elasaad, **S. Batterman**, "Polycyclic-Aromatic Hydrocarbons (PAHs) at Roadside Environments: Analysis of Ambient Air and Dry Deposition," Poster presented at the American Society of Public Health Meeting, Philadelphia, PA, Nov. 7-10, 2009.

The preceding poster won a Student Achievement Award.

140. K. Zhang, **S.A. Batterman**, "Vehicle emissions in congestion: comparison of work zone and free-flow conditions," Poster presented at the International Society of Exposure Assessment Conference, Minneapolis, MN, Nov. 1-5, 2009.

141. **S. Batterman**, "New Directions for Environmental Health: Healthy and Sustainable Homes, Workplaces and Cities. Keynote speech presented at the Healthy City and Environmental Health Conference, Seoul, Korea, Oct. 29-30, 2009.

142. A Vette, **S Batterman**, M Breen, V Isakov, S Perry, D Heist, G Norris, T Lewis, T Robins, F Dion, B Mukherjee, and the Community Action Against Asthma Steering Committee. "Impact of mobile sources on near-roadway exposures and respiratory effects for childhood asthmatics." Poster presented at the American Association for Aerosol Research Specialty Conference – Air Pollution and Health: Bridging the Gap from Sources to Health Outcomes, San Diego, March 22 – 26, 2010.

143. **S Batterman**, B Mukherjee, F-C Su, C Jia, JC D'Souza, "Modeling and Analysis of Personal Exposure to Pollutant Mixtures: Further Analysis of the RIOPA Data," Invited poster presented at the Health Effects Institute Annual Meeting, Alexandria, VA, April 25-27. 2010.

144. T.C. Lewis, T.G. Robins, **S.A. Batterman**, E.A. Parker, W. Brakefield-Caldwell, et al. "Recruitment Design for a Study of Health Effects of Diesel Exhaust Among Children with Asthma: A Blend of Geographic Information Systems and Community-Based Participatory Research Methods," American Thoracic Society International Conference, New Orleans, May 14-19, 2010.

145. A Konoplev, S Batterman, S Chernyak, A Kochetkov, E. Pasynkova, D Samsono, "PBDEs in ambient air of Russian cities and their gradient in direction from Moscow to the Arctic," to be presented at the International Polar Year Oslo Science Conference, June 8-12, 2010, Oslo, Norway.

146. S Chernyak, **Batterman S**, N Basu, S Bohac, W. Northrop. "PAHS, nitro-PAHs & diesel exhaust toxins in the Great Lakes," presented at Dioxin 2010, 30th International Symposium on Toxic Halogenated Persistent Organic Pollutants, San Antonio, TX, Sept. 12-17, 2010.

147. Howard Hu, Martin Philbert, Bruce Richardson, Raymond Yung, Rita Loch-Caruso, Toby Lewis, Vasantha Padmanabhan, Dana Dolinoy, **Stuart Batterman**, John Meeker, Karen Peterson, Olivier Jolliet, Steven Gruber, , Robert Lyons, Laura Rozek, Daniel McConnell, Cathy Spino, Marie O'Neill, Roderick Little, Bhramar Mukherjee, Brisa Sanchez, Maureen Sartor, Gil Omenn, Amy Schulz, Barbara Israel, Niladri Basu. "The UM NIEHS P30 Core Center: Lifestage Exposures and Adult Disease." Poster presented at the Symposium on Epigenetics, University of Michigan, Sept. 23, 2010.

148. L Du, **S Batterman**, Edith Parker, Christopher Godwin, Jo-Yu Chin, Ashley O'Toole, Thomas Robins, Toby Lewis, Wilma Brakefield. "Use and impact of free-standing air filters placed in bedrooms of children with asthma in Detroit, Michigan: Community Action Against Asthma", accepted, 2010 ASPH Annual Meeting, Denver, CO, Nov. 6-10, 2010.

149. Parker, EA, Chung, L., Keirns, C., Strong, L., Israel, BA, Robins, TG, **Batterman, S**., Brakefield-Caldwell, W., Wilson, C., Mentz, G, Lewis, TC "Exploring the Relationship between Physical and Social Environmental Factors and Asthma Exacerbation in Children: Results of the Community Action Against Asthma Baseline Survey," accepted, 2010 ASPH Annual Meeting, Denver, CO, Nov. 6-10, 2010.

150. Matooane M, Naidoo R, **S. Batterman** "Time activity patterns: a case of south Durban, South Africa" presented at the 2010 Joint Conference of International Society of Exposure Science & International Society for Environmental Epidemiology, Seoul, Korea, 28 August 1 September, 2010.

151. **S Batterman**, Jo-Yu Chin, Chunrong Jia, Christopher Godwin, Edith Parker, Thomas Robins, Paul Max, Toby Lewis. "Review And Update Of Naphthalene Exposures - Is This The Highest Risk VOC?", Paper presented at Indoor Air 2011, June 5-10, 2011, Austin, TX.

152. **S Batterman**, Alan Vette, Gary Norris, Jon Thornburg, Jeff Portzer, Tom Robins, Toby Lewis, Community Action Against Asthma Steering Committee. "Traffic-Related Exposures of Children With Asthma Living Near Highways: A Seasonal Assessment Including Indoor and Outdoor Trends of Black Carbon, $PM_{2.5}$ and Other Pollutants", poster presented at Indoor Air 2011, June 5-10, 2011, Austin, TX.

153. Liuliu Du, **Stuart Batterman**, Edith Parker, Christopher Godwin, Jo-Yu Chin, Ashley O'Toole, Thomas Robins, Wilma Brakefield-Caldwell, Zachary Rowe, Toby Lewis, " Free-Standing Air Filters in Bedrooms of Inner City Children With Asthma. Do They Make A Difference?", Paper presented at Indoor Air 2011, June 5-10, 2011, Austin, TX.

154. Chunrong Jia, **Stuart Batterman**, Feng-Chiao Su, "Modeling Exposures to Indoor Air Pollutant Mixtures: Application of Copula Methods to the RIOPA Data," presented at Indoor Air 2011, June 5-10, 2011, Austin, TX.

155. Ashley O'Toole, A, Parker E, **Batterman S**, Robins T, Du L, Godwin C, Grant S, Rowe, Z, Lewis TC, and the Community Action Against Asthma Steering Committee. "Factors Affecting Air Filter Usage in Homes of Children with Asthma In Detroit, MI." Presented at the American Thoracic Society International Conference, Denver, CO, May 13-18, 2011.

156. Lewis TC, Parker EA, Robins TG, **Batterman S**, Mukherjee B, Mentz GB, Ren X, Godwin C, O'Toole AM, Grant S, and the Community Action Against Asthma Steering Committee. "Suitability of Homes of Asthmatic Children In Detroit for Installation of Window Unit Air Conditioners." Presented at the American Thoracic Society International Conference, Denver, CO, May 13-18, 2011.

157. Lewis TC, Robins TG, **Batterman S**, Mukherjee B, Mentz GB, O'Toole AM, Brakefield-Caldwell W, Grant S, Parker EA, and the Community Action Against Asthma Steering Committee. "Baseline Demographic And Health Characteristics Of A Cohort Of Urban Asthmatic Children By Proximity Of Residence To Highways". Submitted to the American Thoracic Society International Conference, Denver, CO, May 13-18, 2011.

158. F-C Su, **S Batterman**, B Mukherjee, C Jia, JC D'Souza, "Modeling and Analysis of Personal Exposure to Pollutant Mixtures: Further Analysis of the RIOPA Data including Extreme Value Distributions and Factor Analyses of Pollutant Data, Invited poster presented at the Health Effects Institute Annual Meeting, Boston, MA, May 1-3, 2011.

159. Davyda Hammond, **Stuart Batterman**, Gary Norris, Alan Vette, Michael Breen, Janet Burke, Vlad Isakov, Toby Lewis, and the Community Action Against Asthma Steering Committee, "Impact of Mobile Sources on Near-Roadway Exposures and Respiratory Effects for Children with Asthma" Invited poster presented at the Health Effects Institute Annual Meeting, Boston, MA, May 1-3, 2011.

160. **Stuart Batterman**, "Recent and Ongoing Studies of Air Pollutants and Asthma among Children in Detroit," Invited keynote speaker, Asthma Initiative of Michigan (AIM) Partnership Forum, Michigan Department of Community Health, Lansing, MI, May 10, 2011.

161. **S. Batterman**, S Chernyak, P Mochungong. Persistent organic pollutants in bottom ash from hospital waste incineration and adjacent soils in Africa, Presented at Dioxin 2011, August 21-25, Brussels, Belgium.

162. **Stuart Batterman**, Liuliu Du, Edith Parker, Christopher Godwin, Ashley O'Toole, Thomas Robins, Jie Zhou, Community Action Against Asthma, and Toby Lewis, "An intervention study using free-standing HEPA air filters and air conditioners placed in bedrooms of inner city children with asthma." Platform presentation at the International Society of Environmental Epidemiology Annual Meeting, Barcelona, Spain, Sept. 13-16, 2011.

163. **S Batterman**, S Li, S Sangameswaran, B Muhkerjee, A Ekstrom, T Robins, P Hopke, S Raja, T Lewis, "Traffic-related exposures and health outcomes of children with asthma living both near and far from highways." Poster presented at the International Society of Environmental Epidemiology Annual Meeting, Barcelona, Spain, Sept. 13-16, 2011.

164. TC Lewis, LS. Rozek, A VanZommeren-Dohm, B Mukherjee, X Ren, GB Mentz, TG Robins, E Hughes, LN Doan, **S Batterman,** and Community Action Against Asthma Steering Committee. "Characterization of Global DNA Methylation at LINE-1 in a Cohort of Urban Asthmatic Children with a Gradient of Exposure to Highways" Poster presented at the International Society of Environmental Epidemiology Annual Meeting, Barcelona, Spain, Sept. 13-16, 2011.

165. Lei Huang, Stanislav V. Bohac, Jo-Yu Chin, Sergei Chernyak, and **Stuart A. Batterman**. "Effect of fuel composition on PAH and nitro-PAH emissions from diesel engines. Poster presented at the 21st Annual International Society of Exposure Science (ISES) conference, Baltimore, Maryland, USA. October 23 - 27, 2011.

166. **Stuart A. Batterman**, Jo-Yu Chin, Stanislav V. Bohac, Lei Huang, Sergei Chernyak, and Dennis N. Assanis. "Dependence of Diesel Engine Exhaust Markers on Fuel Type." presented at the 21st Annual International Society of Exposure Science (ISES) conference, Baltimore, Maryland, USA. October 23 - 27, 2011.
167. **Stuart A. Batterman**, "Near Roadways Exposure to Urban Air Pollutants Study (NEXUS) - Health Effects Measurements and Analyses Update," Invited seminar and Webinar presented at the START Grants Progress Review Meeting, US EPA, Research Triangle Park, March 28-29, 2012.
168. T. Lewis, L Doan, T Robins, S Batterman, B Mukherjee, G Mentz, X Ren, S Grant, E Parker, "Asthma Control In Detroit Children Is Associated With Exposure To Highway Traffic." to be presented at the American Thoractic Society International Conference, May, 2012.
169. Feng-Chiao Su, Shi Li, Bhramar Mukherjee, Stuart A. Batterman, "Analysis of Personal Exposures in the RIOPA Study: Extreme Value, Mixture, and Dirichlet Process Models", poster presented at the Health Effects Institute Annual Conference, Chicago, IL. 15-17 April, 2012.
170. A. Mendes, C. Pereira, D. Mendes, L. Aguiar, F. Guimarães, M. Botelho, M.P. Neves, **S. Batterman**, J.P Teixeira, Indoor air quality and thermal comfort -- Results of a pilot study in elderly care centers in Portugal, presented at the second International Congress on Environmental Health, Lisbon, Portugal, May 29-June 1, 2012.
171. **Stuart A. Batterman**, "Workshop on approaches to improve assessment of exposure to traffic-related pollutants," poster presented the Health Effects Institute, Chicago, IL, April 18, 2012.
172. Ana Mendes, Lívia Aguiar, Diana Mendes, Susana Silva, Cristiana Pereira, Mónica Botelho, Paula Neves, Stuart Batterman, João Paulo Teixeira. "GERIA Project – Indoor Air and Quality of Life in Elderly Care Centres" paper presented at Healthy Buildings 8, Brisbane, Australia, 8 - 12 July 2012.
173. Janet Burke, Ali Kamal, Sarah Bereznicki, Kathie Dionisio, Ram Vedantham, Carry Croghan , Matthew Landis, Gary Norris, Alan Vette, **Stuart Batterman**, Community Action Against Asthma. "Variability in exposures to traffic-related air pollutants across Detroit in the Near-Road Exposures and Effects of Urban Air Pollutants Study (NEXUS)". Presented at the International Society of Exposure Science (ISES) conference, Seattle, WA. October 28-November 1, 2012.
174. **Stuart Batterman**, Liuliu Du, Christopher Godwin, Jo-Yu Chin, Thomas Robins, Toby Lewis, Community Action Against Asthma. "Concentration gradients in residences with strong pollutant sources and air filters -- melding field study data and models to understand exposure." Presented at the International Society of Exposure Science (ISES) conference, Seattle, WA. October 28-November 1, 2012.
175. Michael Breen, James Crooks, Thomas Long, Bradley Schultz, Miyuki Breen, John Langstaff, Kristin Isaacs, Cecilia Tan, Ronald Williams, Ye Cao, Robert Devlin, **Stuart Batterman**, Martha Sue Carraway, "GPS-based Microenvironment Tracker (MicroTrac) to Estimate Time-Location Profiles for Individuals in Health Studies." Presented at the International Society of Exposure Science (ISES) conference, Seattle, WA. October 28-November 1, 2012.
176. *Lei Huang, Sergei Chernyak, **Stuart A. Batterman**, "PAHs, Nitro-PAHs, Hopanes and Steranes in Lake Trout from Lake Michigan", Poster presented at the SETAC North America 33rd Annual Meeting, Long Beach, CA, 11-15 November 2012.
177. *M Bradley, L Huang, J Rutkiewicz, K Mittal, J Head, S Chernyak, **S Batterman**, N Basu, "In ovo exposure to 1-nitropyrene: Developmental, biochemical and behavioral changes in white leghorn chicken hatchlings." Poster presented at the SETAC North America 33rd Annual Meeting, Long Beach, CA, 11-15 November 2012.
178. *Peter Dornbos, Sean Strom, Tom Cooley, Sergei Chernyak**,** **Stuart Batterman** and Niladri Basu. "Polybrominated Diphenyl Ethers in Wisconsin River Otters and Michigan Bald Eagles" Paper presented at the SETAC North America 33rd Annual Meeting, Long Beach, CA, 11-15 November 2012.
179. Michael Breen, Janet Burke, **Stuart Batterman**, Alan Vette, Gary Norris, Christopher Godwin, Matthew Landis, CAAA, Carry Croghan, Thomas Long, Miyuki Breen, Bradley Schultz. "Air Pollution Exposure Model for Individuals (EMI) in Asthma Health Study: Predicting Air Exchange Rates for Residences in Detroit, Michigan", Presented at the Annual Meeting of the Society of Toxicology, San Antonio, TX, March 10-14, 2013.
180. Michelle Snyder, Vlad Isakov, Janet Burke, Alan Vette, Sarav Arunachalam, **Stuart Batterman**, "Applying Multi-scale Air Quality Models to Support Epidemiologic Studies," Clean Air Research Center Meeting, US Environmental Protection Agency, Research Triangle Park, NC, July 22, 2013.

181. João Carrilho, **Stuart Batterman**, Manuel Gameiro da Silva. "Estimating Time Varying Air Exchange Rates." submitted to the REHVA World Congress and 8th International Conference on IAQVEC, Prague, Czech Republic, June 16-19, 2013.

182. V. Isakov, Michelle Snyder, David Heist, Steven Perry, Janet Burke, Sarav Arunachalamy**, Stuart Batterman**, Rajiv Ganguly, and CAAA. "Development Of Model-Based Air Pollution Exposure Metrics For Use In Epidemiologic Studies." Submitted to the 33rd NATO/SPS International Technical Meeting (ITM) on Air Pollution Modeling and Its Applications, August 26-30, 2013 Miami, FL.

183. João Carrilho, Manuel Gameiro da Silva, **Stuart Batterman**, "Instantaneous air exchange rates from tracer gas profiles", to be presented at Mediterranean Congress of Air Conditioning (CLIMAMED), Istanbul, Turkey, Oct. 3--4, 2013.

184. **Stuart Batterman**, Thomas Robins, Toby Lewis, Rajiv Ganguly, Michael Breen, Janet Burke, Vlad Isakov, Michelle Snyder, Erminia Ramirez, Wilma Brakefield-Caldwell. "Improving Exposure Estimates for Traffic-Related Air Pollutants." Platform presentation at the Air & Waste Management Association Annual Conference & Exhibition, Chicago, IL, June 25-28th, 2013.

185. *Rajiv Ganguly, **Stuart Batterman**, Michelle Snyder, Vlad Isakov. Geocoding and Exposure Errors for Residences near Highways: Application of AERMOD in Detroit, Michigan. Platform presentation at the Air & Waste Management Association Annual Conference & Exhibition, Chicago, IL, June 25-28th, 2013.

186. Michelle Snyder, Sarav Arunachalam, Vlad Isakov, David Heist, **Stuart Batterman**, Kevin Talgo, Rajiv Ganguly, Paul Harbin. Sensitivity Analysis of Dispersion Model Results in the NEXUS Health Study due to Uncertainties in Traffic-related Emissions Inputs. Platform presentation at the the Air & Waste Management Association Annual Conference & Exhibition, Chicago, IL, June 25-28th, 2013.

187. Sarah D. Bereznicki, Janet Burke, Kathie Dionisio, Carry Croghan, **Stuart Batterman**. A Multi-pollutant Evaluation of Traffic Exposure Classes Used in the Near-Road Exposures and Effects of Urban Air Pollutants Study (NEXUS). Platform presentation at the Air & Waste Management Association Annual Conference & Exhibition, Chicago, IL, June 25-28th, 2013.

188. Michelle Snyder, Sarav Arunachalam, Vlad Isakov, David Heist, Janet Burke, Sarah Bereznicki, Kathie Dionisio, **Stuart Batterman**, and Paul Harbin. "Applying Multi-scale Air Quality Models to Support Epidemiologic Studies." Poster 4191 to be presented at the Environment and Health – Bridging South, North, East and West. Joint meeting of International Society of Environmental Epidemiology, International Society of Exposure Sciences, and International Society of Indoor Air Quality, Basel, Switzerland, August 19-23, 2013.

189. Michael Breen, Janet Burke, **Stuart Batterman**, Alan Vette, Gary Norris, Christopher Godwin, Matthew Landis, Carry Croghan, Thomas Long, Bradley Schultz, Wilma Brakefield. "Air Pollution Exposure Model for Individuals (EMI) in Asthma Health Study: Predicting Air Exchange Rates for Residences in Detroit, Michigan." Platform presentation at the the Environment and Health – Bridging South, North, East and West. Joint meeting of International Society of Environmental Epidemiology, International Society of Exposure Sciences, and International Society of Indoor Air Quality, Basel, Switzerland, August 19-23, 2013.

190. Nichole Baldwin, Philip Hopke, **Stuart Batterman**, Suresh Raja, Thomas Robins, "Spatial-Temporal Variation of Pollutants in the Near-Road Environment." submitted to the Environment and Health – Bridging South, North, East and West. Joint meeting of International Society of Environmental Epidemiology, International Society of Exposure Sciences, and International Society of Indoor Air Quality, Basel, Switzerland, August 19-23, 2013.

191. Rajiv Ganguly, **Stuart Batterman**, Vlad Isakov, Michelle Snyder, Thomas Robins, Toby Lewis, Paul Harbin. "A new approach for maintaining anonymity and enhancing robustness of model-based personal exposure estimates." submitted to the Environment and Health – Bridging South, North, East and West. Poster 4430 presented at the Joint meeting of International Society of Environmental Epidemiology, International Society of Exposure Sciences, and International Society of Indoor Air Quality, Basel, Switzerland, August 19-23, 2013.

192. Rajiv Ganguly, **Stuart Batterman**, Vlad Isakov, Michelle Snyder, Thomas Robins, Toby Lewis, Paul Harbin. " Participant Use of Free-Standing Filters in an Asthma Intervention Study." Platform presentation 4420 presented at the Environment and Health – Bridging South, North, East and West. Joint meeting of International Society of Environmental Epidemiology, International Society of Exposure Sciences, and International Society of Indoor Air Quality, Basel, Switzerland, August 19-23, 2013.

193. Joana Bastos, **Stuart Batterman**, Fausto Freire. Comparative life-cycle analysis of residential typologies in lisbon, Portugal: an apartment building and two semi-detached houses. Presented at Energy for Sustainability 2013, Coimbra, Portugal, 8 to 10 September, 2013.

194. Stuart Batterman, Rajiv Ganguly, Vlad Isakoff, Janet Burke, Saravanan Arunachalam, Michelle Snyder, Tom Robins, Toby Lewis, "Dispersion Modeling of Traffic-Related Air Pollutants: Exposure and Health Effects among Children with Asthma in Detroit, Michigan." Poster presented at the Transportation Research Board (TRB) 93rd Annual Meeting, Washington, DC, January 12-16, 2014.

195. M. Breen, J. Burke, **S. Batterman**, A. Vette, G. Norris, C. Godwin, M. Landis, C. Croghan, B. Schultz, M. Breen. Air Pollution Exposure Model for Individuals (EMI) in Health Studies: Predicting Spatiotemporal Variability of Residential Air Exchange Rates. Poster presented at the Annual Society of Toxicology Meeting, Phoenix, AZ, March 23-27, 2014.

196. Stuart A. Batterman, Veronica J Berrocal, Saravanan Arunachalam, K. Max Zhang, Gisselle Kolenic. "Integrating enhanced models and measurements of traffic-related air pollutants for epidemiological and risk studies using Bayesian Melding." Invited poster to be presented at the 2014 Health Effects Institute Annual Conference, May 4-6, 2014, Alexandria, VA, USA.

197. Sergei Chernyak, **Stuart Batterman**. "Measuring Persistent Organic Pollutants in Newborn Blood Spots: Performance and Stability of Brominated Flame Retardants, PCBs, and Halogenated Pesticides." SETAC Europe 24th Annual Meeting in Basel, Switzerland, 11-15 May, 2014, Basel, Switzerland.

198. **S. Batterman**, Chernyak S. "Performance and Integrity of Blood Spot Measurements of BFRs, PCBs and Halogenated Pesticides," Presented at the 14th Annual Workshop on Brominated & Other Flame Retardants (BFR), Indianapolis, IN June 22-24 2014.

199. Lewis, T., T. Robins, **S. Batterman**, B. Mukherjee, G. Mentz, X. Ren, E. Parker, E Ramirez, "Association of Highway Traffic and Lung Function Among Children with Asthma in Detroit", presented at the International Society of Environmental Epidemiology meeting, Aug. 24-28, 2014, Seattle, WA.

200. Feng-Chiao Su, **Stuart Batterman**, Brian Callaghan, Eva Feldman. "Amyotrophic Lateral Sclerosis (ALS), Occupational Risk Factors and Exposure Windows: A Case-Control Study in Michigan." presented at the International Society of Environmental Epidemiology meeting, Aug. 24-28, Seattle, WA.

201. Vlad Isakov, David Heist, Janet Burke, Michelle Snyder, Sarav Arunachalam, **Stuart Batterman**. "Hybrid Air Quality Modeling Approach for use in the Near-road Exposures to Urban air pollutant Study (NEXUS)." Submitted to the 16th International Conference on Harmonisation within Atmospheric Dispersion Modelling for Regulatory Purposes, 8-11 September 2014, Varna, Bulgaria.

202. **S. Batterman**, Sarah Chambliss, "Exposure Assessment and Misclassification for Traffic-Related Air Pollutants Using Census Information: Spatial Resolution Needs". Presented at the the 2014 annual meeting of International Society of Exposure Science, Cincinatti, OH, Oct. 12-16, 2014.

203. J. Burke, G. Norris, S. Bereznicki, C. Croghan, A. Russell, S. Brown, **S. Batterman**, "Variability in source impacts for residential indoor and outdoor PM2.5 in NEXUS homes." Presented at the 2014 annual meeting of International Society of Exposure Science, Cincinatti, OH, Oct. 12-16, 2014.

204. M. Breen, J. Burke, **S. Batterman**, A. Vette, G. Norris, C. Godwin, M. Landis, C. Croghan, V. Isakov. "Exposure Modeling of Residential Air Exchange Rates for NEXUS Participants," Presented at the 2014 annual meeting of International Society of Exposure Science, Cincinatti, OH, Oct. 12-16, 2014.

205. V. Isakov, D. Vlad, J. Burke, K. Dionisio, S. Bereznicki, M. Snyder, S. Arunachalam, **S. Batterman**. Air Quality Modeling of Traffic-related Air Pollutants for the NEXUS Study. Presented at the 2014 annual meeting of International Society of Exposure Science, Cincinatti, OH, Oct. 12-16, 2014.

206. **S. Batterman**, T. Stuart, T. Lewis, T. Robins, G. Mentz, V. Isakov, J. Burke. "Using modeled estimates of exposure to traffic-related air pollutants to identify respiratory health impacts for the NEXUS cohort." Presented at the 2014 annual meeting of International Society of Exposure Science, Cincinatti, OH, Oct. 12-16, 2014.

207. João Carrilho, Manuel d'Silva. **Stuarty Batterman**, "Measurement of infiltration rates from daily cycle of ambient CO_2", Presented at the 35th AIVC – 4th TightVent – 2nd Venticool Conference, Poznan, Poland, Sept. 24-25, 2014.

208. **S. Batterman**, "Emerging Health and Safety Issues in the Petrochemical Industry: A Life Cycle Perspective," invited keynote speach presented at International Conference of Industrial Hygiene & Occupational Medicine, Kaohsiung Medical University, Kaohsiung, Taiwan, Apr. 25~26, 2015.

10.5.2 Papers Accepted/Submitted for Delivery at Professional Meetings

209. João Carrilho, M. Mateus, **Stuart Batterman,** Manuel d'Silva. **"**Using periodic variation of outoor gases to measure the infiltration rates of buildings, submitted to ISIAQ Healthy Buildings, Eindhoven, The Netherlands, May 18-20, 2015.
210. Stuart Batterman, Luilui Du, Christopher Godwin, Zachary Rowe, Jo-Yu Chin, "Air exchange rates and migration of VOCs in basements and residences," submitted to ISIAQ Healthy Buildings, Eindhoven, The Netherlands, May 18-20, 2015.
211. Stuart Batterman, Michael Breen, "Exposures in homes, schools and commuting microenvironments: The significance of traffic-related air pollutants for children." Submitted to ISIAQ Healthy Buildings, Eindhoven, The Netherlands, May 18-20, 2015.
212. Joana Bastos, Stuart Batterman and Fausto Freire, "How does residential location influence the environmental life-cycle impacts of a household?", Submitted to UAHS World Congress on Housing, Dec. 16-19, 2014, Funchal, Portugal.
213. Janet Burke, Vlad Isakov, Michael Breen, Stuart Batterman. "Modeling exposures to traffic-related air pollutants for the NEXUS respiratory health study of asthmatic children in Detroit, MI. International Society of Exposure Science Conference, Henderson, NV, Oct. 18-23, 2015.
214. João Carrilho, M. Mateus, **Stuarty Batterman,** Manuel d'Silva, The effect of diffusion on tracer gas method measurements of air exchange rates. Submitted to the 36th Air Infiltration and Ventilation Centre Conference, Madrid, Spaijn, Sept. 23-24, 2015.
215. João Carrilho, M. Mateus, **Stuarty Batterman,** Manuel d'Silva. Further developments on the atmospheric tracer gas technique for measuring AERs. Submitted to the 36th Air Infiltration and Ventilation Centre Conference, Madrid, Spaijn, Sept. 23-24, 2015.

10.6 Organizational Reports or Manuals of a Research and/or Scholarly Nature

1. **S. Batterman**, "Logan Energy Audit Package," Report to the Planning Department, Massachusetts Port Authority, Boston, MA 1980.
2. **S. Batterman**, "Energy Use Reporting System Update at the Massachusetts Port Authority," Report to the Planning Department, Massachusetts Port Authority, Boston, MA, Jan. 10, 1981.
3. **S. Batterman**, "Recent Renewable Energy and Conservation Efforts in Canada," Domestic Policy Review, Solar Energy Research Institute, Boulder, CO, 1981.
4. **S. Batterman**, D. Golomb, J. Gruhl, "Air Quality Models Incorporating Uncertainty and Probability of Exceedances," Energy Laboratory Report MIT-EL 81-64, Massachusetts Institute of Technology, Cambridge MA, 1981.
5. **S. Batterman**, M. Schenker, F. Speizer, J. Gruhl, "Estimating Pollutant Exposures From Coal-Fired Power Plants in a Rural Region," Energy Laboratory Report MIT-EL 81-047, Massachusetts Institute of Technology, Cambridge MA, 1981.
6. N. Faramelli, **S. Batterman,** et al., "Renovations to the Boston Fish Pier: an Environmental Impact Assessment," Planning Department, Massachusetts Port Authority, Boston MA, 1982.
7. **S. Batterman**, "Predicting Peak Pollutant Concentrations Using Joint Probabilities of Meteorological Factors," MIT Energy Lab Working Paper No. MIT-EL 82-023WP, Massachusetts Institute of Technology, Cambridge, MA, April, 1982.
8. **S. Batterman**, "Air Quality Assessment of Proposed Cogeneration Facility," Report to Applied Research Group Inc., Brookline MA, 1983.
9. **S. Batterman**, J. Fay, D. Golomb, J. Gruhl, "Air Quality Models Pertaining to Particulate Matter" EPA-600/S3-84-074, Environmental Sciences Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Research Triangle Park NC, 1984. (NTIS: PB84210939XSP) 82p.
10. D. Golomb, **S. Batterman**, T. Rubin, "Ambient Monitoring of Pollution around Synthetic Fuels Plants," Energy Laboratory Report MIT-EL 84-015, Massachusetts Institute of Technology, Cambridge MA, 1984 (NTIS PB84210939XSP) 40p.
11. **S. Batterman**, D. Golomb, "Health Effects of Air Pollution Due to Coal Combustion in the Chestnut Ridge Region of Pennsylvania: Final Report," Energy Laboratory Report MIT-EL 85-008, Massachusetts Institute of Technology, Cambridge MA, 1985.
12. **S. Batterman**, J. Fay, D. Golomb, "Incorporating Meteorological Data into Receptor Analysis: RAPS (Regional Air Pollution Study) Revisited." EPA A600D85061, Environmental Sciences Research Laboratory,

Office of Research and Development, U.S. Environmental Protection Agency, Research Triangle Park NC (NTIS PB85188944XSP) 21p.

13. M. Schenker, F. Speizer, J. Samet, **S. Batterman**, "Health Effects of Air Pollution Due to Coal Combustion in the Chestnut Ridge Region of Pennsylvania: Results of Cross-Sectional Analysis in Children," Energy Laboratory Report MIT-EL 85-00, DOEEV04968T2, Massachusetts Institute of Technology, Cambridge MA, 1986. (NTIS DE86000215XSP) 109p.
14. **S. Batterman**, J. Fay, D. Golomb, "Local and Regional Contributions to Urban Particulate Matter. Final Report. Mar 85-Jun 86," EPA600386052, Environmental Sciences Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Research Triangle Park NC (NTIS PB86236965XSP), 1986. 87p.
15. **S. Batterman**, J. Fay, D. Golomb, "Significance of Regional Source Contributions to Urban PM-10 (Nominal 10 Micrometers) Concentrations," EPA600D86119 Environmental Sciences Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Research Triangle Park NC (NTIS PB86208725XSP) 1986. 16p.
16. **S. Batterman**, "Optimal SO_2 Abatement Policies in Europe: Some Examples," WP-86-42, International Institute for Applied Systems Analysis, Laxenburg Austria, 1986. http://www.iiasa.ac.at/Publications/Documents/WP-86-042.pdf
17. **S. Batterman**, "Influential Receptors in Targeted Emission Abatement Strategies," WP-87-079, International Institute for Applied Systems Analysis, Laxenburg Austria, 1987.
18. **S. Batterman**, "Cost-Effectiveness Analysis of Emission Control Policies in Europe," Report to the Air Pollution Group, Nordic Council of Ministers, National Environment Protection Board, Solna, Sweden, 1987.
19. A. McFarland, **S. Batterman**, "Space Contamination Studies," Aerosol Technology Laboratory Report 5276/10/01/88/SAB, Texas A&M University, College Station TX, 1988.
20. **S. Batterman**, "Modeling and Estimation of Contaminant Soil-Air Fluxes," in Environmental Engineering Program Status Reports, Environmental Engineering Program, Division of Critical Engineering Systems, National Science Foundation, Washington DC, 1988.
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22. **S. Batterman**, A. McFarland, "Soil/Air Fluxes of Hazardous Substances at Treatment, Storage and Disposal Facilities: Models and Treatment, Annual Report," Gulf Coast Hazardous Substances Research Center, Beaumont TX, 1990.
23. **S. Batterman**, A. McFarland, "Hazardous Airborne Contaminants: Sampling, Assessment and Control, Final Report," Advanced Technology Program, Marine Science and Atmospheric Science, Texas Advanced Technology Program, Austin TX, 1991.
24. **S. Batterman**, Assessment of Subsurface VOCs Using a Chemical Microsensor Array. Interim Final Report, Environmental Restoration Program, US Dept. of Energy, Argonne, IL, Mar. 1991.
25. **S. Batterman**, ed., "Second Preliminary Draft Recommendation on FTIR Spectrometers for Measurement of Air Pollutants," International Organization of Legal Metrology, NTIS, Gaithersburg, VA, Apr. 1993.
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28. **S. Batterman**, "Update on Fungal Volatile Organic Compounds," Report to S.C. Johnsons Corp., Racine WI, Jan. 1994.
29. **S. Batterman**, "Interim Reports: Identification of Pollution Sources in HVAC Systems," American Society of Heating, Ventilating and Air Conditioning Engineers, Atlanta GA, Dec. 1992; Mar. 1993; Sep. 1993; Dec. 1994; Mar. 1994; Sep. 1994; Dec. 1995; Mar. 1995.
30. **S. Batterman**, "Soil Diffusion Measurements: Updates," U.S. Department of Energy, Lawrence Livermore National Laboratory, Livermore CA, May 1993; Sept. 1993.
31. **S. Batterman**, E. T. Zellers, "Assessment of Subsurface VOCs Using a Chemical Microsensor Array -- Final Report", Contract No. 02112409, DOE/CH-9215, Office or Research and Development, Environmental and Waste Management Div., U.S. Dept. of Energy, Washington, DC., June, 1993. (NTIS DE94008065XSP) 56p.

32. **S. Batterman**, P. Milne, "Diffusion Experiments Progress Report," Report to Institute for Crustal Studies, Vadose Zone Research Lab, University of California, Santa Barbara, CA, Sept. 9, 1993.
33. **S. Batterman**, "Manasquan River Study: Preliminary Evaluation of Surface Water and Sediment Chemical Quality," Report to Clean Sites/AWD Technologies, Oct. 1994.
34. **S. Batterman**, "Training Delivery Annual Report, University of Michigan Hazardous Substance Academic Training Program," National Institute for Occupational Safety and Health, Cincinnati OH, June 1994.
35. A.H. Conner, **S. Batterman**, M.G.D. Baumann, "Emission of Volatile Organic Chemicals from Particleboard, One Year Progress Report," August, 1994, Report to the National Particle Board Association, Gaithersburg MD.
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39. **S. Batterman**, Y.L. Huang, "An Analysis of Emissions and Impacts for the Genesee Wood Waste Boiler," to Maurice and Jane Sugar Law Center, Detroit, MI, May 2, 1995.
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41. **S. Batterman**, "Curriculum and Mission Statement for a MS Concentration in Environmental and Occupational Health Management and Policy," University of Michigan, Ann Arbor, Nov. 1995.
42. **S. Batterman**, "Comments Regarding ROD Changes to Metamora Landfill National Superfund Site to US EPA Region V, April 23, 1996.
43. **S. Batterman**, Y-H. Huang, "Evaluation of The Screening Risk Analysis for the Texas Industries (TXI) Facility in Midlothian, Texas written by the Texas Natural Resource Conservation Commission and Other Materials Related to the Texas Industries Facility", to American Lung Association of Texas, April, 1996.
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45. **S. Batterman**, "An Evaluation of SO_2 Concentrations Resulting from the AECI Fire," Report to the Legal Resources Centre, Cape Town, South Africa, Jan. 26, 1997.
46. S. Daniels, S. Batterman, M. Klemp, A. Wood, "Progress Report: Continuous Monitoring of Volatile Organic Compounds (VOCs) Affecting Indoor Air Quality in Laboratory and Industrial Environments," Michigan State Research Fund, Lansing, MI, March 31, 1997.
47. **S. Batterman**. "Teaching and Research Activities 1996-7: A Summary Report to the Academy of Finland," Helsinki, Finland, May, 1997.
48. C.Y. Peng, C.Y., **S. Batterman**, "Continuous Monitoring of Volatile Organic Compounds (VOCs) in the Laboratory Using the Cryointegrator G", Final Report for Continuous Monitoring of Volatile Organic Compounds (VOCs) Affecting Indoor Air Quality in Laboratory and Industrial Environments, Michigan State Research Fund Grant No. 801P6001063. Submitted to Quality Air of Midland, Inc., Midland, MI, May 23, 1997.
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50. S.L. Daniels, **S. Batterman**, M. Klemp, A. Wood, C. White, "Continuous Monitoring of Volatile Organic Compounds (VOCs) Affecting Indoor Air Quality in Laboratory and Industrial environments," Report to State of Michigan Jobs Commission and MERRA, June 12, 1997, 48 pp.
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54. S. Daniels, **S. Batterman**, M. Klemp, C.W. White, "Microbial Volatile Organic Compounds (MVOCs) as Control Parameters for Engineered Antimicrobial Process in Indoor Air Environments," Final Report submitted to the National Science Foundation for NSF 9661260, Oct. 1, 1997 (32 pp).
55. **S. Batterman**, K Mancy, S. Wang, L. Zhang, J. Warila, O. Lev, H. Shuval, B. Fattal, "Evaluation of the Efficacy of a New Secondary Disinfectant Formulation Using Hydrogen Peroxide and Silver and the Formulation of Disinfection By-Products Resulting From Interactions with Conventional Disinfectants," Annual Progress Reports to US EPA, Sept. 1998; April, 2000.
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61. **S. Batterman**, E. Barnett, C. Harms, P. Kalliokoski, T. Metts, "Indoor Air Quality Study for Quick Reliable Printing," submitted to Precision Air, Inc., Midland, MI, April 2001, 54 p.
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67. **S. Batterman** "Faculty, Curriculum and Research Development Related to Cleaner Production Technologies and Advanced and Smart Materials, A Tertiary Education Linkage Project Between the University of Michigan and The Peninsula Technikon, Final Report for June 1, 1999 – Feb. 28, 2003", UNCF, USAID, March 14, 2003.
68. C. Godwin, **S. Batterman**, C. Jia, A. Franzblau, T. Gruszczynski2, S. Ellendula1 "Exposure Assessment and Occupant Health and Comfort Among Teachers in Schools and at Home," Final Report to: Pilot Research Projects in Occupational Health and Safety, The University of Michigan Center for Occupational Health & Safety Engineering, A NIOSH Education and Research Center, University of Michigan, Ann Arbor, MI, Nov. 5, 2003.
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74. Naidoo, R; Gqaleni, N.; **Batterman, S**; Robins. "Multipoint Plan: Project 4: Health Study and Health Risk Assessment. South Durban Health Study." Centre of Occupational and Environmental Health, University of KwaZulu Natal, Durban, South Africa; Department of Environmental Health Sciences, University of Michigan, Ann Arbor, MI, USA; July, 2006.
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76. **S. Batterman**, S. Chernyak, C. Jia, C. Godwin, S. Charles, T.C. Chen "Emissions of PBDEs from Urban Sources in the Great Lakes Region, Final Report to US EPA, September 30, 2008.
77. R.L. Wahl, H.Q. Le, **S. Batterman**, K. Dombkowski, J.J. Wirth, E. Wasilevich, M. Depa, "Impact of Exposure to Urban Air Toxics on Asthma for the Pediatric Medicaid Population in Dearborn, Michigan," Final Report, submitted to Mickey Leland National Urban Air Toxics Research Center, Nov. 3, 2008. 79 p.
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81. **S. Batterman**, B. Mukherjee, Chiang-Feng Su, Shi Li. "Personal Exposure to Mixtures of Volatile Organic Compounds: Modeling and Further Analysis of the RIOPA Data", HEI Report, Boston, MA, June 2014.
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83. **S. Batterman**, T. Lewis, T. Robins, B. Mukherjee. "Childhood Health Effects from Roadway and Urban Pollutant Burden Study - Health Effects of Near-Roadway Exposures to Air Pollution." National Center for Environmental Research, US Environmental Protection Agency, Washington, DC, Aug. 5, 2014.
84. **S. Batterman**, Christina Bush, Jeffrey Crum, Carrie Geyer, Tom O'Connell, Steve Song, Tom Szocinski, Matt Williams, Public Sector Consultants Inc. "Final Report: Updating Part 201 Vapor Intrusion Criteria". Prepared for The Criteria Stakeholder Advisory Group (CSA), Michigan Department of Environmental Quality, Lansing, Michigan. September 10, 2014

10.7 Other Publications

10.7.1 Non-peer-reviewed articles

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7. **S. Batterman**, "Environmental, Safety, and Health Engineering," by G. Woodside (book review) *Choice*, 35, 5, Jan. 1998.
8. **S. Batterman**, "Mad Cows and Mother's Milk; The Perils of Poor Risk Communication," by D. Powell, W. Leiss (book review) *Choice*, 35, 9, May 1998.
9. **S. Batterman**, "Basic Concepts of Industrial Hygiene" by R. Scott (book review) *Choice*, 35, 9, May 1998.
10. **S. Batterman**, "Risk Assessment and Indoor Air Quality," by E.L. Anderson, R.E. Albert (book review) *Choice*, 36, 7, March 1999.
11. **S. Batterman**, "Hazardous Waste Incineration: Evaluating the Human Health and Environmental Risks," S.M. Roberts, C.M. Teaf, J.A. Bean, eds. (book review) *Choice*, June 1999.
12. **S. Batterman**, "Environmental Engineers Handbook," D.H. Liu and B.G. Liptak. (book review), June, *Choice*, Dec. 1999.
13. **S. Batterman**, "The Science of Environmental Pollution," FR Spellman (book review), *Choice*, Feb. 2000.
14. **S. Batterman**, "Environmental Management in Practice, B. Nath, L. Hens, P. Comptom, D. Devuyst (book review), *Choice*, June, 2000.
15. **S. Batterman**, "Risk Assessment in Environmental Management, DK Asante-Duah (book review), *The Science of the Total Environment*, **250**, 169-170, 2000.
16. **S. Batterman**, "Conquering Nature: The Environmental Legacy of Socialism in Cuba," S. Diaz-Briquets, J. Perez-Lopez (book review) *Choice*, Sept., 2000.
17. C. Bradlee*, **S. Batterman**, C. Godwin, "Pollutant Mixtures in Indoor Air: Assessment, Risks, and Management," *Environmental Manager*, Nov., p.29-33, 2000.
18. **S. Batterman**, "The Ozone Layer: A Philosophy of Science Perspective," M. Christie, Cambridge, 2000, (book review), *Choice*, Dec. 2001. (in press)
19. **S. Batterman**, "Risk-Benefit Analysis," R. Wilson, E.A. Crouch, Harvard University Press, Cambridge, 2002, M. Christie (book review), *Choice*, April, 2002.
20. **S. Batterman**, "Elimination of Risk in Systems," J. Bradley, Tharsis Professional Pub, Victoria, BC, Canada, 2002, *Choice*, July 2002.
21. **S. Batterman**, "Hazardous Air Pollutant Handbook: Measurements, Properties and Fate in Ambient Air, CW. Spicer et al., Lewis Pub., *Choice*, Nov. 2002.
22. **S. Batterman**, "Deceit and Denial: The Deadly Politics of Industrial Pollution," G Markowitz, D. Rosner, The Milbank Memorial Fund, 2002, *Choice*, March 2003.
23. **S. Batterman**, "Environmental Disasters, Anthropogenic and Natural," K.Y. Kondratyev, A.A. Grigoryev, C.A.Varotsos, Springer, 2002, *Choice*, May, 2003.
24. **S. Batterman**, "Hazardous Materials Chemistry for Emergency Responders, 2nd Ed.," R. Burke, Lewis Pub, 2003 (book review) *Choice*, June, 2003.
25. **S. Batterman**, "Life-Cycle Assessment and Environmental Engineering," Editorial, *J. Environmental Engineering*, Sept. 2004.
26. **S. Batterman**, "The Politics and Culture of Air Pollution: Smoke and Mirrors," E M. DuPuis (ed), New York University, (book review) *Choice*, January, 2005.
27. **S. Batterman**, "Air Monitoring for Toxic Exposures, second edition," H J McDermott, John Wiley & Sons, (book review) *Choice*, 42, 5, April, 2005.
28. **S. Batterman**, "Dynamics of Mercury Pollution on Regional and Global Scales," N. Pirrone, K.R. Mahaffy, ed., Springer, (book review) *Choice*, 43, 4042, March, 2006.
29. **S. Batterman**, "The Environmental Protection Agency: structuring motivation in a green bureaucracy: the conflict between regulatory style and cultural identity, R. McMahon (book review), *Choice*, Dec. 2006.

30. **S. Batterman**, "Risk and reliability analysis: a handbook for civil and environmental engineers, P. Vijay, SK Jain and A Tyagi, (book review), *Choice*, May, 2008.
31. **S. Batterman**, "Global environmental outlook: environment for development, United Nations Environment Program, (book review), *Choice*, 2008 (in press).
32. **S. Batterman**, "The Engineering Guide to LEED-new construction: sustainable construction for engineers. L. Haselbach, McGraw-Hill, (book review), *Choice*, 2008 (in press).
33. **S. Batterman**, "Catalogue of risks: Natural, technical, social and health risks." Dirk Proske. Springer, London, 2008. (book review), *Choice*, March, 2009.
34. **S. Batterman**, "Handbook of Performability Engineering, Krishna B. Misra, ed., Springer-Verlag, London (book review), *Choice*, August, 2009.
35. **S. Batterman**, "Understanding Green Building Guidelines," Traci Rose Rider, W.W. Norton & Co., New York (book review), *Choice*, Dec., 2009.
36. **S. Batterman**, "Air Pollution Measurement, Modeling, and Mitigation, A. Tiwary, J. Colls, Routledge, 2010, (book review), *Choice*, January, 2010.
37. **S. Batterman**, "Risk in Technological Systems," Grimvall G., ed., Springer-Verlag, London. 2010 (book review), *Choice*, April, 2010.
38. **S. Batterman**, "Understanding Environmental Pollution, 3rd Ed.," Marquita Hill, Cambridge University Press, 2010. (book review) *Choice*, Nov. 2010
39. **S. Batterman**, "Air Pollution - Health and Environmental Impacts," Gurjar BR, Molina LT, Ojha CSP, eds. CRC Press, Boca Raton, FL, 2010 (book review), *Choice*, Jan, 2011.
40. **S. Batterman**, "Patty's industrial hygiene: v.1: Hazard recognition; v.2: Evaluation and control; v.3: Physical and biological agents; v.4: Program management and specialty areas of practice, ed. by Vernon E. Rose and Barbara Cohrssen. 4 volumes. 2011 (book review), *Choice*, June, 2011.
41. **S. Batterman**, "Understanding green building materials" TR Rider, S Glass, J McNaughton, WW Norton Press, 189 p. 2011 (book review), *Choice*, Nov., 2011.
42. **S. Batterman**, "Stakeholders and scientists: achieving implementable solutions to energy and environmental issues," ed. by Joanna Burger. Springer, 2011. 453p, 189 p. 2011 (book review), *Choice*, Jan., 2012.
43. **S. Batterman**, "Introduction to environmental engineering." S Franzle, B Markert, and S Wunschmann. Wiley VCH. 453p, 2012 (book review), *Choice*, May, 2012.
44. **S. Batterman**, "Industrial disasters, toxic waste, and community impacts: health effects and environmental justice struggles around the globe," FO Adeola, Lexington Books, 2012, 291p (book review) *Choice*, June 2013.
45. **S. Batterman**, "Air pollution prevention and control: bioreactors and bioenergy, ed. by Christian Kennes and Marcia C. Veiga. Wileym London, 2013, 549 (book review) *Choice*, Sept. 2013.
46. **S. Batterman**, "The Human and Environmental Impacts of Fracking", Madeline Finkel, Prager Press, 2015, 219 p. (book review), *Choice*, May 2015.
47.

10.7.2 Other

48. **S. Batterman**, "Air Quality Measures for Epidemiological Investigations," M.S. Thesis, Civil Engineering, Massachusetts Institute of Technology, Cambridge, MA, 1981.
49. **S. Batterman**, "Prediction and Apportionment of Ambient Air Pollutants," Ph.D. Thesis, Civil Engineering, Massachusetts Institute of Technology, Cambridge MA, 1986.
50. **S. Batterman**, Contributor, The Environmental Science Encyclopedia, Cunningham, W.P., T. H. Cooper, E. Gorham, M.T. Hepworth, A.A. Marcus, eds., Gale Research Pub., 1994.
51. **S. Batterman**, "Review of the Metamora Landfill Superfund Site Cleanup," Technical Assistance Grant Report, also published in citizen group newsletter, September 1, 1994.
52. **S. Batterman**, "Review of the Metamora Landfill National Priority List Site," Metamora Technical Advisory Committee, Lapeer MI, April 1994. Published in citizen newsletter June 1995.
53. **S. Batterman**, A. Duncan, E. Spiegel, et al., Environmental Management at the University of Michigan: A Report from the Greening the Maize and Blue Advisory Committee, University of Michigan, Ann Arbor, MI, May, 1996.

54. **S. Batterman**, "An Update on the ROD Changes to Metamora Landfill National Superfund Site", Metamora Concerned Citizens Newsletter, Oct. 1996.
55. **S. Batterman**, "Metamora Landfill Community Update", Technical Assistance Grant (TAG) Advisory Committee, Winter 1997.
56. **S. Batterman**, "Metamora Landfill Community Update and Newsletter", Technical Assistance Grant (TAG) Advisory Committee, January 7, 1999.
57. **S. Batterman**, "Metamora Landfill Community Update and Newsletter", Technical Assistance Grant (TAG) Advisory Committee, February 25, 1999.
58. **S. Batterman**, E. Barnett, C. Harms, P. Kalliokoski, T. Metts, "Indoor Air Quality Study for Quick Reliable Printing," Precision Air, Inc., April 25, 2001, 56 p.
59. J. Nriagu, **S. Batterman**, J. Gannon, "History Of Environmental Health Sciences at The University Of Michigan," on UM SPH Web site: http://www.sph.umich.edu/ehs/history.html, Sept. 2001.
60. **S. Batterman**, "EHS Field Experience Handbook: A Guide for MPH Students," Department of Environmental Health Sciences, University of Michigan, Ann Arbor, MI, October, 2001, 29 p.
61. A. J. Ervin, **S. Batterman**, "Effects of Air Ionization on Indoor Air Pollutants," Poster presented at the Undergraduate Research Opportunity Program (UROP) Spring Research Symposium, University of Michigan, Ann Arbor, MI, April 10, 2002.
62. U.R. Okwumabua, **S. Batterman**, "High Pollution Days in Durban, South Africa: Meteorological Factors," Poster presented at the Undergraduate Research Opportunity Program Spring Research Symposium, University of Michigan, Ann Arbor, MI, April 10, 2002.
63. **S. Batterman**, A. Dalvie, "External Examination – University of Botswana, Gabarone, Botwana, Nov. 6, 2008. Submitted to the Deputy Vice Chancellor of Academic Affairs, University of Botswana. 17 p.
64. **S. Batterman**, Mary Anne Carroll, Knute J Nadelhoffer, "Internal Review Committee Report on the Graham Environmental Sustainability Institute," submitted to the Provost, University of Michigan, Ann Arbor, March 28, 2009.
65. **S. Batterman**, "Report on sulfur dioxide (SO_2) exposures from a large sulfur fire at a sulfur forming and shipping facility," Submitted to Ackroyd LLP, 15th floor, First Edmonton Place, 10665 Jasper Avenue, Edmonton, Alberta, March 29, 2009.
66. US EPA, **S. Batterman** et al. "Fact sheet: Science in Action: Health Effects of Roadway Pollution: Joint Research Project by the U.S. Environmental Protection Agency and University of Michigan," http://www.epa.gov/nerl/documents/NearRoadwayTechnical_external_fact_sheet_071910.pdf, 2011.
67. **S. Batterman**, "Health Effects of Hydrogen Sulfide Exposures: A Review of the Evidence Pertaining to Low Level Exposures", Sierra Club, Washington, DC. Aug. 2012, 56 p.

10.8 Invited Lectures and Presentations

1. **S. Batterman**, "Uncertainty of Targeted Acid Rain Control Strategies," Technical Research Center of Finland, Helsinki, Finland, Jan. 8, 1990
2. **S. Batterman**, "Hazardous Substance Regulation," and "Hazardous Substance Analysis: Volatile Organic Compounds," lectures prepared for course Hazardous Substance Sampling and Monitoring, Center for Occupational Health and Safety Engineering, University of Michigan, Ann Arbor MI, March 18-20, 1991.
3. **S. Batterman**, "Hazardous Substance Regulations," Presented to class EIH 503, Principles of Environmental Health, University of Michigan, Ann Arbor MI, Jan. 22, 1992.
4. **S. Batterman**, "Acid Rain Update," lecture presented at NSF Teacher Training Project, School of Education, University of Michigan, Ann Arbor MI, Feb. 3, 1992.
5. **S. Batterman**, "Indoor Air Quality", presented to class EIH-531 Environmental Chemistry, University of Michigan, Ann Arbor MI, Dec. 2, 1992.
6. **S. Batterman**, "Decision Making in Hazardous Waste Siting," Invited lecture presented to ChE 195, Introduction to Engineering Analysis, College of Engineering, University of Michigan, Ann Arbor MI, March 17, 1993.
7. **S. Batterman**, "Hazardous Substances Academic Training Program," Presentation to the Advisory Committee, University of Michigan Center for Occupational Health and Safety Engineering, Ann Arbor MI, June 23, 1993.

8. **S. Batterman**, "Pollution Sources in HVAC Systems: Phase 2. Identification and Quantification of Sources," Presentation to the National Institute for Occupational Safety and Health, University of Michigan, Ann Arbor MI, June 24, 1993.
9. **S. Batterman**, "Diffusion Processes in Soils: Measurements and Models," Lawrence Livermore National Laboratory Environmental Restoration Group, Livermore CA, July 2, 1992.
10. **S. Batterman**, H. Burge, E. Albert et al. "Pollution Sources in HVAC Systems," Presentation to the U.S. Environmental Protection Agency, Air and Energy Engineering Laboratory, Research Triangle Park NC, July 13, 1993.
11. **S. Batterman**, "Environmental Accounting" and "Life Cycle Analysis," Two invited lectures presented to English for Business and Management Studies, University of Michigan, Ann Arbor MI, July 19, 1993.
12. **S. Batterman**, P. Milne, M. Dojka, "Diffusion Measurements Update," Presentation to U.S. Department of Energy, Ann Arbor, Oct. 21, 1993.
13. **S. Batterman**, "Deficiencies in Cleanup Plans for Metamora Landfill National Priorities List Site," Technical Advisory Committee, Congressman Kildee's Office, Flint MI, Jan. 3, 1994.
14. **S. Batterman**, "Curriculum of the Hazardous Substances Academic Training Program at the University of Michigan," Presentation to the National Institute for Occupational Safety and Health Annual Meeting of the Directors of the Hazardous Substances Academic Training Program, Stevenson WA, Feb. 15-16, 1994.
15. **S. Batterman**, "Introduction to Environmental Impact Assessment," Invited lecture presented to Course SNRE-370, Introduction to Urban and Environmental Planning, School of Natural Resources and Environment (also to course ARCH-423, Introduction to Architecture and Urban Planning), University of Michigan, Ann Arbor MI, March 24, 1994.
16. **S. Batterman**, "The Proposed Flint Waste-to-Energy Cogeneration Facility: Potential Environmental Impacts," Invited lecture presented to Course COMM-500, Natural Resources/Communications and the Scripts Fellowship Program, University of Michigan, Ann Arbor MI, Sept. 28, 1994.
17. **S. Batterman**, "The Regulatory Process," Invited Lecture to Course COMM-500, Natural Resources/Communications and the Scripts Fellowship Program, University of Michigan, Ann Arbor MI, Oct. 5, 1994.
18. **S. Batterman**, "Environmental Impact Assessment," Invited lecture presented to Course SNRE-370, Introduction to Urban and Environmental Planning, School of Natural Resources and Environment (also to course ARCH-423, Introduction to Architecture and Urban Planning), University of Michigan, Ann Arbor MI, Nov. 3, 1994.
19. **S. Batterman**, "Needs Assessment for the Hazardous Substances Academic Training Program," Presentation to the Directors of the NIOSH HSAT Programs, Redondo Beach CA, Feb. 13, 1995.
20. **S. Batterman**, "Use of an Automated GC-MS Chamber Testing System," Presentation to the Forest Products Laboratory, Madison, WI, August 23-4, 1995.
21. C. Gelman, O. Osak, **S. Batterman**, "New Filters for High Volume Air Samplers," Presentation to US Environmental Protection Agency, Research Triangle Park, NC, Sept. 18, 1995.
22. **S. Batterman**, "Review of Cleanup Plans for Metamora Landfill National Priorities List Site," Technical Advisory Committee, Congressman Kildee's Office, Pontiac, MI, Sept. 28, 1995.
23. **S. Batterman**, "Changes in the Record of Decision for the Metamora Landfill National Priorities List Site," Technical Advisory Committee, Congressman Kildee's Office, Pontiac, MI, April 16, 1996.
24. **S. Batterman**, "Comments on the Metamora Landfill Superfund Site ROD Recommendation," US EPA/Michigan DEQ Public Hearing, Metamora, MI, April 23, 1996.
25. **S. Batterman**, "Evaluation of the Risk Analysis for the Texas Industries (TXI) Facility in Midlothian, Texas," Cedar Hill, TX, May 28, 1996.
26. **S. Batterman**, "Environmental Impact and Risk Assessment," Two invited lectures presented to English for Business and Management Studies, University of Michigan, Ann Arbor MI, July 17, 1996.
27. **S. Batterman**, "An Overview of Air Pollution Related Research," Invited lecture to Building Technology Group, Technical Research Centre of Finland, Espoo, Finland, Aug. 22, 1996.
28. **S. Batterman**, "Update on the Metamora Landfill National Priorities List Site," Technical Advisory Committee, Lapeer, MI, February 13, 1997.

29. **S. Batterman**, “The Metamora Landfill National Priorities List Site Remediation Program,” Technical Advisory Committee and Public Meeting, Metamora, MI, April 23, 1997.
30. **S. Batterman**, "Risk Assessment of Waste Combustion,” Invited lectures presented to English for Business and Management Studies, University of Michigan, Ann Arbor MI, July 24, 1997.
31. **S. Batterman**, “Effects of Technology on Biomedical/Environmental Issues,” Invited lecture to the University of Michigan Undergraduate Research Opportunities Program, Dec. 3, 1997.
32. **S. Batterman**, “Estimating Routine and Extreme Exposures in Environmental and Occupational Health,” Dept. of Epidemiology and Preventative Medicine, University of California, Davis, CA, Feb. 11, 1998.
33. **S. Batterman**, “The Metamora Landfill National Priorities List Site Remediation Program,” Technical Advisory Committee and Public Meeting, Lapeer, MI, April 27, 1998.
34. **S. Batterman**, “Extreme Environmental Exposures: A Large Sulfur Fire in South Africa,” Environmental Health Seminar, University of Michigan, Ann Arbor, MI, Sept. 25, 1998.
35. **S. Batterman**, “Technical Analysis in Environmental Justice Determinations,” School of Law, Wayne State University, Detroit, MI, Sept. 28, 1998.
36. **S. Batterman**, “The Metamora Landfill National Priorities List Site Remediation Program,” Technical Advisory Committee and Public Meeting, Lapeer, MI, Jan.7, 1999.
37. **S. Batterman**, “The Metamora Landfill National Priorities List Site Remediation Program,” Technical Advisory Committee and Public Meeting, Lapeer, MI, Feb. 25, 1999.
38. **S. Batterman**, C. Bailey, “Public Health and Risk Assessment,” Invited lecture to the National Student Environmental Justice Conference, Ann Arbor, MI, March 26-28, 1999.
39. **S. Batterman**, “Update and History of the Metamora Landfill National Priorities List Site,” Technical Advisory Committee, Metamora, MI, April 7, 1999.
40. **S. Batterman**, "Health and Environmental Impacts of a Large Sulfur Fire,” Invited lectures presented to English for Business and Management Studies, University of Michigan, Ann Arbor MI, July 29, 1999.
41. **S. Batterman**, “Trends and Practices in IAQ Management,” presented to the Facilities Planning and Design Department, University of Michigan, Sept. 1, 1999.
42. **S. Batterman**, “Air Toxics and Toxicology,” presented at Michigan Air Toxics Strategy Roundtable, Detroit, MI, Nov. 6, 1999.
43. **S. Batterman**, “Environmental Health Issues,” presented to the Undergraduate Research Opportunities Program, University of Michigan, Nov. 10, 1999.
44. **S. Batterman**, "Environmental Management for a Large Sulfur Fire,” invited lectures presented to English for Business and Management Studies, University of Michigan, Ann Arbor MI, July 20, 2000.
45. **S. Batterman**, “Health Implications of St. Lawrence Cement Facility,” invited lecture and discussion presented to the St. Lawrence Cement/Community Forum, Hudson, NY, Sept. 13, 2000.
46. **S. Batterman**, “Risk Assessment and Children,” invited lecture presented in course “Risk Communication,” School of Natural Resources and the Environment, University of Michigan, Ann Arbor, MI, Jan. 22, 2001.
47. **S. Batterman**, “The Pentech-University of Michigan Tertiary Education Linkage Program in Faculty, Curriculum and Research Development Related to Cleaner Production Technologies and Advanced and Smart Materials, presented at the Peninsula Technikon, Bellville, South Africa, separate presentations to the faculty of Chemical Engineering and Mechanical Engineering, March 2, 2001.
48. **S. Batterman**, E. Barnett, C. Harms, “Results of Indoor Air Quality Study at Quick Reliable Printing,” presented to workers and management of QRP Inc. Midland, April 24, 2001.
49. **S. Batterman**, “Research and Practice in Environmental Health, presented in the Introductory Environmental Health Sciences Seminar,” University of Michigan, Oct. 5, 2001.
50. **S. Batterman** (with T. Robins), “Settlers Primary School Health Study: Interim Report,” Nelson R. Mandela School of Medicine, University of Natal, Durban, South African, Feb. 28, 2002.
51. **S. Batterman**, Rappatuer on paper “Nonpoint Source Pollution: Air and Land Dimensions” by T. Gladwin et al., presented at The Great Lakes: Our Challenging Future, University of Michigan Symposium, Nov. 5-6, 2002.
52. **S. Batterman** (with T. Robins) “Settlers Primary School Health Study: Draft Final Report,” Nelson R. Mandela School of Medicine, University of Natal, Durban, South African, Nov. 21, 2002.

53. **S. Batterman**, "Air pollution and environmental justice," 2 hr lecture presented to HBHE class Environmental Education (G. Gee), University of Michigan, March 13, 2002.
54. **S. Batterman**, D. Giwahla, O. Franks, "The University Michigan – Peninsula Technikon Tertiary Linkage Project (TELP) – Case Study," US AID TELP/EDDI Annual Conference, Washington, DC, March 6-9, 2003.
55. **S. Batterman**, "The South Durban Health Study," presented at "Listening to the people – A community environmental health gathering," John Dunn Hall, Gouritz Place, Wentworth, South Africa, GroundWork and South Durban Community Environmental Alliance (SDCEA), February 22, 2004.
56. **S. Batterman**, "Environmental Health Perspectives on Asthma – School of Public Health Orientation, School of Public Health, Ann Arbor, MI, Sept. 2, 2004.
57. **S. Batterman**, "Environmental Health Perspectives on Asthma – School of Public Health Orientation, School of Public Health, Ann Arbor, MI, Sept. 1, 2005.
58. **S. Batterman**, "The Indoor Environmental at Schools: Characterization and Assessment of a Public Health Issue," presented at the Seminar on Indoor Air Quality and Public Health in Schools, Centro de Saude Ambiental e Occupacional, Insituto Nacional de Saude, Porto, Portugal, Dec. 7, 2005.
59. S. Charles, **S. Batterman,** "Quantification of 2,5-dimethylfuran in Environmental Tobacco Smoke (Quantifying and Reducing Exposures to Environmental Tobacco Smoke)," presented to the 2006 University of Michigan Tobacco Research Network Workshop, School of Public Health, University of Michigan, Ann Arbor, May 9, 2006.
60. **S. Batterman**, "Assessment of Traffic Related Air Pollutants," Faculty of Science and Technology, University of Coimbra, Coimbra, Portugal, Nov. 29, 2006.
61. **S. Batterman**, "Strategies and Tools for Sustainable Development and Environmental Management," Faculty of Science and Technology, University of Coimbra, Coimbra, Portugal, Feb. 26, 2007.
62. **S. Batterman**, "Situation analysis and options for health care waste management in Mozambique. Ministry of Health, Maputo, Mozambique. June 6, 2007.
63. **S. Batterman**, "Case studies in exposure and risk assessment: Applications from A (Ais for ADME and Africa) to Z (Z is for z-score and "xenobiotic")". Presented in course EHS 688: Topics in Environmental Health, School of Public Health, University of Michigan. Oct. 8, 2008.
64. **S. Batterman**, "Public health and air quality in urban environments". Presented in course Civil Engineering 990 "Sustainable urban environments". Nov. 11, 2008.
65. **S. Batterman**, "Highways and health." Presented to the University Chapter of the American Society of Civil Engineers, Ann Arbor, Nov. 21, 2008.
66. **S. Batterman**, "Comments on Estimating Benefits of Reducing Hazardous Air Pollutants Workshop, US Environmental Protection Agency, Washington, DC., April 30 and May 1, 2009.
67. **S. Batterman**, "Vignettes in air pollution and waste management: Vehicle emissions, medical waste, and emerging pollutants," EWRE Research Seminar, Civil Engineering, University of Michigan, Ann Arbor, MI, March 10, 2010.
68. **S. Batterman**, "Assessment and risks of PBDEs," Presented in class: EHS 508 "Risk Assessment," University of Michigan, Ann Arbor, MI, March 25, 2010.
69. **S. Batterman**, "Climate Change and Public Health: The issues, research possibilities and the need for developing postgraduate training initiatives," Environmental and Occupational Health, University of Kwa-Zulu Natal, Durban, South Africa, April 30, 2010.
70. **S. Batterman**, "Atmospheric Toxics Webinar Series (Sources of Brominated Flame Retardants)", Great Lakes Commission. Oct. 26, 2010. Available at http://www.glc.org/glad/meetings/webinar/.
71. **S. Batterman**, "Public health and air quality in urban environments". Presented in course ENVIRON 407 (Program in the Environment) "Sustainable Cities". March 29, 2011.
72. **S. Batterman,** "High Resolution Spatial and Temporal Mapping of Air Pollution in Detroit", Detroit Sustainability Indicators Integrated Assessment Workshop, Graham Environmental Sustainability Institute/Data Driven Detroit, Detroit, MI, May 23, 2011
73. **S. Batterman,** "Safeguarding God's Creation: Air." St. David's Episcopal Church, Southfield, MI, Feb. 12, 2012.
74. **S. Batterman**, "Environment Health Town Hall," course entitled "Michigan Student Caucus", School of Education, University of Michigan, Oct. 23, 2012.

75. **S. Batterman** with Maria Gunnoe and Jeremy Richardson, "Impacts of coal, and health effects of power plant emissions," panel Discussion, Rackham Graduate School, University of Michigan, Oct. 25, 2012.
76. **S. Batterman**, "Health Impacts from Air Pollution," presented at the SW District Community-Environmental Meeting, Detroit Hispanic Development Center, Detroit, MI, Jan. 31, 2013.
77. **S. Batterman**, "Air quality and your child," Community Action Against Asthma Health Fair, presented at Samaritan Health Center, Detroit, MI. April 24, 2013.
78. **S. Batterman**, "Environmental quality, schools, and health," presented at the workshop "Developing Policy on Environmental Quality, Schools, and Health in Michigan," School of Natural Resources and Environment, Kresge Foundation, Ann Arbor, MI. May 10-11, 2013.
79. **S. Batterman**, "Concentrations, exposures and health impacts of traffic-related air pollutants," presented at faculty forum, Department of Civil & Environmental Engineering, University of Michigan, Ann Arbor, May 30, 2013.
80. **S. Batterman**, with Linda Birnbaum, others, Air Pollution Community Forum, First Congregational Church of Detroit, Detroit, MI, June 18, 2013.
81. **S. Batterman**, "Environmental Determinants of Healthy and Sustainable Cities", invited keynote address at the Energy for Sustainability Conference, University of Coimbra, Coimbra, Portugal, Sept. 9-11, 2013.
82. **S. Batterman**, "Energy Surprises", Energy for Sustainability Program, University of Coimbra, Coimbra, Portugal, Sept. 18, 2013.
83. **S. Batterman**, Panel discussion of film “Unacceptable Levels,” Michigan Theater, October 16, 2013.
84. **S. Batterman**, Vehicle Emissions, Pollutant Exposures, and Health, Department of Civil Engineering, University of Illinois, Campaign-Urbana, IL, Oct. 2, 2014.
85. **S. Batterman**, Vehicle Emissions, Exposures, and Health, National Fuel and Emissions Laboratory, U.S. Environmental Protection Agency, Ann Arbor, MI, Oct. 8, 2014.
86. **S. Batterman**, Traffic, emissions, air quality, exposures and health, Presented to class PH-600 Cross-Disciplinary Approaches To Public Health Challenges, Feb. 10, 2015.
87. **S. Batterman**, Challenges & Successes in Exposure Science: Biomonitoring, Environmental Measurements, and Models. Dean's Seminar, College of Public Health, University of South Florida, Tampa, FL, February 17, 2015.
88. **S. Batterman**, Vehicle Emissions, Exposures, and Health. Division of Epidemiology, Human Genetics and Environmental Science, Health Science enter, The University of Texas, Houston, TX, Feb. 27, 2015.
89. **S. Batterman**, Challenges in Exposure Science: Biomonitoring, Environmental Measurements, and Models. , College of Environmental Science and Engineering, Fujian Normal University, Fuzhou, Fujian, China. April 23, 2015.
90. **S. Batterman**, Emerging Health and Safety Issues in the Petrochemical Industry: A Life Cycle Perspective. Keynote address, International Conference of Industrial Hygiene & Occupational Medicine, Kaohsiung Medical University, Kaohsiung, Taiwan, Apr. 25~26, 2015.
91. **S. Batterman**, Wells to Wheels: Emissions, pollutant exposure and health, School of Environment, Tsinghua University, Beijing, China, April 28, 2015.
92. **S. Batterman**, Health benefits of active mobility and healthy cities, in Win-Win: Course on Healthy Cities, Polytechnique de Turin, Turin, Italy, May 24-29, 2015.

11 TEACHING

11.1 Full-Time Graduate Level Courses

Development and delivery of following courses:

1. CVEN-607 - Engineering Aspects of Air Pollution. Introductory course addressing air quality fundamentals, including air quality regulations; source emissions; abatement technologies; dispersion and receptor modeling; source apportionment and management; monitoring instrumentation; and contemporary air pollution issues. (Texas A&M University)
2. CVEN-681 - Graduate Seminar in Environmental Engineering. Student seminars on various research topics. (Texas A&M University)

3. EHS-572 - Environmental Impact Assessment. Comprehensive framework for evaluating and predicting environmental impacts of manmade projects including evaluative and predictive methods addressing air, water and soil quality; transport and fate of contaminants; selection, application, integration and evaluation of computer models; and risk assessment. Also cross-listed in the School of Natural Resources. (University of Michigan)
4. EHS-599 - Hazardous Wastes: Regulation, Remediation and Worker Protection. Focus on hazardous waste site assessment and cleanup, including surface water, groundwater and air investigations; remediation practices; ultimate disposal of wastes; facility siting; monitoring methods; worker and community protection. This course is also cross-listed in the College of Engineering. (University of Michigan)
5. EHS-670 - Studies in Advanced Water Resource Science and Engineering. In-depth case studies of ongoing proposals and permit applications to site or remediate hazardous waste facilities (incinerators, landfills, etc.) including evaluation of technical issues; facility siting; risk assessment; policy; risk management; regulatory aspects; and communication and public relations. In 1993, this course was also cross-listed in the School of Literature, Sciences and Arts. (University of Michigan)
6. EHS-680 - Environmental Management of Hazardous Substances. Overview of selected topics in environmental management, including risk assessment, life cycle analysis, environmental justice, and risk-based decision making. (University of Michigan)
7. Characterization of Indoor and Outdoor Pollutants and Exposure Assessment. Graduate course in air pollution, focusing on exposure assessment to indoor and outdoor air pollutants. (University of Kuopio, Department of Environmental Sciences, Oct. 28 - Nov. 1, 1996, 18 lecture-hours)
8. Indoor Air Pollutants and their Behavior. Post-graduate course addressing indoor air pollutants, including assessment, monitoring and modeling. (Technical University of Helsinki, Department of Mechanical Engineering, Dec. 9 - 13, 1996, 20 lecture-hours)
9. EHS-869 - Doctoral Student Seminar (formerly Industrial Hygiene Student Seminar.) Research and literature related to industrial hygiene, environmental health sciences, and environmental management.
10. EHS-796 - Environmental Impact Assessment Models and Applications - Modeling and quantitative assessment techniques used in the field. (University of Michigan).
11. Participation in other courses in the Environmental Health Department at the University of Michigan includes:

    EIH-501 - Toxic Exposures at Work and Home. 3 hour lectures on environmental exposure assessment. (1997, 1998, 10/1999, 1/2000)

    EIH-503 - Principles of Environmental Health. Occasional lectures.

    EIH-531 - Environmental Chemistry. Occasional lectures and laboratory demonstrations.

    EHS-585 – Introductory Environmental Health Sciences. Occasional lectures.

    EHS-507 – Principles of Exposure Assessment. Occasional lectures (2002-)

    EHS-601 – Foundations in Environmental Health Sciences. Regular lectures (2011-)

    (Participation in courses in other departments, seminars and conferences is shown in Other Invited Lectures and Presentations and Service.)
12. Introduction to Environmental Impact Assessment. 6 lecture hours, including computer modeling, at KwaZulu Natal University, Durban, South Africa, Aug. 23-26, 2004.

11.2 Full-Time Undergraduate Level Courses

Development and delivery of following courses in the Civil and Environmental Engineering curriculum at Texas A&M University:

13. CVEN-302 - Computer Applications in Engineering. Numerical methods applied to engineering problems, including errors; roots of equations; systems of equations; curve fitting; regression; interpolation; integration; ordinary differential equations; and partial differential equations.
14. CVEN-383 - Engineering Systems Analysis I. Introductory probabilistic considerations in civil engineering systems design, including models and modeling practices; systems engineering language and communication; probability concepts; inferential statistics; civil engineering systems; and decision-making models.
15. CVEN-384 - Engineering Systems Analysis II. Applications of systems analysis techniques to engineering design, operation and maintenance issues, including modeling; numerical methods; optimization; engineering economics; and project planning and evaluation.

11.3 Continuing Education Courses

16. Air Quality Modeling, Monitoring, and Control. Advanced continuing education course for engineers and practitioners. 24 lecture hours. Peninsula Technikon, Cape Town, South Africa, July 16-18, 1997.
17. Risk Assessment and Environmental Health. Continuing education for instructors and government practitioners in environmental health management. 40 lecture hours. With J. Nriagu. University of Natal, Durban, South Africa; also Peninsula Technikon, Cape Town, South Africa, July 7-12, 1997.
18. Exposure, Hazard, and Risk Assessment. Advanced continuing education course for engineers and practitioners, including use of ALOHA and RMP*COMP computer models, 35 lecture hours. Peninsula Technikon, Cape Town, South Africa; also University of Natal, Durban, South Africa, July 19-23, 1999.
19. Review of Air Quality Control Engineering, AIHA Industrial Hygiene Refresher Course 1.5 lecture hour. University of Michigan, Ann Arbor, Aug. 17-20, 1999; March 19-24, 2000; Sept. 25-29, 2000; March 26-30, 2001; Sept. 10-14, 2001; April 8-12, 2002; Sept. 9-13, 2002; April 8-12, 2002; Sept. 9-13, 2002; Mar. 31-Apr. 4, 2003; July 28 – Aug. 1, 2003; Mar 29- Apr. 2, 2004; Sept. 19 – 23, 2005; Sept. 17-21, 2007, April 2010; Sept. 20-24, 2010; March 28-April 1, 2011; Sept. 23-27, 2013;
20. Indoor Air Quality Assessment and Management, AIHA Industrial Hygiene Refresher Course 1.5 lecture hour. University of Michigan, Ann Arbor, March 26-30, 2001; Sept. 10-14, 2001; April 8-12, 2002; Sept. 9-13, 2002; Mar. 31-Apr. 4, 2003; July 28 – Aug. 1, 2003; Mar 29- Apr. 2, 2004; Sept. 19 – 23, 2005; Sept. 17-21, 2007. April, 2010; Sept. 20-24, 2010; March 28-April 1, 2011; Sept. 23-27, 2013;
21. Workshop On Indoor Air Quality, 6 lecture hour. Indoor air quality programme for environmental health practitioners: combining theory with practice. Centre For Occupational And Environmental Health, School of Family & Public Health Medicine, Nelson R Mandela School Of Medicine, Durban, South Africa, July 9-14, 2007.

11.4 Educational Advising

11.4.1 Doctoral Dissertation Research Committees

Chair

1. Chung-Yu Peng - Identification and quantification of VOC emissions from buildings and heating, ventilating and air conditioning systems", Dr.P.H., Environmental and Industrial Heath, Sept. 1998.
2. Mariana Luoma - "Aerosol measurements and particle deposition in HVAC systems," Ph.D., Environmental and Industrial Heath, Sept. 1997.
3. Yu-Li Huang - "Spatial and temporal variation in pollutant concentrations: implications for exposure and risk assessment of airborne pollutants," Ph.D., Environmental Health Sciences, Dec. 1999.
4. David Bowman - "Analysis of contaminant loss pathways from Great Lakes confined disposal facilities"
5. Andrea Jensen - "Application of environmental performance standards for siting and capacity assessment of hazardous waste facilities"
6. Alok Mittal - "Models of bioventing processes for remediation of VOCs in unsaturated soils" (Civil Engineering).
7. Christopher Godwin – "Indoor air quality and human health in large mechanically ventilated office buildings," Ph.D., Environmental Health Sciences, Jan. 2003.
8. Erin Drury – "Environmental risk assessment and communication" (tentative)
9. Chu-Yun Huang -- "Gas phase filtration for indoor air quality" (tentative)
10. Tricia A. Metts – "Filtration of Ozone by Carbonaceous Materials: Removal Efficiencies and Reactions with Volatile Organic Compounds", Ph.D., Environmental Health Sciences, Dec. 2004. Assistant Professor, Department of Environmental Health, East Tennessee State University.
11. An-Tsun Huang, "Formation, Fate and Risks of Disinfection Byproducts in Food and Water," Ph.D., Environmental Health Sciences, Jan. 2005. Director of Coordinating Services, Cancer Control Program, Lombardi Comprehensive Cancer Center, Georgetown University.
12. Christopher Bradlee, "PBPK Modeling of Chemical Mixtures"
13. Hien Q. Lee, "Exposure and impacts of air pollutants on adverse birth outcomes in Michigan" (2004 – 8), May, 2008. Research Investigator, E.I. du Pont de Nemours and Company, Wilmington, DL.
14. Chunrong Jia, "VOC Risks and Exposures in Three Detroit Area Communities," Ph.D., Environmental Health Sciences, April 2007. Asst. Prof. Environmental Health, Univ. of Memphis, Memphis, TN.

15. Mamopeli Matooane, “Assessment of Risk to Air Pollution in the South Durban Basin,” University of Natal, Durban, South Africa, Feb. 2004-
16. Kai Zhang, “Exposures and Health Risks Due to Traffic Congestion,” Ph.D., Environmental Health Sciences, May, 2010. Assistant Professor, University of Texas School of Public Health, Houston, TX
17. Jo-Yu Chin, “Characterization of biofuels blends: emissions, permeation and apportionment of volatile organic compounds.” Ph.D., Environmental Health Sciences, May, 2011. Researcher, New York State Department of Health.
18. Robert Knonowech, TBD. (2008 - 2010)
19. Lei Huang, EHS, Polycyclic Aromatic Hydrocarbons (PAHs), Nitro-PAHs and Petroleum Biomarkers in Lake Michigan (2010-14).
20. Liuliu Du, Efficiency and use of stand-alone filters in residential environments, School of Environmental Science and Engineering, Donghua University, Shanghai, China. EHS (2009 - 2012)
21. Tyson Cook, EHS (2010-11).
22. Feng-Chiao Su (Jo-Su), Exposures to mixtures of air pollutants: Analysis of biological, personal and area monitoring, EHS (2008 - 2013). Post-doctoral fellow. University of Michigan.
23. Lei Huang. Polycyclic aromatic hydrocarbons (PAHs), nitro-PAHs and petroleum biomarkers in Lake Michigan. (2010-2014). Post-doctoral fellow. University of Michigan.
24. Chad Milano, "High resolution dispersion modeling and exposure estimation," UM, 2014-
25. Sheena Martinez, "Development of exposure and health metrics to guide environmental policy," UM, 2014-

Co-Chair - as primary advisor

1. Paul Milne - “The measurement of the diffusion rates of volatile organic compounds through laboratory-prepared and intact soils”, Ph.D., Chemistry, May 1996.
2. João Carrilho – “Measurement of infiltration rates in buildings”, Ph.D., University of Coimbra, Coimbra, Portugal (expected 2015).
3. Shi Li, TBD, Biostatistics (2008 - 2013). Statistician at Eli Lilly and Company, Indianapolis

Member

1. Diana Tsimis - "A kinetic model for the biostrip process," Ph.D., Civil Engineering, 1989
2. Rudi Luyendijk - "Microscale impact assessment of the Dutch deltaplan reclamation project using empirical modeling techniques," Ph.D., Civil Engineering, 1991
3. Jeffrey Brook - "A meteorology-based approach to detecting response source-receptor relationships," Ph.D., Atmospheric, Oceanic and Space Sciences, May 1991
4. Joseph Helfand - "Comprehensive biologically based carcinogenic models as tools for risk management of environmental chemicals,” Environmental and Industrial Health, 1993.
5. Steven Michael - "The development of the quadrupole ion trap storage/reflectron time-of-flight mass spectrometer," Ph.D., Chemistry, March 1994
6. Daniel H. Anna, “Modeling the permeation of organic solvents through polymeric chemical protective clothing,” Ph.D., Environmental and Industrial Health, May, 1997.
7. Heather Smith-Cismoski - “Vector modeling of separations for high speed gas chromatography with pressure tunable selectivity,” Ph.D., Chemistry, 1998
8. Pertti Pasanen - “Hygiene of ventilation systems in office buildings: emissions of filters and cleanliness of air ducts,” Faculty of Natural and Environmental Sciences, University of Kuopio, Kuopio, Finland, Ph.D., August 1998.
9. Mukesh Khare - “Air quality modeling for an urban road intersection of Delhi City”, Civil Engineering, Indian Institute of Technology, Ph.D., 1999.
10. Erich D. Steinle - “Potentiometric and spectroscopic studies of metalloporphyrin-based polymer membranes, Ph.D., Chemistry, Oct. 1999.
11. Jeong Yeon Nah – “Application of SAW sensors for VOC mixtures,” expected 1999.

12. Karen L. Skubal – "Effect of field geochemical and microbiological parameters on trichloroethylene biodegradation by indigenous bacteria in natural and amended soil systems," Civil and Environmental Engineering, 2000.
13. Q. Shiang Fu, processes affecting the fate of dioxins in the environment: microbial and chemical reductive dechlorination of polychlorinated dioxins", Civil and Environmental Engineering, 2000.
14. Guibo Xie, "Evaluation of reactive redox capacity for subsurface petroleum contamination remediation design and operations," Civil and Environmental Engineering, Oct. 2001.
15. Chia-Jung (Vincent) Lu, "A portable analytical system employing tunable separation and microsensor array detection for indoor air quality monitoring, Industrial Hygiene," expected 2002.
16. Jae Chang, "Local environmental control manager for underfloor air supply system, Architecture and Urban Planning," expected 2002.
17. Sharad Gokhale, "A hybrid model for prediction of carbon monoxide from vehicular exhaust in urban environment," Environmental Engineering Group, Civil Engineering Department, Indian Institute of Technology, New Delhi, India, expected 2003.
18. Mengda Hsien, expected 2003.
19. Chongzheng Na, "Mechanistic and kinetic study of cyanogen halide formation from amino acids using membrane introduction mass spectrometry, Civil and Environmental Engineering, Nov. 2003 –
20. Mamopeli Matooane, "Assessment of Risk to Air Pollution in the South Durban Basin," University of Natal, Durban, South Africa, Feb. 2004-
21. Dennis Crespo Matos, Adsorption properties of carbon nanotubes, Mechanical Eng. 2004-
22. Qiongyan (Judy) Zong, "A portable gas chromatograph employing novel approaches to sample capture, separation, and detection for trace-level determinations of complex environmental vapor mixture components, Ph.D., Environmental Health Sciences, May, 2008.
23. Sun Kyu Kim, "Microanalytical systems for complex vapor mixtures – development and application to indoor air contaminants and breath biomarkers (2009 -).
24. Matthew W. Spears, "Modeling the Equilibrium Phase Partitioning of Freshly Diluted Internal Combustion Engine Exhaust, Mechanical Engineering", (2011 -) Research Engineering at US EPA.
25. Ana Sofia Mendes, Indoor Environment and Health Related Quality of Life in Elderly Assisted Living Residences, Environmental Health Department, National Health Institute, Porto, Portugal (2010-)
26. Thitiporn Sukaew, Micro-scale preconcentrators for vapor-phase air contaminants: optimizing the design and operating conditions for integration with micro-scale gas chromatographic instrument. EHS (2007 – 13)
27. Nkosana Jafta, "Allergens and indoor environment in low and middle incomes homes in Durban, South Africa, Dept of Environmental and Environmental Health, University of KwaZulu Natal, Durban, South Africa (2007-)
28. Joana MF Bastos, "Integrating urban design and sustainable development: Life-cycle energy and greenhouse gas emissions from urban residential patterns." Sustainable Energy Systems, University of Coimbra, Portugal. July 2012 - 2015.
29. Yun Xiang, "Mobile Sensor Network Design and Optimization for Air Quality Monitoring. Electrical and Computer Engineering, UM, 2012-13.
30. Shi Li, "Bayesian Modeling for Environmental Association and Gene-Environment Interaction Under Complex Epidemiologic Study Designs." Biostatistics, School of Public Health, 2011-13.
31. Joao Carrihlo, Air exchange rate determinations. Sustainable Energy Systems, University of Coimbra, Portugal. 2014-.

<u>Doctoral Pre-Candidate Qualifying and Research Committees</u> (in addition to above) - (29)

1. Lenly Weathers - Civil Engineering, 1987
2. Malali Ravindra - Civil Engineering, 1987
3. Joseph Ernest - Civil Engineering, 1987
4. Andrew Ernest - Civil Engineering, 1987
5. Gwy Am Shin - Environmental Health Sciences, 1992
6. Nam Won Paik - Industrial Health, 1992.
7. Tser-Chen Lin - Environmental Health Sciences, 1993.
8. Jeffrey Haskins - Environmental Health Sciences, 1994

9. Myoung-Jin Kim - Environmental Health Sciences, 1995
10. John MacArthur - Environmental Health Sciences, 1996; 1997
11. Robert Trombley – Environmental Health Sciences, 1998; 1999
12. Janice Lee - Environmental Health Sciences, 1999
13. Wei-Chang Su – Environmental Health Sciences, 1999
14. Erin Drury – Environmental Health Sciences, 1999
15. Laura Brixley - Environmental Health Sciences, 2000
16. Maria Rosario -Environmental Health Sciences, 2000
17. Simin Abrishami - Environmental Health Sciences, 2000; 2001
18. Jamie Meliker - Environmental Health Sciences, 2001
19. Tarino Charleson - Environmental Health Sciences, 2000; 2001
20. Yoo, Sang-Joon - Environmental Health Sciences, 2001
21. Sheryl Kennedy – Environmental Health Sciences, 2002
22. Yi-Chen (Jane) Wu – Environmental Health Sciences, 2003
23. Ronke Soyombo – Environmental Health Sciences, 2003
24. Sang Yoo – Environmental Health Sciences, 2003
25. Melissa Slotnick – Environmental Health Sciences, 2003
26. Mary Johnson – Environmental Health Sciences, 2003
27. Zorimar Rivera – Environmental Health Sciences, 2004
28. Luis Omar Rivera-Gonzalez – Environmental Health Sciences, 2004
29. David Choi – Environmental Health Sciences, 2005

11.4.2 Master's Thesis Research Committees

Chair

1. Pinakin Patel - "Modeling the movement of VOCs in the vadose zone" M.S., Civil Engineering, Feb. 1989
2. Dow J. Zabolio - "Decentralized water demand management," MS, Civil Engineering, May 1989
3. Lenly Weathers - "The design of a groundwater flowmeter," MS, Civil Engineering, February 1989
4. Harriet P. Shannon - "The determination of area source emission factors using whole air sampling," MS, Civil Engineering, November 1989
5. Xiao-Fang Yang - "Gaseous and particulate contamination in space" MS, Mechanical Engineering, December 1989 (Co-chair)
6. Nancy Bartoletta - "Fungal volatiles of potential relevance to indoor air quality, MS, Environmental Health Sciences, May 1991
7. Brian McQuown - "Development of a Passive Soil Gas Flux Sampler," MS, Civil Engineering, December 1991
8. Adarsh Kulshrestha - "Modeling the fate and transport of volatile organic compounds in the vadose zone," MS, Environmental Health Sciences, September 1991
9. Ganda Glinsorn - "Determination of FTIR detection limits for volatile organic compounds, MS, Environmental Health Sciences, April 1992
10. Matthew Pickus - "Dose delivered from a tritium contamination in a laboratory environment," MS, Environmental Health Sciences, April 1997.
11. Mary Lou Davis - "Surgical suite medical waste audit: a case study at the University of Michigan Medical Center"
12. Norton Fogel - "Comparison of remediation approaches for TCE in unsaturated soils: a field study"
13. Paige Davis - "Adequacy of environmental reporting: a case study and the Fortune 50, MS, Environmental Health Sciences, June, 1994
14. Jonathan Greene - "Application of pollution prevention and life cycle design principles to an evaluatory framework for chemical production and utilization," MS, Environmental Health Sciences/Industrial Hygiene, July, 1996.
15. Michael Martinko - "Adequacy of IH monitoring plan at a petroleum refinery", MS, Occupational Health, Dec., 1995

16. Kimberly MacLaren - “Development and evaluation of an industrial hygiene exposure assessment model” MS, Environmental Health Science, expected June, 1996
17. Igor Osak - “Characteristics of existing and potential filter media for high volume air samplers,” MS, Environmental Health Science,” May, 1996
18. John MacArthur - “Uncertainties in the Use of a Mass Balance Framework to Characterize Industrial Emission from Process Vessels” July, 1996
19. Donald K. Ward, “Estimating metal emissions from a cement manufacturing facility burning liquid hazardous waste using soil monitoring and deposition predictions,” MS, Environmental Health Sciences, Dec. 1997.
20. Katherine Sadowski, “Measurement and analysis of EMF from microwave towers,” MS, Environmental Health Sciences, May, 1998.
21. Eugene Mei, “Developing measurable goals for reductions in polycyclic aromatic hydrocarbon loadings to Boston harbor sediments,” MS, Environmental Health Sciences, May, 1998.
22. James Warila, “Ecological risk assessment of silver effluents in aquatic systems,” MS, Environmental Health Sciences, Sept. 1998.
23. Jeffrey Edge, “Needs assessment for hazardous waste and industrial hygiene programs,” MS, Industrial Hygiene, May, 1999.
24. So-Young Lim, “Evaluation of aerosol sampling using pressure drop across pore-type filters, MS, Environmental Health Sciences, May, 1999.
25. Nancy Sachs, “Environmental life cycle impact analysis”
26. Shoba Prandoh, “Temporal measurements of air quality and relationship to sources in a dental office,” MPH, Environmental Health Sciences, July 1999.
27. James Braun, “VOC exposures during commuting,” MS, Industrial Hygiene, May, 2000.
28. Chad Bailey, “Environmental justice studies”
29. Anthony Barnes, “Environmental health protection in South Africa”
30. Dana Lee, “Analysis of job classification hazards at a large pharmaceutical firm (tentative).
31. Gregory Lower, “Receptor modeling of VOCs in Detroit (tentative)
32. Carrie Ziehl, “Multipoint Monitoring and Assessment of VOCs, CO_2, O_3, and NO_X Concentrations in An Office Building, MS, Environmental Health Sciences, Sept., 2001.
33. Emily Barnet, “Air quality and exposures at an off-set printing facility”
34. Cindy Harms, “Air quality and worker symptoms and perceptions at an off-set printing facility”
35. Erika Kovacs, “Revisiting the threshold quantity criteria in the US EPA risk management program”
36. Joy Kistnasamy, “Health effects of learners and teachers at the Settlers School in South Durban associated with ambient air pollution” Department of Environmental Health, Technikon Natal, Durban, South Africa.
37. Nitasha Baijnath, “Short Term Exposure Measures For Acute Respiratory Health Effects Among Learners and Teachers at Settlers Primary School in South Durban,” Department of Environmental Health, Technikon Natal, Durban, South Africa.
38. Lynn Zwica, “The Effect of Ozone Concentration and Humidity on the Removal Efficiency and Surface Area of Activated Carbon,” 2002.
39. Amy Lynne Kascewicz, MPH, 2002 - 2005
40. Sonja A. Rawie, Sonja A. Rawie, “Development of Externality Costs Using Conjoint Analysis and Expert Opinions,” 2002.
41. Dang Nguyen (Environmental Health Sciences)
42. Shalonda Lynnise Hunter (Urban Planning)
43. Yang-won Suh, “THMs in pools”
44. Yungdae Yu, “Evaporative emissions from vehicle fuel cap assemblies”
45. Tim Kennedy (Environmental Health Sciences)
46. Beth Hedgemen
47. Michael Rosenow (Environmental Health Sciences, OJOC, Nov. 2003 -)
48. Gina Hatzivasilis, "Concentrations of volatile organic compounds and air exchange rates in residences and attached garages," July, 2005.

49. Yi-Chen Wu, “Proximity of schools in Detroit to highways.” July, 2005.
50. Angela Fuller, MS
51. Qin Wei Chow, MPH
52. Kevin Bolon (SNRE), 2007
53. Keita Fujihira (SNRE), 2007
54. Tze-Chun Chen, Performance Evaluation of a Medium Flow Sampler for Airborne Brominated Flame Retardants (BFRs), MS, 2008.
55. Scott Schroeder, “CO concentrations in ice rinks in Michigan. MPH, 2008
56. Hudda Elasaad, "A gradient study of PAH deposition near roads, MS, September, 2011.
57. Savitha Sangameswaran, "Sources and factors influencing airborne particulate matter in Detroit, MI" (expected October 2011).
58. Dongyan Sun, TBD, expected May 2012.
59. Yu Yu, Environmental risk factors and amyotrophic lateral sclerosis (ALS): A case-control study of ALS in Michigan, March, 2013.

Member - (11)

1. Evan Cook - "Diffusion of contaminants through landfill liners," MS, Civil Engineering, 1989
2. James W. Askew - "Computer aided cyclone analysis," MS, Agricultural Engineering, 1989
3. John D. Watts - "Flow instrumentation for porous media simulator," MS, Civil Engineering, 1990
4. Jaebum Choi - "Development of soil/air flux measurement instrumentation" M.E., Mechanical Engineering, 1992
5. Graham Barratt, “Mercury dispersal and uptake resulting from Thor Chemical,” M.S., Environmental and Industrial Health (1999).
6. Mark Huang, “Surface acoustic wave sensor applications” (tentative)
7. John Raflowski, “Evaluation of agricultural uses of foundry sand” (tentative)
8. Michael Lane, “Risk assessment at a gasification site” (tentative)
9. Shanna Schmiesing, “Artificial Neural Network Analyses of Microsensor Array Response Patterns”, 2004.
10. Juliet Merts, “Using measured road tunnel air concentrations to verify mobile source emission factors embedded in the IPIECA toolkit and to speciate total hydrocarbons,” Peninsula Technikon, Cape Town, South Africa, 2004 (visit to University of Michigan, 7/1/2002 – 12/28/2002.)
11. Ashish Jachak, “Indoor pollutant concentrations – A non steady state approach,” M.S., Environmental Health Sciences (OJ/OC), 2005.
12. Peter Dornbos MS, Mercury exposure and neurochemical biomarkers in multiple brain regions of Wisconsin River Otters (Lontra canadensis) (May, 2012).

Master's Students Research Projects (non-thesis) - (10)

1. Mary Dawn Azizian - "Emergency response planning and air quality modeling" MPH, Environmental Health Sciences, May 1992
2. Hsiang-Yin Chen - "The treatment of hospital solid wastes", MPH, Environmental Health Sciences, May 1992
3. Chia-Chin Cheng - "Hazard analysis for the transport of hazardous waste transportation in the University of Michigan, MPH, Environmental Health Sciences, April 1993
4. Jeffrey Hartford - “Analysis of particulate releases using duct monitoring", MS, Occupational Health, May, 1994.
5. Paris Watson - "The role environmental/health education should play in the control of schisosomiasis", MPH, Environmental Health Sciences, April, 1993.
6. Richard Martin - To be determined.
7. Shannon Armijo – “A review and critique of questionnaires for indoor air quality investigations,” MPH, May, 1999.
8. Megan McMaster, TBD
9. Adrienne Kari, MPH, 2005.

10. Josh Bennet, MPH 2005
11. Bradley Lampe, MPH (2005-6)
12. Jung Eun Lee, MS, Biostatistics (2008)

Additional Graduate Students Supervised (since 1989, 15)

1. Haza Rashid Hammad - 1989-90
2. Kimberly Osborn - 1989-90
3. Elizabeth Esseks - 1992
4. Ji-Young Lee - 1992-3
5. Michael Dojka - 1993
6. Anthony Barnard - 1993-
7. Jim Hensley - 1994-
8. Barbara Zabawa - 1994-5
9. Iyer Padmanabham - 1994-5
10. Roxanne Present - 1995-6
11. Stephanie Franke - 1996-7
12. Vernon Fillis, "Bioreactors for chlorinated solvents in water, Chemical Engineering, Peninsula Technikon, Bellville, South Africa, visiting University of Michigan, 1/2000 – 8/2000.
13. Greg Hangone, "Life cycle assessment for bagasse," Chemical Engineering, Peninsula Technikon, Bellville, South Africa, visiting University of Michigan, 7/2001 – 12/2000.
14. Philemone Simelane, "Numerical modeling of smart actuators, Mechanical Engineering, Peninsula Technikon, Bellville, South Africa, visiting University of Michigan, 7/2001 – 12/2000.
15. Henrich Amsterdam, "Dispersion Modeling of Air Pollution Sources in the Durban South Industrial Basin" Chemical Engineering, Peninsula Technikon, Bellville, South Africa, visiting University of Michigan, 7/1/2002 – 12/28/2002, MS awarded Jan. 2005.

11.4.3 Undergraduate Advising – Undergraduate Research Opportunities Program and Others

1. Artesha Joy Ervin – 2001 – 2
2. Ugo Okwumabua – 2002
3. Scott Roberts – 2005
4. Mariesha Lala -- 2012
5. Jennifer Liu -- 2012-3
6. Eva Greenthal -- 2013

11.4.4 Post-Doctoral Advising - (15)

1. Dr. Ling Yu He - Analysis of VOCs in ambient air, 1988
2. Dr. Dr. George Moridis - Analysis of moisture and heterogeneities in soils, 1988-9
3. Dr. Quilin Chang - Analysis of VOCs in soils, 1991
4. Dr. Nicola Pirrone - Indoor air quality and ambient particulate deposition, 1991-3, Director, Institute of Atmospheric Pollution Research, Rome, Italy.
5. Dr. Hong-Kui Xiao - Analysis of VOCs in biological specimens, 1993-6
6. Dr. Guo-Zheng Zhang - VOC analysis related to indoor air quality and wood products, 1993-6
7. Dr. Minghao Zhao - Fast GC and microbial VOC analysis - 1997
8. Dr. Shuqin Wang - FTIR and indoor air - 1997 - 2001
9. Dr. Lianzhong Zhang - Disinfection byproducts - 1997 - 2001
10. Dr. Chung Peng - VOC analyses - 1998 – 2000
11. Dr. Christopher Godwin – IAQ analyses – 2003
12. Dr. Jae Hwan Lee – VOC analyses – 2004-2005
13. Dr. Sergei Chernyak – VOC and other organic analysis – 2004 –
14. Dr. Simone Charles – 2005 – 2007, Associate Professor, College of Health and Human Sciences, University of Southern Georgia, Stateboro, GA

15. Dr. Chunrong Jia, 2008 – 2009, Assistant Professor, University of Memphis, Memphis, TN
16. Dr. Jo-Yu Chen, 2011-13, Research Scientist II, Office of Quality and Patient Safety, New York State Department of Health, Albany, NY
17. Dr. Rajiv Ganguly, 2012-13, Associate Professor, Department of Civil Engineering, Jaypee University of Information Technology, Waknaghat, Solan, Himachal Pradesh, India
18. Dr. Feng-Chiao Su, 2013-15
19. Dr. Liuliu Du, 2012-13
20. Dr. Sarah Le, 2014
21. Dr. Owais Gillani, 2014-

11.4.5 Sabbatical and Visitor Advising/Support (8)

1. Dr. Eugene Cairncross, Peninsula Technikon, Bellville, South Africa (4/1/00 – 9/30/00)
2. Prof. Bohua Sun, Peninsula Technikon, Bellville, South Africa (7/30/00 – 8/3/00)
3. Prof. Pentti Kalliokoski, University of Kuopio, Kuopio, Finland (8/1/00 – 7/30/01)
4. Prof. Milan Carsky, University of Durban-Westville, South Africa (7/1/01 – 8/20/01)
5. Dr. Olga Mayan, National Institute for Environmental and Occupational Health (3/16-23/03)
6. Prof. Fausto Freire, University of Coimbra (2/28/08 – 8/15/08)
7. Mr. Peter Mochung Mochungong, Institute for Public Health, University of Southern Denmark (12/27/09-6/25/10)
8. Dr. Liuliu Du, Associate Researcher, School of Environmental Science and Engineering, Donghua University, Shanghai, China. (9/09 –)
9. Dr. Raghavan Sampathraju, Indian National Institute for Occupational Health, Delhi, India, 1/1/12-6/30/12.

11.4.6 Other

Minority International Research Training Program

1. Joy Ervan – 2002 – placement in Chile

11.5 Summary of Academic Advising

Committee chairs/cochairs/members

	PhD Committee Chairs	***PhD Com. Memberships***	***MS Theses/Projects***
Total	*20 (includes 1 co-chair)*		*22*
	57		

Total number of advisees (since 1986, graduate only (requires updating)/)

PhD/DrPH Research Committee	*42*	
Qualifying Exam Committee (excluding above)	*29*	
MS/MPH Research Committee	*64*	
Other MS/PhD		*26*
Post-doctoral fellows	*16*	
Sabbatical and visitors	*3*	
Total students/postdocs advised	*180*	

12 SERVICE

12.1 Professional Memberships and Offices

1. Member, Air and Waste Management Association (1982-)
2. Member, American Society of Testing & Materials, Committee D-22 on Sampling & Analysis of Atmospheres (1986-99)
3. Member, American Geophysical Union (1987-93)
4. Member, Association of Environmental Engineering Professors (1987-95)
5. Member, American Association for Aerosol Research (1989-91)
6. Advisory Board Member, Association of Professionals Involved with Non-Utility Power Generation (1990-96)

7. Associate Member, American Society of Heating, Ventilating and Refrigeration Engineers (1992-5)
8. Chairman, U.S. Working Group on FTIR Spectroscopy for the Measurement of Air Pollution, International Organization of Legal Metrology (March 1992-5)
9. Member, National Environmental Health Association (2000 -)
10. Associate Editor, *ASCE Journal Environmental Engineering* (air pollution topics) (2002-5)
11. Member, International Society for Environmental Epidemiology (2002 -)
12. Editorial Board, *Journal of Environmental and Public Health*, http://www.hindawi.com/journals/jeph/ (2008 -)
13. Member, (External) Scientific Advisory Board of the Energy for Sustainability (EfS) Initiative, University of Coimbra, Portugal (2013 -)

12.2 Journal, Book and Abstract Reviews

1. *Soil Science Society of America* (1997)
2. *Air and Waste Management Association* (formerly Air Pollution Control Association) (1988-)
3. *Journal of Environmental Management* (1991-)
4. *Atmospheric Environment* (1991-)
5. *Environmental Science and Technology* (1992-)
6. *Water Research* (1992-)
7. *Journal of the American Industrial Hygiene Association* (1993-)
8. *The Science of the Total Environment* (1994-)
9. *ASCE Journal of Environmental Engineering* (1994-)
10. *Choice*, Association of College and Research Libraries, American Library Association (published 4 college textbook reviews in 1997-8; 4 in 1998-9; 2 in 1999-0)
11. *The Michigan Academician*, Michigan Academy of Science, Arts and Letters (1998-)
12. *Environmental Practice*, the National Journal of the Association of Environmental Professionals (1999-)
13. *Journal of Industrial Ecology* (2000-)
14. *Indoor Air* (2000-)
15. *International Society of Exposure Analysis/International Society for Environmental Epidemiology* (2002)
16. *Environmental Research* (2005-)
17. *Environment International* (2007-)
18. *Others…*

12.3 Book and Report Reviews for Other Institutions

1. US EPA (various reports and conference paper reviews (1998-)
2. National Research Council, Transportation Research Board (conferences and journals, 1997-)
3. US EPA National Pollution Prevention Center, book and report review, e.g., Overview of Environmental Problems (1995)

12.4 Grant and Proposal Reviews

1. US Department of Energy, Appropriate Technology Small Grants Program (1982, 1983)
2. Environmental Protection Agency, Atmospheric Research & Assessment Peer Review Program (1988, 1990)
3. Department of Energy, Office of Health and Environmental Research, Climate Research Program, Small Business Innovative Research Grants Program (1991, 1992, 1993).
4. Environmental Protection Agency, Science and Engineering Environmental Research Program (1993)
5. Great Lakes Research Protection Fund (March, 1995)
6. National Science Foundation NATO Advanced Study Institute Program (Sept. 1995).
7. US Environmental Protection Agency, National Exposure Research Laboratory, Internal Grants Program, (Sept.-Oct. 1995).
8. US Environmental Protection Agency, National Center for Environmental Research and Quality Assurance, Center for Environmental Research and Quality Assurance, Graduate Education Fellowship programs (Feb. 1996).

9. US Environmental Protection Agency, National Center for Environmental Research and Quality Assurance, Exploratory Environmental Research Program (June, 1996).
10. Center for Indoor Air Quality (June, 1996; June 1997; June 1998).
11. Research Grants Council of Hong Kong, University Grants Committee (March, 1997; February 1998; April 1999, March 2000; December 2000; March 2001; February 2003, February 2004; May 2005, April 2010; October 2012).
12. Panel Member, US Environmental Protection Agency, National Center for Environmental Research and Quality Assurance, Environmental Engineering, Exploratory Grants Program (June, 1998).
13. Panel Member, US Environmental Protection Agency, National Center for Environmental Research and Quality Assurance, Environmental Monitoring for Public Access and Community Tracking (EMPACT) Grants Program (July, 1998).
14. Panel Member, US Environmental Protection Agency, National Center for Environmental Research and Quality Assurance, Graduate Environmental Study Fellowships (March, 1999).
15. Panel Member, US Environmental Protection Agency, National Center for Environmental Research and Quality Assurance, Graduate Environmental Study Fellowships (January, February, 2000).
16. Panel Member, Office of Life Sciences and Microgravity Sciences, NASA Extramural Grants Program (March, 2000)
17. Panel Member, US Environmental Protection Agency, National Center for Environmental Research and Quality Assurance, Futures Research in Socio-economics (Sept. 2000).
18. Research Management Group, Linthicum Heights, MD (December, 2000).
19. Panel Member, US National Institute of Occupational Health and Safety, Hazardous Substances Training and Hazardous Substances Academic Training Programs (September 2001).
20. Panel Member, US Environmental Protection Agency, National Center for Environmental Research and Quality Assurance, Graduate Environmental Study Fellowships (Jan. – Feb. 2002).
21. Panel Member, US Environmental Protection Agency, National Center for Environmental Research and Quality Assurance, Futures Research in Socio-Economics (Jan. 2002).
22. Panel Member, US Environmental Protection Agency, National Center for Environmental Research and Quality Assurance, Superfund Minority Institution Research Program: Hazardous Substances Research (Oct. 2002).
23. Panel Member, US National Science Foundation, Grants Review (April – May, 2003).
24. Panel Member, International Science and Technology Center and Science and Technology Center in Ukraine Projects, US Civilian Research and Development Foundation (October, 2003).
25. Panel Member, Environmental Statistics Research: Novel Analyses of Human Exposure Related Data, US Environmental Protection Agency (April, 2004).
26. Panel Member, New Investigator Award, Health Effects Institute (May, 2004).
27. Subchair, Advanced Research in Environmental Health Special Emphasis Panel (ARCH-SEP), National Institute of Environmental Health Sciences (March, 2005).
28. Reviewer, Cooperative Grants Program (CGP) 2006 of the U.S. Civilian Research and Development Foundation (CRDF), October 2006.
29. Panel Member, US Environmental Protection Agency, National Center for Environmental Research, Uncertainty Analyses of Models in Integrated Environmental Assessments (March, 2007).
30. Panel Member, Graham Environmental Sustainability Institute; Water, Environmental and Health, Pilot Research Program (Feb. 2008)
31. Panel Member, US Environmental Protection Agency, National Center for Environmental Research, Uncertainty Analyses of Models in Integrated Environmental Assessments (March, 2007).
32. Panel Member, Advanced Research Program, Texas Higher Education Coordinating Board, Austin, TX. Nov.-Dec. 2007.
33. Panel Member, Strategic Environmental Restoration Defense Program, US Department of Defense (Vapor Intrusion), April, 2008.
34. Panel Member, Research Excellence Centers, National Research Foundation, United Arab Emirates (Oct. 2008).

35. Reviewer, Cooperative Grants Program (CGP) of the U.S. Civilian Research and Development Foundation (CRDF), April, 2009.
36. Reviewer, Institute for Population Studies, Health Assessment, Administration, Services and Economics (INPHAASE), Wayne State University, 2010.
37. Reviewer, Knowledge Foundation, Sweden. 2010.
38. Panel Member, "Exploring Linkage between Health Outcomes and Environmental Hazards, Exposures, and Interventions for Public Health Tracking and Risk Management", US EPA/CDC, Washington, DC. 2010.
39. Reviewer, "Developing Exposure Indices for Rapid Prioritization of Chemicals in Consumer Products", American Chemistry Counsel, July, 2010.
40. Member, Neurological, Aging and Musculoskeletal Epidemiology Study Section [NAME], National Institutes of Health, Washington, DC. April - June, 2013.
41. Reviewer, Development research grants, Academy of Finland, Helsinki, Finland, July - Aug., 2013.
42. Reviewer, Collaborative Research Fund (CRF), Earmarked Research Grant (ERG), Hong Kong, Feb., 2014.
43. Panel Member, National Institute for Occupational Safety and Health, Disability and Injury Disease Prevention and Control Special Emphasis Panel, July, 2014.
44. Panel Member, National Institute for Occupational Safety and Health, Disability and Injury Disease Prevention and Control Special Emphasis Panel, January, 2015.
45. Reviewer, Environmental Health Sciences Center for Urban Responses to Environmental Stressors (CURES), Wayne State University, Detroit, MI. Feb., 2015.
46. Member, Neurological, Aging and Musculoskeletal Epidemiology Study Section [NAME], National Institutes of Health, Washington, DC. April - June, 2015.

12.5 University Service

12.5.1 Texas A&M University

1. Member, Graduate Studies Committee, Department of Civil Engineering (1986-1989).
2. Member, University Computer Advisory Committee for Statistical Software (1986).
3. Member, Computer Committee, Department of Civil Engineering (1987).
4. Student Advisor (for Division), Environmental and Water Resources Engineering Division, Department of Civil Engineering (1987-8).
5. Developed database/tracking system for Environmental and Water Resource Engineering Division students (1987).
6. Participant, Institute for Innovation and Design Workshops (1987).
7. Participant, Network of University Teachers (computer assistant instruction, role playing) (1988).
8. Reviewer, University Library Learning Resources Center, for recommendation of statistical software packages (1988).
9. Member, Program Promotions Subcommittee, Graduate Studies Committee, Department of Civil Engineering (1988).
10. Member, Academic Standards Subcommittee, Graduate Studies Committee, Department of Civil Engineering (1988-9).
11. Representative, Graduate Council, Department of Chemistry Dissertation Committee (1989).

12.5.2 University of Michigan

1. Sponsor, High School Minority Apprenticeship Program (1991, 1992, 1993).
2. Mentor, University Mentorship Program, Office of Student Services (fall, 1991).
3. Supervisor, Undergraduate Research Opportunity Program (1992, 1994, 1995, 2001, 2002).
4. Participant, Corporate and Foundations Relations Recruitment Programs (1992).
5. Member, Science Advisory Panel, Environmental Health Affects Network, CIESIN (1992-3).
6. Participant, UV-B Conference, Environmental Health Effects Network (Feb. 24-5, 1992).
7. Member, Environmental Protection Subcommittee, Vice President Womack's Financial Affairs Committee (1992-5).
8. Member, Education and Research Center (formerly Educational Resource Center) (1993-).

9. Advisor, Occupational Safety and Environmental Health and Plant Departments on indoor air quality and building ventilation (1993-)
10. Co-coordinator for environmental case study course, Scripts Journalism Fellows Programs (1993).
11. Participant, Workshops on the Interdepartmental Institute for Environmental Science and Engineering (1994).
12. Participant, Workshop on the Future of the Automobile, Pollution Prevention Center, (1994-5).
13. Faculty Adviser, School of Natural Resources and Environment, Greening the Maize and Blue Course (1995-).
14. Moderator, Campus Environmental Management Panel (Nov. 1995).
15. Member, Promotion Committee for Dr. Andrei Barkovskii, College of Engineering (Oct. 1997-Feb. 1998).
16. Advisor, External Advisory Committee, Center for Sustainable Systems (Feb. 1998 –).
17. Member, Waste Disposal Alternatives Task Force, OSEH and the Medical Center (Feb. – Aug. 1999).
18. Member, Individually Developed Overseas Internship Award Review Committee, International Institute (March - April, 1999; Feb. 2000).
19. Member, Executive Committee, Certificate Program in Industrial Ecology, Rackham School of Graduate Studies (March, 1999-).
20. Member, Environmental Justice Program Development Committee (Nov. 1999).
21. Member, Add-hoc Transportation and Planning Committee (June 2000 – April 2001).
22. Reviewer, IIE Fulbright Campus Committee (Oct. 2000, Oct. 2001).
23. Reviewer, Office of Vice President for Research, Faculty Grants and Awards Program (Jan. 2001; May 2005; May 2006)
24. Advisor, Minority International Research Training Program, Center for Human Growth and Development (Jan. 2002-)
25. Panelist, A Strategic Integrated Assessment for Revitalizing the Role of the University of Michigan in Great Lakes Research (March 2005).
26. Panelist, Careers in Environmental Health, WISE (Women in Science and Engineering) and UIR (UROP in Residence), March 2005.
27. Panelist, Environmental Sustainability Forum (interviews and focus groups), June, August 2005.
28. Member, Search Committee, Graham Environmental Sustainability Institute, Jan – May, 2006.
29. Coordinator, Research Symposium in Water, Health and Environmental Sustainability, Graham Environmental Sustainability Institute, May – Sept. 2007.
30. Reviewer, Environmental Sustainability Multidisciplinary Research Team Grant Proposals, Graham Environmental Sustainability Institute, Mar. 2008.
31. Member, Energy Conservation Committee (Joint between Utilities; Plant Operations; Architecture, Engineering and Construction; Faculty), July 2008 – present.
32. Delegate, Universities Council on Water Resources (2008 -)
33. Faculty Associate, Program in the Environment (University-wide crossroads for undergraduate environmental study (2008 -).
34. External Reviewer, Tenure and Promotion Committee, College of Engineering (Oct. 2008).
35. Faculty advisor, Students for Jamaica, Blue Mountain Project, University of Michigan Medical School, Dec. 2008 - Jan. 2009)
36. Chair, Provost's committee, 3 year review of the Graham Environmental Sustainability Institute, Jan. – Mar. 2009.
37. Member, Advisory Board, Center for Global Health, Sept. 2009 -
38. Member, Office of the Vice-President for Research 2010 - 2012 Research Faculty Awards Selection Committee, Mar. – Apr. 2010, 2011, 2012.
39. Member, Faculty Steering Committee, Report on Sustainability at The University of Michigan, Integrated Assessment, Graham Environmental Sustainability Institute (Feb. 2010 – Dec. 2010).
40. Faculty Associate, Center for Global Health (Feb. 2011-)
41. Member, Council of Fellows, The Cooperative Institute for Limnology and Ecosystems Research (CILER/NOAA) (July 2011 -)

42. Member, ADVANCE Committee for mentoring new faculty, Civil and Environmental Engineering (Feb. 2013).
43. Member, Planet Blue Team (energy conservation/sustainability) (Mar. 2011 - present).
44. Chair, SPH Planet Blue Advisory Committee to the Dean (May 2011 - 2013).
45. Member, Tenure and Promotion Committee, Mechanical Engineering, College of Engineering (2014)

12.5.3 School of Public Health, University of Michigan

1. Contributor (and subject and editor) for "Case Study Course Examines Envotech's Proposed Hazardous Waste Incinerator," School of Public Health *Findings Magazine* (1993).
2. Member, Ad-hoc Committee for the Internal Review of the School of Public Health (1993-4).
3. Member, Advisory Committee on Academic Programs (1995 – 1997, 2000 – 2003, 2008 – 10).
4. Member (alternate), Advisory Committee on Academic Programs, School of Public Health (1998-2003).
5. Member, Planning Committee, Second Isadore Bernstein Symposium, Fourth School of Public Health Symposium on "Genetically Modified Organisms: Public Health Implications" (scheduled for Oct. 26, 2001) (2001).
6. Member, Web Implementation Committee (2000-1).
7. Member, Public Health Information Services Advisory (PHISA) Committee (2000-5).
8. Member, Merit Database Review Subcommittee, Public Health Information Services Advisory (PHISA) Committee (March–May, 2003)
9. Facilitator, SPH Retreat, April 28, 2003.
10. Chair, SPH Ad Hoc Committee on Academic Conduct (April – May, 2003).
11. Member, Informatics and Information Technology Committee, also Informatics Subcommittee (Sept – May, 2006).
12. Member, Global Public Health Advisory Committee (Dec., 2009 - present).
13. Member, Curriculum Subcommittee, Global Public Health (Sept. 2010 - present).

12.5.4 Department of Environmental Health Sciences, University of Michigan

1. Member, Governance Committee (1989-).
2. Member and Equal Opportunity Liaison Officer, Faculty Search Committee (1990).
3. Member, Curriculum Committee (1990-2000).
4. Organizer, equipment and infrastructure upgrade and maintenance. Includes ventilation systems, machine shop renovation, research and teaching instrument maintenance, computer networking, etc. (1990-).
5. Member and Chemical Hazards Safety Officer, Safety Committee (1991-4).
6. Promotions and student recruitment, including writing and editing brochures, initiating contact with potential students, etc. (1991-).
7. Member, Ad-hoc Committee for an On-Job On-Campus Program on Environmental Quality Management (1991-1992).
8. Member, William Gibson Award Subcommittee (1992).
9. Director, Hazardous Substances Academic Training Program (1993-).
10. Reviewer and Contributor, EIH/HN Reorganization Task Force Draft Plan (Dec. 94-Jan. 95).
11. Member, Toxicology Faculty Search Committee (1995-6).
12. Chair, Curriculum Committee (1995-6).
13. Member, Interprogram Activities Task Force (1995 – 1996).
14. Member, EIH Search Committee (1995-1996).
15. Member, Curriculum Committee (1997-1999).
16. Member, Advisory Committee on a Common MPH Program (1998).
17. Participant, Accreditation Board for Engineering and Technology (ABET) Site Visit to Industrial Hygiene Program, Nov. 1997; Nov. 2000.
18. Member, Admissions Committee (1999-00).
19. Member, Executive Committee (1999-).
20. Mentor, Environmental Toxicology Training Program (2000-).

21. Coordinator, SPH Staff Recognition Awards (April, 2000; April, 2001).
22. Coordinator, Departmental Orientation held Aug. 31, 2000.
23. Chair, Curriculum Committee (2000-2005).
24. Associate Chair for Academic Affairs and Development (2000-2005).
25. Acting Head, Environmental Health Program (2002).
26. Host, facilitator for visit of Dr. Olga Mayan Gonçalves, head of Environmental and Occupational Health Center at the National Institute of Health in Oporto, Portugal (Mar. 17-22, 2003).
27. Member, Retreat Planning Committee (April 2003).
28. Panelist, 40th Annual Warren Cook Industrial Hygiene Discussional, University of Michigan (Oct. 23-4, 2003).
29. Coordinator and evaluator, EHS MPH First Annual Poster Session (Oct. 24, 2003).
30. Co-Chair, Strategic Planning Committee (Dec. 2003 – March 2004).
31. Panelist, 41st Annual Warren Cook Industrial Hygiene Discussional, University of Michigan (Oct. 21-2, 2004).
32. Member, Risk Sciences and Communication Faculty Search Committee (Sept. 2004 – Apr. 2005)
33. Member, EHS Chair Faculty Search Committeee (Aug. 2004 - Apr. 2005)
34. Member, Human Nutrition Planning Committee (Dec. 2004 – Feb. 2005).
35. Member, Admissions Committtee (2005-)
36. Member, Doctoral Committee (2005-6)
37. Member, OJ/OC Planning Committee (2005-)
38. Panelist, 42nd Annual Warren Cook Industrial Hygiene Discussional, University of Michigan (Nov. 3-4, 2005).
39. Panelist, 44th Annual Warren Cook Industrial Hygiene Discussional, University of Michigan (Nov. 1-2, 2007).
40. Member, Academic Programs Committee (2007-8)
41. Chair, Professional Program Curriculum Committee (2008-11)
42. Panelist, 45th Annual Warren Cook Industrial Hygiene Discussional, University of Michigan (Oct. 23-24, 2008; 2009; 2010, 2011; 2012).
43. Member, Strategic Planning Committee (2007-8)
44. Member, Academic Degree (MS/PhD) Committee (2014-5)
45. Co-Chair, Admissions and Recruitment Committee (2014-5)

12.6 Community Service

12.6.1 International Service

1. Reviewer, Design of ambient air quality monitoring network for Mexico City, Movimiento Ecologista Mexicano, A.C., Mexico City, Mexico (1988).
2. Participant, Seminar on Acid Rain Control Strategies for Finland," Technical Research Center of Finland, Helsinki Finland (January 1990).
3. Participant, Hydrocarbon Measurement Intercomparison Experiment (1991-2).
4. Organizer, Cooperative agreement for U-M and the Italian National Research Council, Universita della Basilicata, Dipartimento di Ingegneria e Fisica dell'Ambiente (December 1992).
5. Wastewater Engineer/Public Health Specialist, Conference on Scientific Research In The Egyptian Universities And Its Role In Solving Developmental And Environmental Problems, Cairo, Egypt (July 1995).
6. Expert Witness, Desai Presidential Commission of Inquiry into the Sulphur Fire at AECI Somerset West, Western Cape, South Africa, Jan. 29-31, 1997 (headed by Supreme Court Justice S. Desai).
7. Advisor, Cape Air Quality Project, Cape Town, South Africa (1998-9).
8. Chair, Session EE-1c, Residual Risk -- How do we do it? Air and Waste Management Meeting 93rd Annual Meeting in Salt Lake City, June 18-22, 2000.
9. Member , US Advisory Committee, International Center To Support Training And Research In Environmental And Occupational Health In Southern Africa, University of Michigan Fogarty Grant, 9/30/01 – present. See http://www.sph.umich.edu/fogartysa/admin.html
10. Advisor, South Durban Air Quality Monitoring Project, Metropolitan Council, Durban, South Africa. (Feb. 2001-6).

11. International Coordinator, 13th Annual Conference, International Society of Exposure Analysis, Stresa, Italy. Sept. 2003.
12. Advisor, collaborator, for Dr. Patel at RS University, Raipur, India on project "VOC Studies in Central India," (July- 2003)
13. Advisor for Prof. Eugene Cairncross at Peninsula Technikon, Bellville, South Africa on air quality research and curriculum development in air quality (Aug. 2003).
14. Advisor for Dr. Rajen Naidoo at University of Natal, Durban, South Africa on curriculum development in Environmental Health under Fogarty Activity (Aug. 2003).
15. Chair, Resolutions Committee, 8th World Congress on International Health, International Federation of Environmental Health, Durban, South Africa (Feb. 23-27, 2003).
16. Chair, Session AT-3a Urban Air Toxics including Nanoparticles, Air and Waste Management Meeting 98th Annual Meeting in Minneapolis, MN, June 21-24, 2005.
17. Member, Advisory Board, Center for Occupational and Environmental Health, University of KwaZulu Natal, Durban, South Africa, 2003-
18. Symposium Coordinator, "Exposure and Health Studies in Durban, South Africa," 17th Conference of the International Society for Environmental Epidemiology, Johannesburg, South Africa, Sept. 13-17, 2005.
19. External Examiner, Ph.D., University of Pretoria, South Africa, September 2005.
20. External Examiner, M.S., Cape Peninsula University, South Africa, September 2005.
21. Member and Coordinator, Energy for Sustainability (EFS) Initiative, developing two post-graduate programs in "Buildings and the Urban Environment" and "Energy Policy and Systems," University of Coimbra, Portugal, Nov. 2006 – June 2007.
22. External Reviewer, Promotion Committee, University of Kuwait, Kuwait. May, 2007.
23. Meeting organizer, Curriculum Development Workshop in Environmental Health, Center for Occupational and Environmental Health, University of KwaZulu Natal, Durban, South Africa. Funded by Fogarty International Center, University Of Michigan. July 16-18, 2007.
24. Host and Facilitator, Fulbright Scholar Program for Prof. Fausto Freire, University of Coimbra, Portugal, to visit University of Michigan, 2007-8. (awarded)
25. Host and Facilitator, Fulbright Scholar Program for Prof. Mahmoud M. Abdel-Salam, Department of Environmental Sciences, Alexandria University, Alexandria, Egypt, 2007-8 (pending).
26. Advisor, Probus Sigma Lda, (International Environmental Certification), Gois, Coimbra, Portugal (Jan. 2007-).
27. External Examiner, Ph.D., University of Kuopio, Finland, October, 2007.
28. External Evaluator, Department of Environmental Health, Faculty of Health Sciences, University of Botswana, Botswana (Oct.-Nov. 2008).
29. External Evaluator of 3 PhD proposals, Department of Mechanical Engineering, University of Coimbra (Portugal), August, 2009.
30. External Reviewer, Tenure and Promotion, National University of Singapore, Singapore (Dec. 2010).
31. External Reviewer, Tenure and Promotion, American University of Beirut, Lebanon (Jan. 2011).
32. External Examiner, Ph.D., Indian Institute of Technology, New Delhi, India (March, 2011).
33. External Reviewer, Tenure and Promotion, Universiti Sains Malaysia, Palau Pinang, Malaysia. (May, 2011).
34. Member, Program Committee, Energy for Sustainability Multidisciplinary Conference EfS, Faculty of Science and Technology, Coimbra, Portugal, 8-10 September 2013.
35. Session chair, Air Pollution and Equity, Environment and Health – Bridging South, North, East and West. Joint meeting of International Society of Environmental Epidemiology, International Society of Exposure Sciences, and International Society of Indoor Air Quality, Basel, Switzerland, August 19-23, 2013.
36. External Reviewer, Promotion Committee, Dalla Lana School of Public Health, University of Toronto, Canada. (Feb., 2014).
37. Conference Chair, Energy for Sustainability 2015 Multidisciplinary Conference (along with António Gomes Martins), Coimbra, Portugal, May 14-15, 2015. Organized by the Institute for Research and Technological Development in Construction Sciences (ITeCons) on behalf of the Energy for Sustainability Initiative of the University of Coimbra.

National

1. Participant, Workshop on Hazardous Waste Incineration, Manhattan College, New York City (June, 1988).
2. Participant, Workshop on Intermedia Contaminants, UCLA, Santa Monica, CA (August 1988).
3. Participant, Ventilation and IAQ Workshop, U.S. Environmental Protection Agency, Raleigh NC (September 14-16, 1993).
4. Participant, National Institute for Occupational Safety and Health Annual Meeting of the Directors of Hazardous Substances Academic Training Program, Stevenson WA (February 15-17, 1994).
5. Chairman, U.S. Working Group on FTIR Spectroscopy for the Measurement of Air Pollution, International Organization of Legal Metrology (1992-4).
6. Reviewer, U.S. Environmental Protection Agency for "Field Standard Operating Procedure for the Use of Open Path FTIR Spectroscopy at Hazardous Waste Sites, Environmental Response Branch, Edison, NJ (1992).
7. Reviewer, U.S. Environmental Protection Agency for "Guidance for Capacity Assurance Planning, Capacity Planning Pursuant to CERCLA Section 104(c)(9)," Office of Solid Waste and Emergency Response, EPA530-R-94-002, Washington DC (1993-4).
8. Reviewer and editor, Air Quality Chapter, in Overview of Environmental Problems (book), US EPA National Pollution Prevention Center, University of Michigan (1995-6).
9. Sponsor, American Society of Heating, Refrigeration and Ventilation Engineers Scholarship, awarded to Marianna Luoma (June, 1995).
10. Member, Advisory Board, Great Lakes Environmental Justice Program (1997-).
11. Comments to US Environmental Protection Agency Science Advisory Board regarding "Cumulative Air Toxics Exposure Methodology, dated July 20, 1998 (1998).
12. Panelist, International Attempts to Protect the Environment, Town Hall Forum, moderated by US Congresswoman Lynn Rivers, Washtenaw Community College (Aug. 23, 1999).
13. External Reviewer, Tenure and Promotion Committee, St. Louis University (Sept. 1999).
14. Member, Robert E. Dougherty Educational Foundation (administers scholarships in the area of wood science, technology and forest products) (1999 -).
15. External Reviewer, Tenure and Promotion Committee, University of Illinois (July, 2000).
16. Member, Science Advisory Committee, Ecology Center and the Michigan Environmental Council (Nov. 2000-
17. Advisor, Camden Regional Legal Services, Camden, NJ. (Oct., 2001 – Nov., 2005)
18. External Reviewer, Houston Chronicle (October 2004 - March 2005) on series of articles addressing toxic air pollution exposure in Texas.
19. External Reviewer, Tenure and Promotion Committee, Harvard University (March 2006).
20. Reviewer, Health benefits of vehicle emission control, Environmental Law and Policy Center, Chicago, IL, Nov 2005 - Jan. 2006.
21. External Reviewer, Committee on Appointments and Promotions, Johns Hopkins University (Sept. 2007).
22. External Reviewer, Tenure and Promotion Committee, University of California, Davis, CA (Aug. 2008).
23. External Reviewer, Tenure and Promotion Committee, Clarkson University, Potsdam NY (Sept. 2008).
24. External Reviewer, Tenure and Promotion Committee, Ohio State University, Columbus, OH (Jan. 2009).
25. Invited Panelist, US Environmental Protection Agency, Benefits of Reducing Hazardous Air Pollutants Workshop, Washington DC, April 30 – May 1, 2009.
26. External Reviewer, Promotion Committee, Robert Wood Johnson Medical School, Piscataway NJ, August 2009.
27. External Reviewer, Tenure and Promotion Committee, Stanford University, Stanford, CA (Feb. 2010).
28. Member, Board of Directors, Ecology Center, Ann Arbor, MI (June 2010 – June 2013).
29. Member, Board of Directors, Energy Works, Ann Arbor, MI (Jan. 2011 – Jan. 2013).
30. External Reviewer, Tenure and Promotion Committee, Tufts University, Medford, MA (July, 2011).
31. External Reviewer, U.S. Environmental Protection Agency Office of Research and Development, Technical Qualifications Board (July, 2013).
32. External Reviewer, Tenure and Promotion Committee, Drexel University, Philadelphia, PA (Oct. 2014).

12.6.2 State

1. Testimony prepared and delivered to Michigan Department of Natural Resources concerning proposed Carleton Farms waste management facility in Sumpter Township, MI (August 1991).
2. Testimony prepared for United States vs. BASF-Inmont Corp. et al., DJ90-11-3-289, concerning the Remedial Design, Remedial Action Plan, Scope of Work (SOW) and Consent Decree for the Metamora Landfill National Priorities List Site (September 1991).
3. Member (nominated), State Science Advisory Council, State of Michigan (December 1992).
4. Representative, State Site Review Board, Michigan Act 64 Hazardous Waste Act (September 1992-).
5. Technical Advisor, Technical Assistance Grant Program, Metamora Landfill National Priorities List Site, Metamora, MI (1994-8).
6. Participant, Table Top Emergency Incident Planning Exercise, Washtenaw County, MI (September 1995).
7. Expert witness (exposure and risk assessment), NAACP vs. J. Engler, Flint, MI (1996-7).
8. Technical expert (indoor air quality), Michigan Education Association (Feb. – May 1998).
9. Member, Advisory Committee, Air Toxics Project Team, Wayne County Air Pollution Control Agency, Detroit, MI (1998 - 2001).
10. Member, Community Council, Environmental Health of Arab Americans in Metro Detroit, Arab Community Center for Economic and Social Services, Dearborn, MI (2000-).
11. Advisor, Southwest Detroit Environmental Vision, regarding Detroit Intermodal Freight Terminal (Feb – May 2003).
12. Testimony to Michigan Department of Environmental Quality on proposed Ypsilanti Wastewater Incineration facility (March, 2003)
13. Peer reviewer, Michigan Department of Environmental Quality on EIS Guidelines for Toxics (Sept. 2003).
14. Board Member, Community Advisor Panel, CHASS, Detroit, MI (Nov. 2003 -)
15. Reviewer, Michigan Department of Environmental Quality on Detroit Air Toxics Initiative (DATI) Risk Assessment Report (Draft Nov. 2004; Final Nov. 2005).
16. Reviewer, Ozone Attainment Strategy for the Southeast Michigan Region, Southeast Michigan Council of Governments Task Force on Air Quality, April, 2005.
17. Reviewer, Draft Environmental Impact Assessment for the Detroit Intermodal Freight Terminal, July, 2005.
18. Reviewer, Environmental Justice Analysis for Marathon Petroleum Corporation, April 2008.
19. Member, Environmental Justice Resource Group, Department of Environmental Quality, State of Michigan. Jan. 2009-.
20. Reviewer, Draft Environmental Impact Assessment for the Detroit River International Crossing, Jan. 2011.
21. Member, Michigan Department of Environmental Quality, Air Toxics Workgroup, Lansing, MI, 2012-13
22. Panelist, with Moms Clean Air Force, Michigan League of Conservation Votes, MYR, on "Unacceptable Levels", Michigan Theater, Oct 16, 2013.
23. Member, Technical Assistance Group 3, Vapor Intrusion, The Criteria Stakeholder Advisory Group, Michigan Department of Environmental Quality, Lansing MI. June - Oct. 2014.
24. Member, Transportation Coordinating Committee, Southeast Michigan Council of Governments (SEMCOG Metropolitan Planning Organization), Detroit, MI (Sept. 2014-)
25. Panelist, Institute for Journalism and Natural Resource (forum and tour for journalists), Delray House, Detroit, MI, Oct. 23, 2014.

12.6.3 Press Interviews/Articles (partial list)

Interviews/articles with media regarding hazardous waste, and ambient and indoor air quality, including:

1. New York Times, Sept. 1991 (Air Toxics).
2. Sumpter County Dispatch, Oct. 1991 (Landfills).
3. Detroit Free Press, Feb. 18, 1992 (Landfills).
4. Lapeer County Press, May 13, 1992 (Hazardous waste).
5. Lapeer County Press, July 8, 1992 (Hazardous waste).
6. Ypsilanti Press, Sept. 18, 1992 (Hazardous waste).
7. Ann Arbor News, Oct 16, 1992 (Hazardous waste).
8. Detroit Free Press, November 25, 1992 (Fire and air pollution, Mike Williams).
9. Contributor (and subject), "Case Study Course Examines Envotech's Proposed Hazardous Waste Incinerator," Findings Magazine, School of Public Health, University of Michigan, summer, 1993.
10. Air Conditioning News, Oct. 15, 1993; Oct. 25, 1993.
11. Ann Arbor News, Nov. 1, 1993 (Envotech facility and State DNR).
12. Ypsilanti Press, Nov. 30, 1993 (Superfund site cleanup).
13. Scripts News Service, Mar. 29, 1994 (Radon in drinking water).
14. Engineers Digest, Oct. 20, 1995 (Indoor air quality).
15. Flint Journal, Oct. - Nov. 1995 (Waste wood cogenerator).
16. Indoor Air Quality Update - Jan. 1996 (Indoor air quality).
17. The University Record - Dec. 1995 (Campus environmental management program).
18. Dallas Morning News - May 30, 1996 (Hazardous waste incineration).
19. Dallas Morning News/Arlington Morning News Edition - May 31, 1996 (Hazardous waste incineration).
20. Dallas Morning News - June 1, 1996 (Hazardous waste incineration).
21. Dallas/Fort Worth Star - Telegraph May 1996 (Hazardous waste incineration).
22. Cape Town South Africa Daily Argus - Jan. 1997 (AECI sulfur fire and exposure assessment).
23. Cape Town Good Hope Radio - Jan. 1997 (Sulfur fire and community health impacts).
24. Flint Journal, April 1997 (Woodwaste cogenerator).
25. Peninsula Techikon Newspaper, Bellville, South Africa - July 1997 (Air quality and environmental health).
26. Michigan Daily, Nov. 1998 (Landfill gas combustion).
27. Saginaw News, Feb. 1999 (Chemical risks, emergency plans)
28. Traverse Northern Michigan Magazine, July 16, 1999 (Incineration)
29. The Washington Post, Oct. 15, 1999 (Air pollution, environmental policy).
30. WAMC/Northeast Public Radio, Sept. 13, 2000 (NY, NH, etc.) (Health effects of air pollution)
31. Register-Star, Hudson Valley Newspapers, Sept. 14, 2000 (Health effects of air pollution).
32. WNEM-TV, CBS affiliate, Saginaw, MI, April 2000 (Indoor air cleaners and ozone).
33. Register-Star, Hudson Valley Newspapers, NY, May 22, 2001 (Health effects of air pollution).
34. The Mercury, Durban, South Africa, March 1, 2002 ('Pollution levels linked to asthma')
35. The Mercury, Durban, South Africa, November, 2002 ('Air Pollution levels linked to asthma')
36. CourtTV.com, February, 2003 ('Indoor air quality and mold')
37. Findings, UM School of Public Health, Fall/Winter 2003 ('Research Steers South Africa Toward Environmental Change')
38. Environmental Health Perspectives, Health, Environment, Economic Development Project in Durban, Jan. 2004.
39. Ann Arbor News, Ann Arbor, MI ('Homes, Sick Homes, Perhaps'), Jan. 27, 2004.
40. East Coast Radio, Durban, South Africa (2, 'Durban health study, International Federation of Environmental Health Meeting), Feb. 26, 2004.
41. Houston Chronicle, Houston, TX ('Toxic Air - How we did it. Houston Chronicle's methodology in measuring and evaluating regional air quality by Dina Cappiello), March 4, 2005.

42. Houston Chronicle, Houston, TX (‘In Harm's Way. Troubled neighbors’ by Dina Cappiello), March 27, 2005.
43. Houston Chronicle, Houston, TX (‘En El Paso Del Daño - Cómo medimos y evaluamos la calidad del aire’) Miércoles 26 de enero de 2005
44. The Mercury, Durban, South Africa (‘Tackling pollution - Researchers from the University of Natal are hoping to pinpoint links between sickness and the air which people are forced to breathe’ by Tony Carnie, April 2005.
45. Civil & Environmental Engineering University of Michigan Newsletter for Alumni and Friends, Fall 2005. http://cee.engin.umich.edu/pdfFiles/Newsletter%20Fall%2005.pdf (Article on new appointments).
46. Detroit Metro Times, Detroit, MI (Environmental Impacts of the Second International Crossing in Detroit), April 17, 2006.
47. The Mercury, Durban, South Africa (Durban Health Study), Aug. 4, 2006.
48. Mail and Guardian (national paper) South Africa (Durban Health Study), Aug. 4, 2006.
49. Business Reporter, Durban, South Africa (Durban Health Study), Aug. 4, 2006.
50. Los Angeles Times, Los Angeles (Health effects of refineries), Aug. 16, 2006, Nov 5, 2006; Story includes: “Dark cloud over good works of Gates Foundation,” published Jan. 7, 2007.
51. The Dallas Morning News, “State of Neglect: Plant emissions create an air of uncertainty in Midlothian,” January 17, 2009 (Randy Lee Loftis)
52. Spinal Column Newsweekly, Polybrominated diphenyl ethers (PBDEs), January 20, 2009. http://www.spinalcolumnonline.com/publicationreturnframe.lasso?-token.address=http://www.oaklandlakefront.com
53. WDET Radio, Detroit Michigan, (EPA Study on Air Quality, Asthmatics and Roadways, 10 minute interview), July 2, 2009.
54. Free Press, Detroit, MI, July 2009.
55. University of Michigan Record Update - online, June 7, 2010, June 15, 2010
56. Edmonton.Journal.com ("Fort Saskatchewan residents sicker than neighbors: Prof") June 09, 2010
57. Edmonton Journal ("Experts criticize upgrader proposal" by Hanneke Brooymans) June 09, 2010
58. The Globe and Mail ("Delay refinery until health effects are studied, Alberta regulators urged") June 12, 2010.
59. Men's Health Journal ("Air pollution in Cars and Congestion"), May, 2011.
60. Fox 17, Grand Rapids, MI ("Flame retardants in children's items"), June, 2011.
61. WUFT Public Radio, Florida (syndicated state-wide), Public Health Minute with Bill Latimer, "Effects of Roadway Pollution," June 19, 2013.
62. MLIVE, Michigan considers loosening toxic air contaminant regulations, Oct. 14, 2013. http://www.mlive.com/business/index.ssf/2013/10/michigan_toxic_air_contaminant.html
63. University of California, Irvine. Press Release: "UCI-led study documents heavy air pollution in Canadian area with cancer spikes: Carcinogens detected in emissions downwind of ‘Industrial Heartland’", Irvine, Calif., Oct. 22, 2013.
64. University of Michigan, Ann Arbor, MI. Press Release: "U-M School of Public Health, Detroit partners aim to improve air quality in the city." Feb. 18, 2014.
65. Dirksen Senate Office Building, Senate Energy and Public Works Committee; briefing to Senators Barbara Boxer and Sheldon Whitehouse on "Human Health Impacts of Tar Sands Production and Refining," Also briefing to Senate staffers and press (3 events) Feb. 26, 2014.
66. US News and World Reports. Tar Sands Toxicity. Feb. 26, 2014.
67. The Michigan Daily, Ann Arbor, MI. Detroit study to examine effects of bad air quality. Feb. 27, 2014. P.1.
68. Al Jazeera America, New York “Detroit Air Quality, Feb. 27, 2014.
69. Environment News Service. Alberta MD: Canada ‘Lying’ About Tar Sands Health Impacts.” Feb. 27, 2014. Ens-newswire.com/2014/02/27/alerta-md-canada-lying-about-tar-sands-health-impacts/
70. Inside Climate News, April 3, 2013. Toxic Emission Spikes at Fracking Sites Are Rarely Monitored, Study Finds. http://insideclimatenews.org/news/20140403/toxic-emission-spikes-fracking-sites-are-rarely-monitored-study-finds.
71. Scientific American. Fracking Sludge in Open Pits Goes Unmonitored As Health Worries Mount. http://www.scientificamerican.com/article/fracking-sludge-in-open-pits-goes-unmonitored-as-health-worries-mount-video/ Oct. 2, 2014.

72. InsideClimate News. Open Pits Offer Cheap Disposal for Fracking Sludge, but Health Worries Mount, https://icnbooks.creatavist.com/infrackingswake, Oct. 7, 2014.
73. Risk & Insurance Magazine: Market for Occupational Health professions. Feb. 24, 2015.

12.6.4 Local Assistance and Advising (selected)

Pro bono advice to citizens, nonprofit groups, local government, industry, etc., regarding hazardous substances, soil and groundwater, and air quality, including:

1. Indoor air quality, Livingston MI, Oct. 1993.
2. Groundwater contamination from leaking underground storage tank, Oakland, MI July-Dec. 1993.
3. Potential landfill contamination, Carleton Hills, Augusta, MI, 1993-4.
4. Technical Advisory Committee, Metamora National Priority List Superfund Site, Metamora, MI, 1993-.
5. Flint Neighborhood Commission, Waste to Energy Plant, Flint MI, Dec. 1993.
6. Groundwater contamination from abandoned landfill, Ann Arbor MI, Jan. 1994.
7. Lead paint and atmospheric contamination, Ann Arbor MI, Jan. 1994.
8. Passive smoke exposure and indoor air quality, MI State Prisons, Feb., 1994.
9. Environmental equity and waste-to-energy facility, for Susan Law Center for Economic and Social Justice, March-April, 1994-6.
10. Indoor air quality, gasoline exposure, etc., in Flint, MI, 1994-5.
11. Indoor air quality, soil contamination, VOCs in Hartford IL, Illinois Dept. Public Health, Dec. 1995, April, 1996.
12. Soil contamination from landfill at school grounds; Madison Heights, Oakland County, MI, March - April, 1996.
13. Member, advisory committee, Environmental Monitoring for Public Access and Community Tracking Project, Washtenaw Country, MI, 1998.
14. Indoor air quality, University of Michigan, May, 2001.
15. Soil contamination, Beard Elementary School, Detroit, Sept. 2001.
16. Medical waste incineration, Compass Waste Incinerator Site, Groundwork, KwaZulu Natal, South Africa, Jan-April, 2006.
17. Hazard assessment for sulfur storage from oil sands facility, Bruderheim, Alberta, Canada, April 2007.
18. Landfill air quality impacts, Metropolitan Department of Health, Durban, South Africa, July 2007.
19. Gas monitoring, ChemDaq, Pittsburgh, PA, July 2011.
20. Green screen and evaluation of building materials, ICL and Bayer Corp., Pittsburgh, PA. (Dec. 2011).

13 CONSULTING (selected)

1. Technical Expert, Assessment of co-generation facility, Boston Housing Authority, July – August, 1985.
2. Testimony prepared for United States vs. BASF-Inmont Corp. et al., DJ90-11-3-289, concerning the Remedial Design, Remedial Action Plan, Scope of Work (SOW) and Consent Decree for the Metamora Landfill National Priorities List Site. United Citizens of Lapeer County, Metamora, MI (Sept. 1991).
3. Testimony prepared for Michigan Department of Natural Resources on proposed Carleton Farms waste management facility in Sumpter Township, MI. Citizens Environmental Association, New Boston, MI (August 1991).
4. Technical Expert and Oversight, Metamora Landfill Technical Review Committee and the Technical Assistance Grant Committee, Metamora Landfill National Priorities List Site, Metamora, MI (1994 – 1998).
5. Technical Expert and Expert Witness, Flint waste-to-energy combustion facility, Sugar Law Center, Detroit, MI (May 1995).
6. Wastewater Engineer/Public Health Specialist, US Agency for International Development, Washington DC (Egyptian assignment) (July 1995).
7. Technical Expert, review and de novo analysis of the TXI facility in Midlothian, Texas, American Lung Association of Texas (Dec. 1995-April, 1996).

8. Technical Expert, developments and applications of air filter media among compliance monitoring and other monitoring applications in Europe, Gelman Sciences, Inc. (Sept. 1996-June, 1997).
9. Expert Witness, Desai Presidential Commission of Inquiry into the sulphur fire at AECI Somerset West, Western Cape, South Africa, Jan. 29-31, 1997 (Decided May, 1998).
10. Expert Witness, NAACP vs. J. Engler, Genesee County Circuit Court, Flint, Michigan April, 1997. (Decided May 29, 1997).
11. Technical Expert, Caltex, Cape Town, South Africa (July-Aug., 1997).
12. Technical Expert, American Lung Association, Sierra Club (Aug., 1997 – April 1998)
13. Expert Witness, State Office of Administrative Hearings No 582-97-499. TNRCC Docket No. 96-1466-IHW, In the Matter of the Application of TXI Operations, L.P. For Permit No. HW-50316-00001, Dec. 1997-April, 1998.
14. Technical Expert, indoor air quality, Michigan Education Association (March-April, 1998).
15. Technical Expert, indoor air quality, Michigan Education Association (July, 1999).
16. Technical Expert, developments and applications in indoor air sampling including particulate and bioaerosols, Pall Gelman Laboratory, Inc. (August, 1999).
17. Technical Expert, water quality issues related to hydronic heating systems, Ulmer & Lambert LLP (Sept. 1999).
18. Technical Expert, life cycle analysis and environmental impacts, Ames.Alliance.com, Amesaward.com LLC (Aug. 1999, 2000, 2001, 2002, 2003)
19. Technical Expert, indoor air quality, Aircuity Inc. (Aug. 2000).
20. Technical Expert, exposure and health risk assessment, Community - St. Lawrence Cement Forum (Sept. 2000).
21. Technical Expert, indoor air quality, Collins v Damon (October – November, 2000).
22. Technical Expert, indoor air quality, Scheinfeld v Sobel (May, 2001).
23. Technical Expert, air pollution impacts, Camden (NJ) Regional Legal Services, Inc.. (Dec. 2004 - April 2005).
24. Technical Expert, medical waste incineration, World Health Organization, Geneva, Switzerland (Oct. 2003 – Jan. 2004)
25. Expert Witness. South Camden Citizens in Action v. New Jersey Department of Environmental Protection, et al. (April 2005).
26. Expert Witness. Citizens Against Pollution v. American Electric Power Co., Inc. (Jan. 2005 - Sept. 2006).
27. Technical Expert. medical waste incineration and infection control, Mozambique JHPIEGO/Johns Hopkins University and Centers for Disease Control, (Nov. 2006 –July, 2007; October 2008 – March 2009, Feb. 2010-Dec. 2010, July-Aug. 2011).
28. Technical Expert. Air quality impacts (Jan. 2008-April 2008).
29. Technical Expert. Indoor air quality, Environment Canada (Nov. 2008 - 2010)
30. Expert Witness. Sulfur storage and risk assessment, Natural Resources Conservation Board, Friends of Lamont County, Alberta, Canada (Jan. 2009 – April 2009).
31. Expert Witness. Upgrader/refinery exposure, health risk assessment, Natural Resources Conservation Board, Alberta, Canada (Jan. 2010 – June 2010).
32. Expert Witness. Sour gas well and pipeline exposure and risk assessment, Energy Resources and Conservation Board, Alberta, Canada (Sept. 2010 – Dec. 2010).
33. Technical Expert. Medical waste incineration and infection control, Rwanda, JHPIEGO/Johns Hopkins University and Centers for Disease Control (Aug. 2011, March - July 2013).
34. Technical Expert/Expert Witness. Gravity assisted oils sands extraction, Energy Resources and Conservation Board, Alberta, Canada (July - Dec. 2011).
35. Technical Expert. Exposure, toxicology and risks of hydrogen sulfide. Sierra Club, Washington DC (Dec. 2011 – Aug. 2012).
36. Technical Expert. Indoor environmental quality, Coyne Public Relations (Feb. 2012)
37. Technical Expert. Hydrocarbon/vapor nuisance, Manistee, Michigan (Oct. 2012).
38. Technical Expert/Expert Witness. Simon Properties Group et al. v. Aon Risk Services Central, Inc., Health risk assessment (Feb. 2012 -).

39. Technical Expert. Methanol emissions and impacts on mold and health (March. 2013)
40. Consultant. The House Dust Fungal Microbiome – Influences and Effects, Sloan Foundation Grant, Susan Lynch, PI, University of Southern California. (Oct. 2013-)
41. Technical Expert. Petroleum coke storage and health impacts. National Resource Defense Council. Sept. 2013 - March, 2014.
42. Technical Expert. Kinder Morgan TransMountain Expansion Pipeline application, Living Oceans Society. Jan. – May, 2014.

14 RESEARCH AND TRAINING FUNDING HISTORY

14.1 Awarded Research Grants and Contracts: External

1. Synthetic Fuels Corporation, Ambient Monitoring near Synfuel Plants, S. Batterman (Consultant), $50,000 (total costs), 6/20/84 - 6/19/85.
2. Environmental Protection Agency, Assessment of Air Quality Models and Their Applications, S. Batterman (Consultant) $300,000 (total costs), 9/20/84 - 9/20/86.
3. Nordic Council of Ministers, Natl. Environment Protection Board, Solna, Sweden, Cost-Effectiveness Analysis of Emission Control Policies in Europe, S. Batterman (CoInv), 150,000 D. Krone (total costs), 7/1/87 - 8/26/87.
4. McDonald Douglas Astronautics Co., Assessment of Fate of Particles and Gases Released from a Manned Space Station, S. Batterman (CoInv), $60,000 (total costs), 3/1/87 - 12/31/88.
5. Texas Water Resources Institute, Water Demand Management Using Real-Time Automatic Decentralized Control, S. Batterman (PI), $15,000 (direct costs), 3/3/87 - 12/31/88.
6. Houston Area Research Council, Evaluating In Situ Treatment Processes for Hazardous Waste, S. Batterman (PI), $12,000 (direct costs of computer access grant), 6/2/87 - 12/31/88.
7. Environmental Protection Agency, Variability of Soil and Street Dust in the Philadelphia Area, S. Batterman (PI), $1,000 (direct costs), 9/1/87 - 12/31/87.
8. Gulf Coast Hazardous Substances Research Center, Soil/Air Fluxes of Hazardous Substances at Treatment, Storage and Disposal Facilities: Models and Measurements, S. Batterman (PI), $50,000 (direct costs), 2/1/88 - 8/30/90.
9. NSF, "Modeling and Estimation of Contaminant Soil/Air Fluxes," S. Batterman (PI), $59,923 (total costs), 6/30/88 - 6/30/90.
10. Advanced Technology Program, Texas Coordinating Board, Synthesis of Hydraulic and Pneumatic Controls for Hazardous Site Remediation, S. Batterman (PI), $383,000 (direct costs), 6/1/88 - 9/1/89.
11. Advanced Technology Program: Texas Coordinating Board, Hazardous Airborne Contaminants: Sampling, Assessment and Control, S. Batterman (PI), $130,010 (direct costs), 6/1/88 - 9/1/89.
12. US EPA, Soil/Air Fluxes of Hazardous Substances at Treatment, Storage and Disposal Facilities: Models and Treatment, S. Batterman (PI), $59,975 (total costs), 5/30/89 - 6/1/90.
13. US EPA, Transport of Organic Contaminants in Soils: Vapor Sorption/Desorption Processes, S. Batterman (PI), $35,000 (total costs), 1/1/90 - 3/31/90.
14. US EPA, Soil/Air Fluxes of Hazardous Substances at Treatment, Storage and Disposal Facilities: Models and Treatment, S. Batterman (PI), $62,017 (total costs), 3/1/90 - 11/31/91.
15. Johnson's Corp., Investigation of Fungal Volatiles, S. Batterman (CoInv), $30,000 (total costs), 9/1/90 - 9/1/92.
16. US Department of Energy, Assessment of Subsurface VOCs Using a Chemical Microsensor Array, S. Batterman (PI), $223,351 (total costs), 10/1/90 - 6/31/92.
17. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Pollution Sources in Heating, Ventilating, and Air-conditioning (HVAC) Systems: Phase 1. Identification and Quantification of Sources, S. Batterman (PI), $173,053 (total costs), 9/1/92 - 5/31/95.
18. US Department of Energy, Measurements of Vadose Zone Transport Properties, S. Batterman (PI), $95,964 (total costs), 2/1/93 - 1/30/95.
19. NIOSH, "Biological Monitoring of Methanol Exposures," $432,000 (total costs), S. Batterman (CoInv), 1/1/93 - 6/31/95.
20. Department of Agriculture, National Particle Board Association, Emission of VOCs from Wood Composites, S. Batterman (PI), $32,500 (direct), 3/15/94 - 12/31/95.

21. US EPA, "Biodegradation, Kinetics, Oxygen Transfer and Bioavailability in Bioventing and Related Technologies," S. Batterman (CoInv), $300,000 (direct costs), 5/1/94 - 4/30/95.
22. Gelman Sciences, Investigation of Air Filter Characteristics, $18,000, S. Batterman (PI), 9/1/95-6/1/96.
23. Finnish Academy of Sciences, Support for Visiting Professorship, $20,000, S. Batterman (PI), 6/1/96-12/31/96.
24. US EPA, Evaluation of the Efficacy of a New Secondary Disinfectant Formulation Using Hydrogen Peroxide and Silver and the Formulation of Disinfection By-Products Resulting From Interactions With Conventional Disinfectants, S. Batterman (PI), $594,346 total, $470,708 direct, 5/1/97 - 5/30/01.
25. US EPA, "Longitudinal Studies of Indoor Air Quality in Office Buildings," $430,000, S. Batterman (PI), 6/1/97 - 5/30/01.
26. Michigan Small Business Research Program, Continuous Monitoring of Volatile Organic Compounds (VOCs) Affecting Indoor Air Quality in Laboratory and Industrial Environments, S. Batterman (Co-Inv), $100,000 ($15,000 subcontract to UM), 8/12/96 - 5/12/97. Grant No. 801P6001063.
27. Fogarty Foundation/US Dept. Of Health and Human Services, International Training and Research in Environmental and Occupational Health, T. Robins (PI), S. Batterman (consultant), 9/1/96-8/31/01, $865,000.
28. NSF, Use of High Speed Gas Chromatography to Monitor Microbial VOCs, S. Batterman (Co-Inv), $75,000, ($27,000 subcontract to UM), 2/15/97-9/15/97.
29. Foundation for Research Development (Pretoria, South Africa), Cape Air Quality Project, E. Cairncross (PI), S. Batterman (Team member), R42,000 (US ~$10,000) 1/1/97-1/1/98.
30. Center for Indoor Air Research (Batterman), Gas Phase Filtration for VOC and Oxidant Removal: Laboratory and Field Assessment, S. Batterman (PI), 8%, $381,985, 9/1/99 - 8/30/01.
31. US Agency for International Development, Faculty, Curriculum and Research Development Related to Cleaner Production Technologies and Advanced and Smart Materials: A Tertiary Education Linkage Project Between The University of Michigan and The Peninsula Technikon, S. Batterman (PI), South Africa, 8%, $460,000, 6/1/99 – 5/30/03.
32. MyIndoorAir, Inc. Analysis and Presentation of IAQ Monitoring Data, S. Batterman (PI), $2,500, 9/1/00-5/1/01.
33. Precision Air, Indoor Air Quality in the Work Environment, S. Batterman (PI), $10,290, 12/1/00 – 12/31/01.
34. Durban Metro Council (South Africa), "Air Contaminant Exposures, Acute Symptoms and Disease Aggravation Among Learners and Teachers at The Settlers School in South Durban," T. Robins (PI), S. Batterman (Co-PI), 200,000 R (approximately $30,000) plus numerous in-kind contributions, 2/1/2001 – 12/31/01.
35. NIOSH RO1, "Microanalytical system for indoor VOC monitoring, E. Zellers (PI), S. Batterman (Co-Inv), $782,546 (total), $550,000 (direct), 4/1/02 – 3/31/05.
36. NSF, Sustainable Infrastructure Materials and Systems: Integration of microstructure tailoring and life cycle analysis of engineered cementitious composites (ECC). G Keolian (PI), S. Batterman (Co-Inv). $106,000 (NSF), $156,036 (total), 9/1/02 – 8/31/03.
37. CDC, "Ambient Air Pollution and Adverse Birth Outcomes: A Linked Analysis: Linking Chronic Disease and Environmental Data Sources," R.Wahl (PI), Batterman directs UM subcontract, 10/1/02 – 9/30/05, $165,000 (approximately)
38. NIOSH, "Indoor Air Quality in Public Schools: An Assessment of Exposures and Symptoms of Teachers", S. Batterman (PI), A. Franzblau (Co-PI), $33,000 (direct), 12/1/02 – 6/30/03.
39. American Chemistry Council "Understanding Exposure to Volatile Organic Air Toxics", S. Batterman (PI), $899,385, 6/1/03 – 5/30/06.
40. NSF, Sustainable Infrastucture Materials and Systems: Integration of Microstructure Tailoring and Life Cycle Analysis of Engineered Cementitious Composites, G. Keoliean (PI), S. Batterman (Co-Inv). $2,000,000, 9/1/03 – 8/30/08.
41. NIH R21, "Health, Pollution & Economic Development in South Durban," S. Batterman (PI), $266,083 total, 7/1/03 – 6/30/05.
42. Durban Metro Council, "The Health Status And Risk Factors Associated With Adverse Health Outcomes Among The Durban South Community Durban Metro, South Africa," R. Naidoo (PI), S. Batterman (Co-PI) 6/1/03 – 5/30-05, $800,000 (direct).

43. US EPA (Mickey Leland National Urban Air Toxics Research Center), "Impact of Exposure to Urban Air Toxics on Asthma Utilization for the Pediatric Medicaid Population in Dearborn, Michigan," B. Wahl (PI of Michigan Department of Community Health portion), S. Batterman (PI – Michigan portion), 1/1/05-12/31/06, $200,000.
44. US EPA (Great Lakes National Program Office), "Emissions of PBDEs from Urban Sources in the Great Lakes Region," S. Batterman (PI), 10/1/05 – 9/30/07, $79,988.
45. US EPA (STAR), "Emissions of Brominated Flame Retardants (BFRs) from Industrial and Commercial Sources in the Great Lakes Region," S. Batterman (PI), 5/1/06-5/31/08, $117,685.
46. US Civilian Research and Development Foundation, "Sources, Transport and Impacts of PBDEs In The Russian Arctic," S. Batterman (PI), $49,150, 5/1/06 – 9/30/08
47. US EPA (Mickey Leland National Urban Air Toxics Research Center), "Distribution and Determinants of VOCs", S. Batterman (PI), 11/1/06-10/30/07, $50,000.
48. NIEHS RO1, "A Community Based Participatory Research Intervention for Childhood Asthma Using Air Filters and Air Conditioners," E. Parker (PI), S. Batterman (Co-Inv), 7/1/07-6/30/12, $2,000,000 (direct).
49. NIEHS RO1, "Role of Diesel and Other Vehicular Exhaust in Exacerbation of Childhood Asthma," T. Robins (PI), S. Batterman (Co-Inv), 9/1/07-8/30/12, $2,900,000 (direct).
50. US EPA (STAR) The Detroit Asthma Morbidity, Air Quality and Traffic (DAMAT) Study, B. Wahl (PI), S. Batterman (PI UM Portion), 9/1/07-8/31/10, $750,000.
51. NIEHS RO1, "Mechanisms of Inflammation in Gestational Membranes, 7/1/08 – 6/30/13, R. Loch-Carruso (PI), S. Batterman (Co-Inv), $1,500,000.
52. US EPA Cooperative Agreement, "Childhood Health Effects from Roadway and Urban Pollutant Burden Study" Health Effects of Near-Roadway Exposures to Air Pollution, EPA-G2008-STAR-B1, S. Batterman (PI), 10/1/08-9/31/11, $1,400,000 plus EPA in-kind contribution plus $70,000 supplement.
53. Health Canada, "Critical review of the sources and exposure levels of benzene, toluene, xylene and naphthalene relevant to Canadian residential indoor environments," S. Batterman (PI), 11/1/08-5/30/09, $25,000.
54. HEI, "Modeling and analysis of personal exposure to pollutant mixtures: Further analysis of the RIOPA data," Health Effects Institute. 2009-2011. S. Batterman, PI, 2010-2012. $162,000.
55. NIEHS RO1, "Interactions of Diesel Exhaust and Respiratory Viruses on Asthmatic Children," T. Lewis, PI, S. Batterman (Co-Inv), 2010-2015. $3,200,000 (total).
56. US EPA, "Nitro-PAHs & diesel exhaust toxins in the Great Lakes. Great Lakes Restoration Initiative, S. Batterman, PI, 2010-2012. $288,828.
57. NIEHS P30, "Core Center in Environmental Health - Lifestage Exposures and Adult Disease", H. Hu (PI), S. Batterman (Co-Inv). 7/1/11 – 6/30/15, $2,400,000 (direct).
58. FCT, "Indoor Environment and Health Related Quality of Life in Elderly Assisted Living Residences," A. Mendes (PI) Financiamento do Fundo Social Europeu e de fundos nacionais do MCTES. Grant from FCT to University of Porto (Portugal), including field work, 6 months of study at University of Michigan for a doctoral student.
59. Fulbright Scholar Award, In Public/Global Health at the University of Coimbra, Coimbra, Portugal. April 2011.
60. HEI, "Enhancing Models and Measurements of Traffic-Related Air Pollutants for Health Studies using Bayesian Melding" Health Effects Institute. 2014-16. S. Batterman, PI, $650,177.
61. NIEHS, "Community Action to Promote Healthy Environments". Batterman, Schultz (Co-PIs), 1/1/14 – 12/31/19, $2,300,000 (direct).
62. US EPA, "Environmental Quality, Health and Learning in Conventional and High Performance School Buildings," S. Batterman (PI), 10/1/14 - 12/31/17, $1,000,000

14.2 Awarded Training Grants and Scholarships: External

63. National Institute for Occupational Safety and Health, Hazardous Substance Academic Training Program in Educational Resource Centers, Competitive Award, S. Batterman (PI), $181,000 recommended for 2/1/93 - 6/30/95, $42,000 awarded for 2/93 – 6/30/94.
64. National Institute for Occupational Safety and Health, Hazardous Substance Academic Training Program in Educational Resource Centers, Annual Renewal, S. Batterman (PI), $58,940, 6/30/94 – 7/1/95.
65. Air and Waste Management Association Scholarship Award for Jonathan Greene, Nov. 1994, $1,500.

66. American Society of Heating, Refrigeration and Ventilation Engineering Scholarship Award for Marianna Luoma, March, 1995, $1,500.
67. National Institute for Occupational Safety and Health, Hazardous Substance Academic Training Program in Educational Resource Centers, Annual Renewal, S. Batterman (PI), $60,156, 6/30/95 – 7/1/96.
68. National Institute for Occupational Safety and Health, Hazardous Substance Academic Training Program in Educational Resource Centers, Annual Renewal, S. Batterman (PI), $60,904, 6/30/96- 7/1/97.
69. National Institute for Occupational Safety and Health, Hazardous Substance Academic Training Program in Educational Resource Centers, Four-year Competitive Renewal, S. Batterman (PI), $271,000 recommended for 6/30/97 - 7/1/2001, $58,904 awarded for 6/30/97- 7/1/98.
70. National Institute for Occupational Safety and Health, Hazardous Substance Academic Training Program in Educational Resource Centers, Annual Renewal, S. Batterman (PI), $61,000 (total costs), 6/30/98- 7/1/99.
71. National Institute for Occupational Safety and Health, Hazardous Substance Academic Training Program in Educational Resource Centers, Annual Renewal, S. Batterman (PI), $57,200 (total costs), 6/30/99- 7/1/00.
72. National Institute for Occupational Safety and Health, Hazardous Substance Academic Training Program in Educational Resource Centers, Annual Renewal, S. Batterman (PI), $59,434 (total costs), 6/30/00- 7/1/01.
73. National Institute for Occupational Safety and Health, Hazardous Substance Academic Training Program in Educational Resource Centers, Competitive Renewal, S. Batterman (PI), $493,693 recommended for 6/30/01-7/1/05, $76,500 awarded for 6/30/01-7/1/02.
74. National Institute for Occupational Safety and Health, Hazardous Substance Academic Training Program in Educational Resource Centers, Annual Renewal, S. Batterman (PI), $78,000 (total costs), 6/30/02-7/1/03.
75. National Institute for Occupational Safety and Health, Hazardous Substance Academic Training Program in Educational Resource Centers, Annual Renewal, S. Batterman (PI), $78,000 (total costs), 6/30/03-7/1/04.
76. National Institute for Occupational Safety and Health, Hazardous Substance Academic Training Program in Educational Resource Centers, Annual Renewal, S. Batterman (PI), $78,000 (total costs), 6/30/04-7/1/05.
77. National Institute for Occupational Safety and Health, Hazardous Substance Academic Training Program in Educational Resource Centers, Competitive Renewal, S. Batterman (PI), $450,000 recommended for 6/30/05-7/1/08, $72,500 awarded for 6/30/05-7/1/06.
78. National Institute for Occupational Safety and Health, Hazardous Substance Academic Training Program in Educational Resource Centers, Competitive Renewal, S. Batterman (PI), $450,000 recommended for 6/30/05-7/1/08, $72,500 awarded for 6/30/05-7/1/06.
79. Michigan Education Resource Center, National Institute for Occupational Safety and Health, Pilot Project, Post-doctoral training for S. Charles, S. Batterman (PI), $20,000 6/30/06- 7/1/07.
80. Michigan Education Resource Center, National Institute for Occupational Safety and Health, Pilot Project, Post-doctoral training for Jo-Yu Chin,
81. S. Batterman (PI), $20,000 6/30/08- 7/1/09. Michigan Education Resource Center, National Institute for Occupational Safety and Health, Pilot Project, Post-doctoral training for Feng Su, S. Batterman (PI), $20,000 6/30/09- 7/1/10.
82. S. Batterman (PI), $1,640,000 6/30/10- 7/1/11. Michigan Center for Occupational Health and Safety Engineering Education Resource Center, National Institute for Occupational Safety and Health.
83. S. Batterman (PI), $1,640,000 6/30/11- 7/1/12. Michigan Center for Occupational Health and Safety Engineering Education Resource Center, National Institute for Occupational Safety and Health.
84. S. Batterman (PI), $1,640,000 6/30/10- 7/1/11. Michigan Center for Occupational Health and Safety Engineering Education Resource Center, National Institute for Occupational Safety and Health.
85. S. Batterman (PI), $1,540,000 6/30/12- 7/1/13. Michigan Center for Occupational Health and Safety Engineering Education Resource Center, National Institute for Occupational Safety and Health.
86. Michigan Bloodspot Environmental Epidemiology Project, Program Round 1, ""Investigation and assessment of the use of blood spots for retrospective exposure estimation of persistent organic contaminants, including chlorinated and brominated compounds, in human blood." S. Batterman, PI, $25,000, 2013-4. The overall goals of the proposed project are to refine the analytical approaches used to measure retrospective exposures of persistent organic pollutants (POPs) from archived newborn dried blood spots (DBS), and to ensure that methods are valid and meet quality assurance goals.

87. Michigan Bloodspot Environmental Epidemiology Project, Program Round 2, "Advanced Methods for Analysis of Persistent Organic Pollutants in Dried Blood Spots." S. Batterman, PI, $25,000, 2014-5. The overall goals of the proposed project are to refine the analytical approaches used to measure retrospective exposures of persistent organic pollutants (POPs) from archived newborn dried blood spots (DBS), and to ensure that methods are valid and meet quality assurance goals.
88. NIOSH Educational and Research Center, Dried Blood Spot (DBS) Sampling for Biomonitoring in Occupational Settings." S. Batterman, PI, $20,000, 7/12/14 – 6/30/15. This pilot project has four specific aims: (1) measurement of BFR levels in blood of workers from electronics/foam recycling facilities; (2) comparison of measurements using DBS and conventional venous blood samples; (3) comparison of BFR levels among waste/recycling workers to those of the general public; and (4) investigation of barriers and opportunities of using DBSs in occupational settings.

14.3 Awarded Grants and Contracts: Internal (all direct costs):

89. Research Incentive Fund, Texas A&M University, Professional Development in Hazardous and Solid Waste Modeling and Assessment, S. Batterman (PI), $2,340 (direct costs), 6/11/87.
90. Excellence Program, Texas A&M University, Intermedia Transport and Fate of Hazardous Substances, S. Batterman (PI), $67,000, 3/1/87 - 3/1/88.
91. Center for Teaching Excellence, Texas A&M University, Incentive Grant: Case Study of Hazardous Waste Facility Siting, S. Batterman (PI), $1,000, 4/15/87.
92. International Enhancement Grants Program, Texas A&M University, Analysis of Optimal Emission Abatement Strategies, S. Batterman (PI), $700, 9/22/87.
93. Department of Civil Engineering, Texas A&M University, Funds for Gas Chromatograph/Mass Spectrometer, S. Batterman (PI), $2,500, 10/31/88.
94. School of Public Health, University of Michigan, Laboratory Equipment Funds, S. Batterman (PI), $78,000, 9/1/89.
95. Interdisciplinary Grant Program, Office of Vice President for Research, University of Michigan, Deposition and Flux Measurements of Hydrocarbons Using Fast Response Analyzers, S. Batterman (PI), $30,000, 11/1/89 - 5/1/90.
96. School of Public Health, University of Michigan, Repair Funds for Gas Chromatograph/Mass Spectrometer, S. Batterman (PI), $8,000, 12/2/91.
97. Rackham Faculty Grant, University of Michigan, Assessment and Apportionment of Urban Toxics, S. Batterman (PI), $9,968, 5/1/92 - 4/30/95.
98. International Institute, University of Michigan, Fund for Conferences And Workshops, Workshop and Course on Air Quality Modeling, Monitoring and Control in South Africa, S. Batterman (PI), $1,850, 6/1/97-8/1/97.
99. Rackham Distinguished Faculty and Graduate Student Seminar Program, University of Michigan, Environmental Justice - Law and Science, S. Batterman (PI), $7,500, 4/25/97-5/17/99.
100. Office of the Vice President for Research and Development, University of Michigan, "Core Research Facilities and Equipment Grant," S. Batterman (PI), $100,000, 9/10/98.
101. University of Michigan Office of the Vice President for Research, "Water Disinfection By-products in Breast Milk of Nursing Mothers," A. Franzblau (PI), S. Batterman (Co-PI), 5/1/02 – 4/30/03. $18,444.
102. University of Michigan Office of the Vice President for Research, "Distribution and Effects of Emerging Contaminants on Great Lakes Ecosystem Health," S. Batterman (PI), 9/1/04 – 8/30/05. $56,183.
103. University of Michigan Tobacco Research Network, "Post Doctoral Training in Exposure Assessment & Environmental Health: Quantifying and Reducing Exposures to Environmental Tobacco Smoke," 9/1/05 – 8/30/07, $79,919.
104. Graham Environmental Sustainability Institute, "Sustainable Control of Water-Associated Diseases – A Systems Approach," S. Batterman, PI, $5,000, 2/1/08-12/31/08.
105. Graham Environmental Sustainability Institute, "Climate-induced shifts in distributions and environmental health risks of pesticides and other persistent organic pollutants in Arctic ecosystems," S. Batterman, PI, $20,000. 1/1/11 – 12/31/11.
106. Graham Environmental Sustainability Institute, "Regional, Spatial and Temporal Mapping of Air Pollution In Detroit", S. Batterman, PI, $40,000, 4/1/11-3/31/13.

107. University of Michigan, M-Cubed Project. "Environment and epigenetics in ALS." Feldman (PI), B. Callaghan (Co-Inv), S. Batterman (Co-Inv), $50,000, 6/1/13-5/30/14.