

Statements in Support of Petition for Rulemaking

Statement	Exhibit (w/ Hyperlink)
Statement of Terrence J. Collins	Exhibit A
Statement of Miriam L. Diamond	Exhibit B
Statement of David A. Eastmond	Exhibit C
Statement of David Epel	Exhibit D
Statement of Rolf Halden.....	Exhibit E
Statement of Kim Harley	Exhibit F
Statement of Julie Herbstman	Exhibit G
Statement of Susan Kasper	Exhibit H
Statement of Donald Lucas	Exhibit I
Statement of Sharyle Patton.....	Exhibit J
Statement of Ruthann Rudel	Exhibit K
Statement of Ted Schettler	Exhibit L
Statement of Roland Weber	Exhibit M

Exhibit A

Statement of Terrence J. Collins



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September 12, 2013

I, the undersigned, am writing this statement in support of the Petition to the CPSC to regulate four categories of household products containing non-polymeric additive organohalogen flame retardants.

1. I, Terrence James Collins, am the Teresa Heinz Professor of Green Chemistry in the Department of Chemistry, and the Director of the Institute for Green Science at the Carnegie Mellon University.

My collaboration with environmental health scientists (EHS) has focused on developing appropriate tests to identify chemical properties that give rise to adverse human health effects at low doses through endocrine disruption. Our work has aimed to underpin the development of safe chemicals in general, including safe alternatives to organohalogen chemicals. I have attached a copy of my curriculum vitae and a list of my publications.

In a privately funded collaborative effort spanning five years, my EHS colleagues and I produced and published the Tiered Protocol for Endocrine Disruption (TiPED). This allows green chemists, for the first time, to design with state of the art scientific authority against endocrine disruptors. I am best known for inventing the first small molecule mimics of any of the great families of oxidizing enzymes. My TAML[®] activators are extensively patented and have been commercialized so I am a friend to the commercial development of chemicals. TAML[®] activators were TiPED tested in design to ensure no new endocrine disruptor would be commercially produced and those in development have passed all assays as not being endocrine active thus far.

2. Organohalogens used as flame retardants as a class have specific chemical properties that give them a high potential for causing adverse human health effects via multiple mechanisms. Organohalogens tend to bioaccumulate in human and animal tissues. This occurs because halogens, particularly bromine and chlorine, which are broadly used in flame retardants, often cause the organic chemicals to which they are attached to partition from environmental media (particularly water) into living tissues, where they bioaccumulate. This bioaccumulation is driven by the differential solubility of chemicals in fats, oils, lipids (such as what cell walls are made of) and other similar solvents compared with water and aqueous-like media. As organohalogens tend to be more lipophilic (fat-loving) than their non-halogenated analogues, they will bioaccumulate more readily.

3. Depending on the structure of the organic parent compound, the addition of halogen elements can either increase or decrease the compound's reactivity. Either change can impact the compound's toxicological profile leading to an increased risk of adverse health effects in humans. For alkylorganohalogens (such as most chlorinated organophosphate flame retardants), halogens tend to increase reactivity toward the chemical modification of key biomolecules, including DNA and the histone proteins around which DNA is wrapped. These modifications are likely to interfere with gene expression and to increase the likelihood of cancer. For

arylhydrocarbons (carbon ring-like structures with halogens appended, such as most brominated flame retardants), halogens tend to decrease reactivity, impeding the cell's ability to enzymatically break down the arylhydrocarbons thus increasing their lifetime in the cell.

4. Some organohalogen flame retardants are known to be potent endocrine disruptors, so their bioaccumulation leads to additional likelihood of harm to organisms via developmental damage associated with disruption of the endocrine hormone control of cellular development. Arylhydrocarbon organohalogens can mimic natural hormones that at very low concentrations regulate expression of proteins involved in cellular development. This developmental disruption, which appears to occur via disruption of hormone action, is a major cause of human health harm. The adverse health effects are often manifested at very low concentrations (in the range to which people are exposed) and can disrupt development starting *in utero*. Endocrine disruptors can activate gene expression resulting in abnormally high protein production (agonist), or suppress gene expression resulting in abnormal protein deprivation (antagonist). This disruption of the normal expression of control proteins can lead to cells that do not develop and multiply, are less healthy, have altered fates, and are more likely to develop cancer later in the life of the organism. This is one mechanism by which arylhydrocarbon organohalogens such as dioxins function to produce birth defects and cancer. In my professional opinion, such adverse effects should also be anticipated for arylhydrocarbon organohalogen flame retardants.

5. Organohalogen flame retardants can also disrupt DNA function. Arylhydrocarbon organohalogen flame retardants share chemical similarities with compounds that are known to stick to DNA by inserting into the DNA base pair structures. This intercalation can alter the normal function of DNA and can serve as a mechanism for initiating carcinogenesis.

6. When they burn, organohalogen flame retardants produce halogenated dioxins and furans, which are extremely persistent and extremely toxic to humans. This fundamental and thus far inescapable factor in the full life cycle of the entire class of organohalogen flame retardants is a large cause of harm to human health currently and out into the distant future.

7. To summarize, organohalogen flame retardants have highly persistent and toxic combustion by-products, readily bioaccumulate and can resist breakdown inside cells, can modify the DNA or disrupt its function, and can act as endocrine disruptors. To the best of my knowledge, there is no sound evidence showing a lack of health harm for any organohalogen flame retardants studied to date.

8. Based on the above arguments, I would urge the Consumer Product Safety Commission to regulate the use in consumer products of the entire class of non-polymeric additive organohalogen flame retardant chemicals.

Yours sincerely,

A handwritten signature in blue ink, appearing to read "T. J. Leath". The signature is fluid and cursive, with a long horizontal stroke at the end.

Biographical Sketch of Terrence J. Collins

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EDUCATION

University of Auckland, New Zealand

Bachelor of Science—1974

Master of Science with First Class Honors—1975

Doctor of Philosophy—1978

Advisor: Professor Warren R. Roper, FRS

Ph.D. Thesis: Thiocarbonyl Complexes of Ruthenium and Osmium.

Stanford University

Postdoctoral, with Professor James P. Collman—1978–1980

PROFESSIONAL EXPERIENCE

Carnegie Mellon University

Teresa Heinz Professor of Green Chemistry, 2010–present

Director, Institute for Green Science, 2008–present

Thomas Lord Professor of Chemistry, 2001–2010

Director, Institute for Green Oxidation Chemistry, 2001–2007

Professor of Chemistry, 1993–2001

Associate Professor of Chemistry, 1988–1992

California Institute of Technology

Assistant Professor of Chemistry, 1981–1987

Auckland Technical Institute

Lecturer (part-time), 1974–1977

PRIZES, AWARDS AND DISTINCTIONS

2013 – Fellow of the American Chemical Society

2011 – Chairman, Science Advisory Council, The Heinz Center

2011 – Trustee, The Heinz Center, Washington, DC (6-yr appointment)

2010 – Heinz Award for the Environment

2008 – Honorary Fellow of the Royal Society of New Zealand

2008 – Charles E. Kaufman Award of the Pittsburgh Foundation

2007 – Award of the New York Metropolitan Catalysis Society

2007 – Distinguished Alumnus Award, University of Auckland, New Zealand

2006 – Fellow of the International Union of Pure and Applied Chemists

2004 – Pittsburgh Award of the American Chemical Society

2004 – Award of the Baylor University ACS Students Affiliates for Outstanding Achievements in Green chemistry

2002 – Golden Goggles Award, Middle Tennessee State University

2001 – Honorary Professor, University of Auckland, 2001–present

1999 – Presidential Green Chemistry Challenge Award (1998)

1998 – Award of the Japanese Society of Pure and Applied Coordination Chemistry (1997) for leadership research in green chemistry.

1998 – Visiting Professor, Graduate School of Science, Osaka-City University

1996 – Distinguished Visiting Professor, University of Auckland

1986 – Alfred P. Sloan Research Fellow to 1988

1985 – Camille and Henry Dreyfus Teacher-Scholar to 1990

1982 – Occidental Research Corporation (Junior Faculty Award)

1977 – Lindsay Heathcote Briggs Memorial Prize (Best Ph.D. Thesis in Chemistry)

1975 – Postgraduate Scholarship in Chemistry

1973 – Senior Prize in Chemistry

RESEARCH INTERESTS

- Green chemistry
- Inorganic chemistry
- Homogeneous oxidation catalysis
- Design of green oxidants
- Alternative chemistry for oxidation processes that produce persistent pollutants
- Removing endocrine disrupting chemicals from technology
- Bioinorganic chemistry of high oxidation state transition metal species
- Toxicity and ecotoxicity of chemical processes and products
- Preparation of multinuclear transition metal ions with predetermined magnetic exchange coupling properties

PUBLICATIONS

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4. Munmun Ghosh, Kundan K. Singh, Chakadola Panda, Andrew Weitz, Michael P. Hendrich, Terrence J. Collins, Basab B. Dhar, and Sayam Sen Gupta Formation of a Room Temperature Stable Fe^V(O) Complex: Reactivity Toward Unactivated C–H Bonds, *J. Am. Chem. Soc.*, **2014**, Article ASAP, DOI: 10.1021/ja412537m
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6. C–H Bond Activation of Hydrocarbons by an Fe^VO(TAML) Complex. Assessment of the Nuclear Tunneling Contribution to the Hydrogen Atom Transfer Kinetics, Soumen Kundu, Longzhu Q. Shen, Jasper Van Kirk Thompson, Emile L. Bominaar, Alexander D. Ryabov, and Terrence J. Collins, submitted to *J. Am. Chem. Soc.*
7. Systematic leadership towards sustainability, Göran Broman, Karl-Henrik Robèrt, George Basile, Tobias Larsson, Rupert Baumgartner, Terry Collins, Donald Huisingh, *J. Cleaner Production* **2013**, <http://dx.doi.org/10.1016/j.jclepro.2013.07.019>
8. Zebrafish Assays as Developmental Toxicity Indicators in the Green Design of TAML Oxidation Catalysts, Lisa Truong, Matthew A. DeNardo, Soumen Kundu, Terrence J. Collins, and Robert L. Tanguay, *Green Chem.*, **2013**, 15, 2339–2343 DOI:10.1039/C3GC40376A
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10. TAML Activator /Peroxide Catalyzed Facile Oxidative Degradation of the Persistent Explosives Trinitrotoluene and Trinitrobenzene in Micellar Solutions, Soumen Kundu, Arani Chanda, Sushil K. Khetan, Alexander D. Ryabov, and Terrence J. Collins, *Environ. Sci. Technol.*, **2013**, 47 (10), 5319–5326, DOI: 10.1021/es4000627
11. Designing endocrine disruption out of the next generation of chemicals, T. T. Schug, R. Abagyan, B. Blumberg, T. J. Collins, D. Crews, P. L. DeFur, S. M. Dickerson, T. M. Edwards, A. C. Gore, L. J. Guillette, T. Hayes, J. J. Heindel, A. Moores, H. B. Patisaul, T. L. Tal, K. A. Thayer, L. N. Vandenberg, J. C. Warner, C. S. Watson, F. S. vom Saal, R. T. Zoeller, K. P. O’Brien, and J. P. Myers, *Green Chem.*, **2013**, 15, 181-19, DOI: 10.1039/c2gc35055

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14. Facile Destruction of Formulated Chlorpyrifos through Green Oxidation Catalysis, Soumen Kundu, Arani Chanda, Leticia Espinosa-Marvan, Sushil K. Khetan and Terrence J. Collins, *Catalysis Science and Technology*, **2012**, *2*, 1165-1172, DOI: 10.1039/C2CY00447J (Cover art Featured)
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151. Clark, G. R., T. J. Collins, S. M. James, W. R. Roper, K. G. Town, Triphenyl phosphoniodithiocarboxylato-SS'-carbonylbis(triphenylphosphine)iridium(I) tetra-fluoro borate: X-ray structure of an apparent π - CS_2 complex of iridium, *J. Chem. Soc., Chem. Comm.* **1976**, 47.

Educational Leadership

- Creator of first university course in green chemistry: Introduction to Green Chemistry, 1992—first by many years.
- Founder and principal lecturer in free web course on green chemistry: Introduction to Green Chemistry, see: <http://igs.chem.cmu.edu/> About 10% of the total envisioned course had been produced and uploaded by March 2012.

Introduction to Green Chemistry

Course Overview: Over the past 150 years the field of chemistry has fostered almost no formal training in toxicity or ecotoxicity. We continue to train chemists to create new products and processes, but not educate them to be aware of the need to protect themselves, other people or the ecosphere from the results of their hard work. Green chemistry offers an alternative. The field was best defined by Paul Anastas in the 1990s as "the design of chemical products and processes that reduce or eliminate the use and generation of hazardous compounds." Stated broadly, this course helps students understand the notion of sustainability and how it applies to chemistry. It also explores the history of chemistry, outlines critical need for green chemistry, and the holistic principles that guide its practice as an emerging and important field of science.

Conference Best Papers/Posters

- Gupta, S. S., D. Lenoir, T. J. Collins, Rapid Destruction of Chlorophenols by Activated Hydrogen Peroxide in Presence of TAML Catalysts, IPOC 16, 16th International Conference on Physical Organic Chemistry, August 4–9, **2002**, San Diego, CA – Best Poster Award.
- Hangun-Balkir, Y., L. Alexandrova, S. K. Khetan, C. Horwitz, A. Cugini, D. D. Link, B. Howard, T. J. Collins, Oxidative desulfurization of fuels through TAML® activators and hydrogen peroxide, Pittsburgh-Cleveland Catalysis Society Meeting, Fortieth Annual Spring Symposium, May 10, **2002**, Pittsburgh PA – Best Paper Award.
- Wingate, K. G., M. J. Robinson, T. R. Stuthridge, T. J. Collins, L. J. Wright, Color and AOX Removal from Bleached Kraft Mill Wastewaters Using Catalytic Peroxide Activators, TAPPI International Environmental Conference, April 7-10, **2001**, Montreal, Canada - Best Paper from Water Quality Category.

SYMPOSIA ORGANIZED

- Member of International Advisory Board, Materials and technologies for green chemistry" in Tallinn, Estonia, September 5-9, 2011
- International Conference on Environment 2010, Green Technologies for Benefit of Bottom Billions, Penang, Malaysia, December 13–15, 2010
- Member of International Advisory Board, International Union of Pure And Applied Chemistry Conference 2010—Chemistry for Sustainable Development, Mauritius, July 26–30, 2010
- Member of International Advisory Board. Third International Conference on Green & Sustainable Chemistry, Delft, The Netherlands, July 1-5, 2007
- Advisory Board, Green Chemistry and Engineering Conference, Washington DC, 2005
- Member of International Advisory Board. Canada-US Joint Workshop on Innovative Chemistry in Clean Media, May 20-21, 2004
- Co-Chair, Green Chemistry and Engineering Conference, Washington DC, 2004
- Member of International Advisory Board. First International Conference on Green & Sustainable Chemistry, Tokyo March 13-15, 2003
- Co-Chair, Green Chemistry and Engineering Conference, Washington DC, 2003
- Member, National Advisory Board for the International Conference on Macrocyclic Chemistry, Lawrence, Kansas, scheduled for June 1994
- Chairman, 1986 Industrial Associates Conference on Oxidation Chemistry, Caltech, February 25–27, 1986.
- 1984 International Chemical Congress of Pacific Basin Societies, Symposium Organizer with Eiichi Kimura and Chris Reed of the Symposium on "New Developments in Coordination Chemistry: Oxygen and Oxidation", Honolulu, Hawaii, December 16 – 21, 1984

- Member, International Advisory Board and Report Editor, the International Workshop on “Activation of Dioxide Species and Homogeneous Catalytic Oxidations”, Galzignano (Padova) Italy, June 28-29, 1984.

OTHER PROFESSIONAL ACTIVITIES (FROM 1998 ON) *selected examples*

- Interviewed by David Lemberg for “Science and Society”, June 21, **2007**. Podcast available at <http://www.scienceandsociety.net/audio/collins.mp3>
- Lecture, “Green Chemistry; Sustaining a High Technology Civilization”, Environmental Health Lecture Series, Town Hall, Seattle, WA, January 24, **2007**, broadcasted on NPR.
- Interviewed by Diane Horn (Producer and Host) of National Public Radio affiliate NEXP, Seattle for program “Mind Over Matters”
- Creating a New Chemistry, Air date: Week of 04/18/2007, Story length: 7:17, Producer: Reid R. Frazier, The Allegheny Front: environmental radio for Western PA
- Interviewed by Sarah Bennett of the Listener leading to the article, “Toxic Inheritance,” May 5– 11, **2007**.
- Interviewed by Kim Hill for Radio New Zealand on Green Chemistry (37 minutes), Broadcast February 24, **2007**
- Interviewed and profiled for the website of the Collaborative on Health and the Environment, 2006, <http://www.healthandenvironment.org/articles/homepage/614>
- Greening on Chemical World, December 13, 2006, Jennifer McGuiggan on GC and the Institute for Green Oxidation Chemistry, <http://www.popcitymedia.com/features/41greenchem.aspx>
- American Associate Editor of the Royal Society Journal, *Green Chemistry*—2001-2004.
- Member of Editorial Advisory Board of C&E News—2003-2005.
- Support of GC development for society in general and for less advantages states: Member of ACS Environmental Affairs Committee, Consultant to EPSCOR States on how to develop viable centers in green chemistry research, convener of International Conference on GC, Mumbai January, **2004**.
- Brief to the National Academy of Sciences Committee investigating technologies for killing anthrax on letter supporting machines at Army facilities, November **2003**.
- Member of the Advisory Group, National Academy of Sciences Roundtable on *Science and Technology in Support of a Transition Toward Sustainability*, March **2003**.
- Instructor on the DVD of the ACS and Green Chemistry Institute “Green Chemistry: Meeting Global Challenges”, **2003**.
- PI on grant from ACS-PRF that brought 22 winners of the Presidential Green Chemistry Challenge Award to Congress to meet with legislators and explain the progress and potential of green chemistry. Participated in what were regarded as highly successful meetings with three other Pennsylvania winners personally Senators Santorum and Specter and Congressmen, Doyle and Murphy, explaining the promise of Green Chemistry, November 28-29, **2003**.
- Member, ACS Committee on Environmental Improvement, **2002** –, Associate Member, ACS Committee on Environmental Improvement, 1999 – 2001
- Featured on video of the ACS and the EPA, “Green chemistry: Innovations for a Cleaner World”.
- Quoted widely on the eight-hour 2002 TV component of the multimedia workshop for teacher professional development, “Reactions in Chemistry”, funded by CPB and the Annenberg Foundation.
- National Public Radio Interview with Ira Flatow
<<http://www.npr.org/rundowns/segment.php?wfId=1447823>>
- Integration and Transfer of Knowledge: Since 1998, delivered 145 lectures (>20 international conference plenary lectures and named lectures) outside Carnegie Mellon University on Green Chemistry as a field and the Collins Group research program, including >40 to the general public (279 outside lectures throughout career).
- Consultant for the Green Chemistry Gordon Conferences
- Member of the DOE panel to advise the government on how to spend ca. \$10 M per year for the funding of green chemistry.
- Member of the IUPAC Working Party on Green Chemistry. International consultant helping to script the workshop report for the Organization for Economic Cooperation and Development. Member of writers and coordinators for IUPAC white paper on Green Chemistry.
- United States Representative to the Organization for Economic Cooperation and Development Workshop on the Funding of Sustainable Chemistry, Tokyo, October **2000**
- Member of International Advisory Committee for Japanese Green Chemistry Symposia Series.
- Published first definition of Green Chemistry - ‘Green Chemistry’, Collins, T. J. *Macmillan Encyclopedia of*

Chemistry, Volume 2, Simon and Schuster Macmillan, New York, **1997**, 691-697.

- Published one of first educational articles in GC, “Introducing Green Chemistry in Teaching and Research”, T. J. Collins, *J. Chem. Ed.*, **1995**, 72, 965–966.
- Participant at many national and international meetings designed to further green chemistry education as noted above.
- Developed first university course on Green Chemistry (taught since 1992).
- Member ACS, Royal Society of Chemistry, Royal Society of NZ, Technical Association of the Pulp and Paper Industry.
- Many interviews and expert opinions expressed in books, magazines and newspapers.

Video Presentations

- Professor Collins course “Introduction to Green Chemistry” is being developed for world-wide distribution—see <http://igs.chem.cmu.edu/> for a demo that shows the general idea—the final site will be approximately 10 times bigger and will include further world leading scholars as teachers for the different areas.
- The Collins Group Presidential Green Chemistry Challenge Award was featured on the ACS video: “Green Chemistry: Innovations for a Cleaner World”
- Professor Collins makes multiple appearances discussing green chemistry and sustainability science on an 8-hour educational series produced by Sally Heldrick under funding from the Annenberg Foundation and the Corporation for Public Broadcasting called “Reactions in Chemistry”, a Professional Development series for High School Teachers— <http://www.learner.org/channel/workshops/chemistry/>
- Professor Collins videotaped an online instruction course in green chemistry (July 23, 2004): <http://mts.sustainableproducts.com/modules/greenchem.html>

INVITED LECTURES, COLLOQUIA AND WEBINARS (in Reverse Chronological Order)

1. July 21, 2014,
2. July 9, 2014,
3. July 8, 2014,
4. July 8, 2014,
5. June 30, 2014,
6. May 21, 2014, Building the Chemical Dimension of a Sustainable Civilization Part II: How should university chemists train the sustainability leaders of the future, Great Lakes Green Chemistry Network and Michigan Green Chemistry Clearinghouse Webinar.
7. February 21, 2014, On “Introduction to Green Chemistry” at Carnegie Mellon University, The University Masters in Sustainability, Brunel University, Uxbridge, UK
8. February 20, 2014, Building the Chemical Dimension of a Sustainable Civilization: the compass and the code, Brunel University, Uxbridge, UK
9. November 25, 2013, Building the Chemical Dimension of a Sustainable Civilization, 1-hr Presentation to 180 H&SS students in Nico Slate Class on Innovation and Social Change, Carnegie Mellon University, Pittsburgh PA
10. November 18, 2013, TAML Activators: high performance peroxidase mimics for rapidly removing chemical (especially endocrine disruptors) and biological contaminants from water, EcoChem Conference, Basel, Switzerland
11. November 13, 2013, Building the Chemical Dimension of a Sustainable Civilization, 1-hr Presentation to freshman chemistry students in Newell Washburn’s Honors Chemistry Class, Carnegie Mellon University, Pittsburgh PA
12. November 6, 2013, Building the Chemical Dimension of a Sustainable Civilization, 2-hr Presentation to Architecture Students in Hartkopf Class, Carnegie Mellon University, Pittsburgh PA
13. November 3, 2013, **STUDENT SEMESTER INVITED LECTURE**, TAML® Activators: design, mechanisms of action and applications of the first full functional, small molecule peroxidase mimics, Chemical Engineering Department, Stanford University, Stanford, CA
14. November 3, 2013, **STUDENT LUNCHTIME PRESENTATION/DISCUSSION**, Building the Chemical Dimension of a Sustainable Civilization, Stanford University, Stanford, CA
15. October 24, 2013, The Design of Green Oxidation Catalysts for Environmental Solutions, **KEYNOTE LECTURE**, Michigan Green Chemistry & Engineering Conference Grand Rapids, MI
16. October 24, 2013, Building the chemical dimension of a sustainable civilization: reorienting the compass, resetting the thinking, Panel Presentation, Michigan Green Chemistry & Engineering Conference, Grand Rapids MI
17. October 15, 2013 Building the Chemical Dimension of a Sustainable Civilization, A 2-hour lecture to ca. 600 students, Central Catholic High School, Pittsburgh PA
18. October 3, 2013, TAML Activators: full functional peroxidase mimics for DoD projects, The Chemical and Biological

19. Defense Program's 2013 Enzyme Colloquium and Program Review, CSC Fairview Park Facility, Falls Church, VA. September 25, 2013, Building the Chemical Dimension of a Sustainable Civilization, II International Congress of Green Chemistry and Engineering, Monterrey, Mexico, 9/25/2013
20. August 20, 2013, High Performance Peroxidase Mimics for Rapidly Removing Chemical and Biological Threats from Water, International Seminars on Planetary Emergencies and Associated Meetings – 46⁺ Session, Erice, Sicily.
21. June 20, 2013, Testing the tiered protocol for endocrine disruption (TiPED) with TAML activators, ACS Green Chemistry and Engineering Conference, The Bethesda North Marriott Hotel and Conference Center, Bethesda, MD
22. April 7, 2013, Two Approaches for Designing Against Endocrine Disruptors, ACS National Conference. Division of Organic Chemistry SESSION: Advances in Green Chemistry
23. March 21, 2013, TAML[®] Activators: design, mechanisms of action and applications of small molecule H₂O₂-activating catalyst, Chemistry Department Seminar, Carnegie Mellon University, Pittsburgh PA
24. February 27, 2013, TAML[®] Activators: design, mechanisms of action and applications of small molecule H₂O₂-activating catalysts, Harvard-MIT Inorganic Colloquium, MIT, Boston, MA
25. February 12, 2013, A Code of Sustainability Ethics, Evening Public Lecture, Environmental Research Center, University of West Virginia, Morgantown, WV
26. January 10, 2013, Two approaches for designing as green chemists against endocrine disruptors, QAFCO-TAMUQ CHEMISTRY CONFERENCE 2013, GREEN CHEMISTRY AND GREEN ENGINEERING, Texas A&M University at Qatar, Doha, Qatar
27. December 11, 2012, Setting the Stage: The Frontier of Toxicology and Molecular Design, Toxicology and Sustainable Molecular Design Conference University of Connecticut, Storrs, CT
28. November 19, 2012, Little Green Solutions to Pharmaceutical Pollution, delivered for me in combination with Susan Jobling, European Environment Agency European and the Center for Environment & Human Health (U. Exeter) Workshop on Strategies to Reduce Emissions of Pharmaceuticals and Metabolites to the Environment, Newquay, Cornwall.
29. November 13, 2012, Intellectual and practical challenges of building a sustainable marketplace, **KEYNOTE LECTURE**, Catching the Wave - Green Chemistry and Economic Development in the Great Lakes Region, Hyatt Regency, Chicago IL
30. November 8, 2012, Sustainability, Central Catholic High School, Pittsburgh, PA—90 minute lecture to ca. 350 students.
31. October 26, 2012, Honoring the Vision of Rachel Carson: On Behalf of the American Chemical Society, 6th Rachel Carson Legacy Conference, *Our Planet and Our Health*, Chatham University, Pittsburgh PA
32. October 25, 2012, On The Health and Global Environmental Consequences of Fracking the Marcellus Shale, Pittsburgh Filmmakers Melwood Screening Room, Pittsburgh, PA
33. October 4, 2012, Sustainability is the Premier Chemical Technology Challenge of the 21st Century, **PLENARY LECTURE**, Holiday Inn, Moon PA
34. September 13, 2012, Successful Degradation of 17 α -Ethinylestradiol and other Pharmaceutical Contaminants with Fe-TAML/H₂O₂, Terrence J. Collins*, Susan Jobling, Karla I. Arias Salazar, Matthew R. Mills, Alice Baynes, Nicola Beresford, Jonathan Porras, *POSTER PRESENTATION*, Low Dose Effects and Non-Monotonic Dose Responses for Endocrine Active Chemicals: Science to Practice, Benjamin Franklin Campus Charité-Universitätsmedizin, Berlin
35. June 18, 2012, What/How should Green Chemists Teach in Toxicity and Ecotoxicity?—Integrating fields to teach sustainability. Symposium on Green Chemistry Education: Teaching Toxicology and Molecular Design, Washington Marriott Wardman, Washington, DC
36. June 12, 2012, Energy and Sustainability, Health Care Without Harm— Symposium on Climate Change and Health, Mellon Institute Auditorium, Carnegie Mellon University, Pittsburgh, PA
37. June 6, 2012, What/How should Green Chemists Teach in Toxicity and Ecotoxicity? Integrating fields to teach sustainability. Symposium on Green Chemistry Education: Teaching Toxicology and Molecular Design, Washington Marriott Wardman
38. May 11, 2012, TAML Activators: purifying water of endocrine disruptors in a new (more cost-effective?) way, UKWIR (UK Water Industry Research), Queen Anne's Gate, London, England
39. May 10, 2012, TAML Activators: purifying water of endocrine disruptors in a new (more cost-effective?) way, Safeguarding Spring Symposium - Brunel University's Institute for the Environment Queen's Anniversary Prize Award Celebration, Brunel University, Uxbridge England
40. April 24, 2012, Green Chemistry: sustaining a high technology civilization, Pittsburgh Chemist's Club and Pittsburgh Environmental Working Group of the American Chemical Society, Spaghetti Warehouse, Pittsburgh, PA
41. April 6, 2012, Green Chemistry: setting the compass toward a sustainable future, Slippery Rock University, Slippery Rock, PA
42. March 26, 2012, TAML[®] Activators: mechanisms of action and applications, Symposium on Sustainable Inorganic Chemistry, ACS National Meeting, San Diego, CA
43. March 4, 2012, Green Chemistry: setting the compass toward a sustainable future, Wallace Stegner Center, S.J. Quinney College of Law University of Utah, Salt Lake City, UT
44. February 27, 2012, Green Chemistry and Sustainability, Carlow University, Pittsburgh PA
45. February 1, 2012, Green Chemistry: sustaining a high technology civilization, **THE SECOND HORIZONS@HEINZ ENVIRONMENTAL SALON**, The University Club, Washington, DC

46. December 12, 2011, TAML Activators: Design, mechanisms of action and applications of the first effective peroxidase mimics—cleaning water of chemical contaminants as nature would do it, Brunel University, Uxbridge, England
47. November 19, 2011, Compass, TEDx Pittsburgh, Nemacon PA
48. November 8, 2011, The challenge of developmental disruptors for the chemical enterprise, University of Strasbourg, Strasbourg, France
49. November 8, 2011, Sustainability for Chemists: what does it mean? University of Strasbourg, Strasbourg, France
50. November 2, 2011, TAML Activators: Design, mechanisms of action and applications of the first effective peroxidase mimics—cleaning water of chemical contaminants as nature would do it, University of Strasbourg, Strasbourg, France
51. October 7, 2011, Green Science: on the responsibility of chemists to advance science with human health and the environment in mind Mid-Atlantic Association of Liberal Arts Chemistry Teachers Conference, **KEYNOTE**, Hamilton College, Clinton NY
52. September 22, 2011 Oxidizing organic chemicals with TAML catalysts and hydrogen peroxide: design, mechanisms of action and applications of faithful peroxidase mimics, **PLENARY**, Butlerov Congress—Kazan, Tatarstan, Russia
53. September 16, 2011, Green Chemistry: building a chemical economy that works for sustainability, Sustainable Chemistry Summit: from lab to market, **PLENARY**, Kingston, Ontario, Canada
54. August 29, 2011, Integrating Green Chemistry into the Wider Context of Sustainability Creating Innovation by Collaboration in Green Chemistry Among Industry, University Centers and Students, ACS Meeting—Denver
55. August 18, 2011, New green approaches to disinfection and water purification: or the future leaders who did the work. Green Chemistry Leadership Summit—Green Technologies for Developing Nations Workshop, Montego Bay, Jamaica.
56. June 9, 2011, Green Chemistry: what is it?, Presentation to Trustees and Staff of the Heinz Center, Washington, DC
57. May 4, 2011, The Design of TAML[®] Activators: effective small molecule mimics of the peroxidase enzymes, Blekinge Technical Institute, Sustainability Studies Group, Karlskrona, Sweden
58. May 4, 2011, Green Chemistry: on the responsibility of chemists to advance science with human health and the environment clearly in mind, Blekinge Technical Institute, to the Sustainability Studies students, Karlskrona, Sweden
59. April 8, 2011, Green Chemistry: on the responsibility of chemists to advance science with human health and the environment clearly in mind, **CRUM LECTURE: UNIVERSITY CONVOCATION ADDRESS**, Gordon College, Wenham, MA
60. April 7, 2011, The Design of TAML[®] Activators: effective small molecule mimics of the peroxidase enzymes, to the Science Students of Gordon College and environs, Wenham, Ma
61. March 24, 2011, TAML[®] Activators: design, mechanisms of action and applications of Effective peroxidase mimics, **DISTINGUISHED SCIENTIST SEMINAR**, Scripps Institute, March 22, 2011, La Jolla, CA
62. March 21, 2011, Why we need systematic, evolving methodology for assaying endocrine disruption properties to build a meaningful field of Green Chemistry, **OPENING ADDRESS**, Symposium on Linking Green Chemistry and Environmental Health Sciences, Cavallo Point, CA
63. December 7, 2010, Green Chemistry: sustaining a high technology civilization, Central Catholic High School, Pittsburgh, PA
64. December 2, 2010, Green Chemistry as a Strategy for Reducing Hazardous Chemicals in the Environment, Department of Environmental Medicine, University of Rochester Medical Center, Rochester, NY
65. December 1, 2010, Green Chemistry: sustaining a high technology civilization, Rochester Institute of Technology, Rochester, NY
66. November 4, 2010, Green Chemistry: sustaining a high technology civilization, **UNIVERSITY CONVOCATION**, Ohio Wesleyan University, Lecture to Science Faculty and Students, Delaware Ohio.
67. November 4, 2010, Green Chemistry: making water safer, Ohio Wesleyan University, Lecture to Science Faculty and Students, Delaware Ohio.
68. October 14, 2010, TAML Activators as Mimics of Peroxidase Enzymes: design, mechanisms of action and applications, **PLENARY LECTURE**, 2010 Pfizer Green Chemistry Symposium, San Diego CA
69. October 8, 2010, Molecular Design for Hazard Reduction and Remediation, United States Geological Survey Laboratory, Columbia, MO
70. October 7, 2010, Molecular Design for Hazard Reduction and Remediation, Symposium on Green Chemistry: Integrating Environmental Health Research and Chemical Innovation, University of Missouri—Columbia, MO
71. September 24, 2010, Rachel Carson Legacy Conference, Pittsburgh PA
72. August 24, 2010, Iron–TAML activators: Designing ligands to achieve peroxidase mimics, Fall ACS Meeting, Boston, MA
73. August 12, 2010, Green Chemistry: on the Responsibility of Chemists to Advance Science with Human Health and the Environment Clearly in Mind. 21st International Conference on Chemical Education), **PLENARY LECTURE**, Taipei, Taiwan
74. August 5, 2010, Green Chemistry: Sustaining a High Technology Civilization, Indian Institute of Technology, Kanpur, India
75. August 4, 2010, The Design of TAML Activators: effective small molecule mimics of the peroxidase enzymes, Indian Institute of Technology, Kanpur, India
76. August 3, 2010, Green Chemistry: Sustaining a High Technology Civilization, Indian Institute of Technology, Mumbai, India

77. August 2, 2010, The Design of TAML Activators: effective small molecule mimics of the peroxidase enzymes, National Chemistry Laboratory, Pune, India
78. July 30, 2010, Green Chemistry: Sustaining a High Technology Civilization, National Chemistry Laboratory, Pune, India
79. July 26, 2010, Green Chemistry: Sustaining a High Technology Civilization, Chemistry for Sustainable Development (ICPAC 2010), **PLENARY LECTURE**, Mauritius
80. July 5, 2010, The Design of TAML Activators: Effective Small Molecule Mimics of the Peroxidase Enzymes, International Conference on Porphyrins and Phthalocyanines, ICPP-6, Grand Hyatt Tamaya Resort, Santa Ana Pueblo, New Mexico
81. June 15, 2010, TAML Activators: New Hope for Cleaner Water, Green Remediation Conference, University of Massachusetts, Amherst
82. June 15, 2010, Green Remediation: The Environmental Perspective, **PLENARY**, Green Remediation Conference, University of Massachusetts, Amherst
83. May 27, 2010, Green Chemistry: sustaining a high technology civilization, A Rachel Carson Celebration of Biodiversity Honoring E. O. Wilson, Carnegie Music Hall, Pittsburgh, PA
84. May 3, 2010, Green Chemistry: chemists working to acknowledge, learn about and adapt to endocrine disruption, Endocrine Disruption **GORDON CONFERENCE**, Les Diablerets, Switzerland
85. April 20, 2010, Promise and Progress in Green Technology to Protect Future Generations, Second Annual Symposium—Environmentally Literate Healthcare Providers, University of Pittsburgh School of Medicine Center for Continuing Education in the Health Sciences and the Magee-Womens Hospital, Pittsburgh, PA
86. April 15, 2010, Green Chemistry and the Future: the example of iron-TAML activators, Bethany College, Bethany, WV
87. March 23, 2010, Iron-TAML activators of hydrogen peroxide: probing novel approaches for reducing and eliminating recalcitrant pollutants in water, Symposium on the Sustainability of Water Quality, ACS Conference, Moscone Center, San Francisco, California
88. March 23, 2010, Green Chemistry: the example of iron-TAML activators, Symposium on Chemical Applications of Mössbauer Spectroscopy, ACS Conference, Moscone Center, San Francisco, California
89. March 18, 2010, Policy Issues and the reform of the Toxic Substances Control Act (TSCA), Oxford Union Style Debate, Collins as Questioner, Green Chemistry Roundtable Series Manufacturing a Sustainable Economy, New Hazlett Theater, Pittsburgh PA
90. March 1, 2010, Green Chemistry and the Future: the example of iron-TAML activators, 90 minute interview with Terry Collins conducted by Lou Guillette and students, University of Florida, Gainesville, Florida
91. February 29, 2010, Green Chemistry and the Future: the example of iron-TAML activators, University of Tampa, Tampa, Florida
92. February 13, 2010, Green Chemistry in Pesticide Development and Degradation, **PLENARY**, Pesticide Stewardship Alliance, Hyatt Regency, Savannah, Georgia,
93. January 13, 2010, Green Chemistry Roundtable Series Manufacturing a Sustainable Economy—commentator—John Ehrenfeld address: author of Sustainability by Design, Collins as Questioner, ALCOA Headquarters, Pittsburgh, PA
94. December 7, 2009, Iron-TAML Activators: successful mimics of peroxidase enzymes that can transform water purification, University of Michigan, Ann Arbor, Michigan
95. November 29, 2009, Iron-TAML Activators: highly successful mimics of peroxidase enzymes for green chemical applications, **PLENARY LECTURE**, Inorganic Discussion Weekend, University of Guelph, Guelph, Ontario, 11/29/09
96. November 12, 2009, Green Chemistry: the bottom line must adapt to the germline, Philadelphia Area Alumni, University of Philadelphia, Philadelphia PA
97. November 11, 2009, Green Chemistry: the bottom line must adapt to the germline, Princeton Area Alumni, Hamilton, NJ
98. November 9, 2009, Green Chemistry: sustaining an high technology civilization, Pittsburgh Society for Coatings Technology, Harmer, PA
99. November 3, 2009, Green Chemistry: sustaining an high technology civilization, **HUGH AND NANCY LONG LECTURE**, Westminster College, New Wilmington, PA
100. October 30, 2009, Green Chemistry and the Future: the example of Iron-TAML Activators, Department of Chemistry, Cleveland State University, Cleveland,
101. October 23, 2009, Green Chemistry at Carnegie Mellon University: our approach to the tectonic importance of endocrine disruption e-hormone Conference, Tulane and Xavier Universities, New Orleans
102. October 14, 2009, Green Technologies for the Environment: Stimulating Eco Innovation for the Coming Sustainability Revolution, **PLENARY LECTURE**, Sheraton Bradley Hotel, Windsor Locks, CT
103. September 25, 2009, Green Chemistry: Sustaining an High Technology Civilization, **PLENARY LECTURE**, Rachel Carson Legacy Conference, When Chemicals Disrupt: Managing Our Risk, Manchester Craftsmen's Guild, Pittsburgh, Pennsylvania
104. September 15, 2009, Green Chemistry: Sustaining an High Technology Civilization, **UNIVERSITY PUBLIC LECTURE**, University of California, Berkeley, Berkeley, CA
105. September 14, 2009, Green Chemistry and the Future: the example of TAML activators, Department of Chemistry,

- University of California, Berkeley, Berkeley, CA
106. September 14, 2009, Green Chemistry and the Future: the example of Iron-TAML Activators, Department of Chemistry, University of California, Berkeley, Berkeley, CA
 107. August 23, 2009, Rethinking Remediation, 42nd Session of the International Seminars on Planetary Emergencies, Erice, Sicily, Italy
 108. August 21, 2009, Moving the chemical enterprise toward sustainability: Key issues, 42nd Session of the International Seminars on Planetary Emergencies, Erice, Sicily, Italy
 109. July 21, 2009, Iron-TAML activators with peroxide: an effective green chemical approach to the degradation of pharmaceutical agents in water, Green Pharma Summit, Ritz-Carlton Hotel, Philadelphia, PA
 110. July 8, 2009, Green Chemistry and the Future: the example of Iron-TAML Activators, Department of Chemistry, McGill University, Montreal, Canada
 111. May 16, 2009, It's Your World After All, Graduation Ceremony Mellon College of Science Honors Graduates, **KEYNOTE ADDRESS**, Carnegie Mellon University, Pittsburgh, PA
 112. May 16, 2009, It's Your World After All, Phi-Beta-Kappa Initiation Convocation **PLENARY**, Carnegie Mellon University, Pittsburgh, PA
 113. April 22, 2009, Green Chemistry: Sustaining an High Technology Civilization, Edinboro University of Pennsylvania, **UNIVERSITY LECTURE**, Edinboro, PA
 114. December 10, 2008, Iron-TAML activators: highly successful mimics of peroxidase enzymes for green chemical applications, **PLENARY LECTURE**, Blueprints for Sustainable Infrastructure, University of Auckland, New Zealand
 115. December 8, 2008, Iron-TAML Activators: effective small molecule mimics of peroxidase enzymes, Centre of Theoretical Chemistry and Physics, The New Zealand Institute for Advanced Study, Massey University Auckland, North Shore City, December 8, 2008
 116. November 13, 2008, Green Chemistry and the Future, Carnegie Mellon Alumni, LA Chapter, MEIM Center, LA
 117. November 15, 2008, Building the Technological Dimension of a Sustainable Civilization, **PLENARY LECTURE**, Siemens Science Competition, Heinz History Center, Pittsburgh, PA
 118. November 11, 2008, Pursuing Sustainable Technologies: People change people, Central Catholic High School, Pittsburgh PA
 119. October 16, 2008, Green Chemistry and Worker Health and Safety Training, NIEHS, Sheraton Chapel Hill, NC
 120. October 8, 2008, Environmental Health Sciences and Green Chemistry: Problems Meet Solutions—In Summary, **PLENARY LECTURE**, Beckman Center, Irvine CA
 121. September 19, 2008, Sustainability Determinants, Conference Introduction as Conference Co- Chair, Rachel Carson Legacy Conference, Duquesne University, Pittsburgh, PA
 122. September 17, 2008, Iron-TAML Activators: effective small molecule mimics of peroxidase enzymes, Department of Chemistry, University of Wisconsin, Madison
 123. August 18, 2008, Design, performance and mechanistic chemistry of FeIII-TAML activators, Graduate Student Symposium: Transitioning into Green Chemistry, ACS National Meeting, Sheraton Philadelphia City Center Hotel, Philadelphia, PA
 124. July 18, 2008, Green Chemistry and Technology Futures, Presented to the leadership of the United Steelworkers Union, New Haven, CT
 125. July 17, 2008, Iron-TAML activators: highly successful mimics of peroxidase enzymes—Lessons from kinetic and mechanistic studies, **INORGANIC CHEMISTRY GORDON CONFERENCE**, Salve Regina University, Newport, RI
 126. June 4, 2008, Green Chemistry and the Future, Presented to the University of Minnesota electronically from Yale University, New Haven, CT
 127. May 28, 2008, Green Chemistry and the Future, Presentation to Bobby Vagt, President, Heinz Endowments and several other officers, Pittsburgh, PA
 128. May 2, 2008, Green Chemistry and the Future, **UNIVERSITY CONVOCATION ADDRESS**, St. Olaf College, Northfield, Minnesota
 129. April 28, 2008, Green Chemistry and the Future, Presentation to the Upper School, Winchester Thurston Academy, Pittsburgh, PA
 130. April 16, 2008, Green Chemistry and the Future, Rachel Carson Spirit & Nature Conference, Chatham University, Pittsburgh, PA
 131. April 14, 2008, A life in search of sustainability: People change people, **JOURNEYS LECTURE**, Carnegie Mellon University, Pittsburgh, PA
 132. April 7, 2008, Undergraduate researchers excel in green chemistry and oxidation catalysis, **BECKMAN SCHOLARS 10-YEAR ANNIVERSARY PRESIDENTIAL PLENARY SYMPOSIUM**, ACS National Meeting, New Orleans
 133. March 17 2008, Green Chemistry and the Future, **CHARLES E. KAUFMAN AWARD ADDRESS**, Bridgeville, PA
 134. March 18 2008, Green Chemistry and the Future, North Central West Virginia American Chemical Society, Fairmont State University, Fairmont, WV
 135. March 14, 2008, Green Chemistry and the Future, Good Jobs, Green Jobs Conference, Convention Center, Pittsburgh, PA
 136. February 19, 2008, Green Chemistry and the Future, **AFTER-DINNER KEYNOTE LECTURE**, American Institute of Chemical Engineers, University of Pittsburgh, Pittsburgh, PA

137. February 14, 2008, Green Chemistry and the Future, Presentation to the Maine Legislature Standing Committee on Maine Resources, State Capitol, Augusta, ME
138. November 29, 2007, Green Chemistry and the Future, **KEYNOTE LECTURE**, *Health and Environmental Funders Network*, Airlie Conference Center, Warrenton, VA,
139. November 19, 2007, Learning and Developmental Disabilities Initiative National Teleconference, Priming for Prevention, Cyberspace, USA
140. November 14, 2007, The Vision, Research and Educational Program of the Institute for Green Oxidation Chemistry, Citizens for Global Solutions Pittsburgh and the Global Studies Program of the University Center for International Studies at the University of Pittsburgh, Pittsburgh, PA
141. October 26, 2007, Green Chemistry and the Future, **PLENARY LECTURE**, La Roche College, Pittsburgh, PA
142. October 26, 2007, The Vision, Research and Educational Program of the Institute for Green Oxidation Chemistry, Central Catholic High School, Pittsburgh, PA
143. October 10, 2007, The Vision, Research and Educational Program of the Institute for Green Oxidation Chemistry, Central Catholic High School, Pittsburgh, PA
144. October 4, 2007, Yale University, Green chemistry: sustaining a high technology civilization, New Haven, CT
145. September 26, 2007, Green Chemistry and Life Cycle Analysis, EPA Conference on "Pollution Prevention through Nanotechnology", Arlington, VA
146. September 25, 2007, GreenOx Catalysts, Inc.: the green chemistry behind a new Pittsburgh startup, Commercial Development and Marketing Association for the Chemicals Industry Annual Conference, Pittsburgh, PA
147. September 21, 2007, Green chemistry: sustaining a high technology civilization, **PLENARY LECTURE**, The Fire Retardant Dilemma Conference Series: Part 3, Berkeley, CA
148. September 20, 2007, Green chemistry: sustaining a high technology civilization, The Energy and Resources Group Fall 2007 Colloquium Series, U.C. Berkeley, Berkeley CA
149. September 11, 2007, Green Chemistry and the Future: Part B, Innovation Day 2007, Society of the Chemical Industry–Chemical Heritage Foundation, Philadelphia, PA
150. September 11, 2007, Green Chemistry and the Future: Part A, Innovation Day 2007, Society of the Chemical Industry–Chemical Heritage Foundation, Philadelphia, PA
151. August 29, 2007, Green Chemistry and the Future, **PLENARY LECTURE**, 20th Rocky Mountain Regional ACS Meeting (Joint with AICHE), Denver, CO
152. August 19, 2007, Green chemistry and sustainability: essential elements for chemical pedagogy, Boston ACS Meeting in Symposium on Green Chemistry as an Integral Component of Academic Sustainability Centers, Boston MA
153. August 8, 2007, Iron-TAML activators: effective green chemistry catalysts for the oxidative decomposition of Pharmaceuticals and Personal Care Products, 2007 Northeast Water Science Forum, Pharmaceuticals and Personal Care Products: state of the science, Portland, ME
154. August 6, 2007, Certain chemicals are disrupting your hormone system: what can GreenChemistry do protect you and your family? Workshop on Endocrine Disrupting Chemicals, Steelworkers Health, Safety and Environment Conference and the Steelworkers Joint Health, Safety and Environment Conference, Dearborn, MI
155. July 16, 2007, Green Chemistry: Sustaining an High Technology Civilization, University of Pittsburgh, Center on Race and Social Problems, School of Social Work, Pittsburgh, PA
156. July 16, 2007, Green Chemistry: Sustaining an High Technology Civilization, Lunch and Learn, Center for Environmental Oncology, Herberman Auditorium, UPMC Cancer Pavilion, Pittsburgh, PA
157. June 2, 2007, Iron-TAML activators: effective green chemistry catalysts for peroxide activation, Pan American Studies Institute in Green Chemistry, Universidad Iberoamericana, México City, México
158. June 1, 2007, Toxicity and Ecotoxicity: the vital GC challenge of the endocrine disruptors, Pan American Studies Institute in Green Chemistry, Universidad Iberoamericana, México City, México
159. June 6, 2007, Green Chemistry: Sustaining an High Technology Civilization, **KEYNOTE LECTURE**, First Israeli International Conference on Green Chemistry, Porter School of Environmental Studies, Tel Aviv University, Israel
160. May 31, 2007, Green Chemistry: "an ethical imperative", Pan American Studies Institute in Green Chemistry, Universidad Iberoamericana, México City, México
161. May 16, 2007, Iron-TAML activators: effective green chemistry catalysts for peroxide activation, **AWARD ADDRESS**, Catalysis Society of Metropolitan New York, Somerset, NJ
162. May 16, 2007, Green Chemistry: Sustaining an High Technology Civilization, ExxonMobil Research and Engineering Co, Annandale, NJ
163. April 23, 2007, Green Chemistry and the Future, King County Wastewater Treatment Authority and People for Puget Sound, Seattle, WA
164. April 23, 2007, Green Chemistry and the Future, Department of Ecology of Washington State, Olympia, WA
165. April 20, 2007, Green Chemistry and the Future, Women's Health and the Environment: new science, new solutions, Pittsburgh, PA
166. August 6, 2007, Green Chemistry: Sustaining an High Technology Civilization, **PLENARY LECTURE**, Steelworkers Health, Safety and Environment Conference and the Steelworkers Joint Health, Safety and Environment Conference, Dearborn, MI
167. April 4, 2007, Iron-TAML® activators: effective green chemistry catalysts for peroxide activation, Centre College,

- Danville, KY
168. March 26, 2007, Iron-TAML® activators: effective green chemistry catalysts for peroxide activation, Eckard Münck Bader Award Symposium, Chicago ACS, Chicago IL
 169. March 23, 2007, Converging Landscapes: Chemistry meets Toxicology meets the Environment — with a little emphasis on pharmaceuticals, Gordon Cain Conference 2007, New Chemical Bodies: Bio-Monitoring, Body Burden and the Uncertain Threat of Endocrine Disruptors, Chemical Heritage Foundation Conference, Philadelphia, PA
 170. February 27, 2007, Green Chemistry; Sustaining a High Technology Civilization, SCION, Rotorua, New Zealand
 171. February 22, 2007, Green Chemistry: In Search of an Ethics for the Technological Age, IPENZ and Engineers for Social Responsibility, University of Auckland, New Zealand
 172. February 21, 2007, Green Chemistry; Sustaining a High Technology Civilization, **AWARD AND UNIVERSITY LECTURE**, Maidment Theater, University of Auckland, Auckland, New Zealand
 173. January 25, 2007, Green Chemistry; Sustaining a High Technology Civilization, Lunch Round table Discussion, Summit on Environmental Challenges to Reproductive Health and Fertility, University of California, San Francisco, San Francisco, CA
 174. January 25, 2007, Green Chemistry; Sustaining a High Technology Civilization, Oregon Environmental Council Health Sciences Series, Multnomah Athletic Club, Portland, OR
 175. January 24, 2007, Green Chemistry; Sustaining a High Technology Civilization, Environmental Health Lecture Series, Town Hall, Seattle, WA
 176. January 24, 2007, Iron-TAML® activators: effective green chemistry catalysts for peroxide activation, University of Washington, Seattle, WA
 177. December 14, 2006, Green Chemistry and the Future, Presentation to Birchmere, VC, Pittsburgh, PA
 178. December 7, 2006, Green Chemistry and the Future, Presentation to the VC Firm Draper-Triangle, Pittsburgh, PA
 179. December 1, 2006, Green Chemistry and the Future, Presentation to the VC Firm Pennsylvania Early Stage Partners, Pittsburgh, PA
 180. November 15, 2006, Green Chemistry: Sustaining a High Technology Civilization, Greenbuild 2006, Denver, CO
 181. October 30, 2006, The Design and Development of Green Oxidation Catalysts: real steps toward a less polluted world, Presentation to 40 Venture Capitalists, Carnegie Mellon University, Pittsburgh, PA
 182. October 27, 2006, The Design and Development of Green Oxidation Catalysts: real steps toward a less polluted world, Louisiana State University, Baton Rouge, LA
 183. October 25, 2006, Green Chemistry and the Future, Presentation to the Heinz Endowments Board of Trustees, Carnegie Mellon University, Pittsburgh, PA
 184. October 17, 2006, Design, Study and Applications of Green Oxidation Catalysts, Kenyon College, Gambier, OH
 185. October 3, 2006, Green Chemistry: a personal view of the challenges and an update on TAML® activator chemistry, Presentation to 10 Classes of Central catholic High School, Pittsburgh, PA
 186. September 12, 2006, Greening Chemistry: what is it?, Egyptian First International Conference in Chemistry, Chemistry for Human Needs in Developing Countries, Sharm El-Shiekh, Egypt
 187. September 12, 2006, Greening Oxidation Catalysis, Egyptian First International Conference in Chemistry, Chemistry for Human Needs in Developing Countries, Sharm El-Shiekh, Egypt
 188. October 16, 2006, Green Chemistry: Sustaining a High Technology Civilization, **UNIVERSITY CONVOCATION ADDRESS**, Kenyon College, Gambier, OH
 189. September 14, 2006, Green Chemistry and Sustainability, Egyptian First International Conference in Chemistry, Chemistry for Human Needs in Developing Countries, **LEADER OF 2.5 HOUR ADDRESS AND DISCUSSION**, Sharm El-Shiekh, Egypt
 190. August 27, 2006, The Design and Development of Green Oxidation Catalysts: real steps toward a less polluted world, Green Chemistry **GORDON CONFERENCE**, Magdalen College, Oxford, United Kingdom
 191. August 17, 2006, The Design and Development of Green Oxidation Catalysts: real steps toward a less polluted world, Auckland University, Auckland, New Zealand
 192. August 16, 2006, The Design and Development of Green Oxidation Catalysts: real steps toward a less polluted world, Waikato University, Hamilton, New Zealand
 193. August 9, 2006, The Design and Development of Green Oxidation Catalysts: real steps toward a less polluted world, Monash University, Melbourne, Australia
 194. August 9, 2006, Designing Green Catalytic Oxidation Processes, Monash University Student Lecture, Melbourne, Australia
 195. July 3, 2006, TAML Oxidant Activators: Design, Chemistry and Applications, ICPP-4, Rome, Italy
 196. June 26, 2006, Green Oxidation Catalysis, 2006 Summer School on Green Chemistry, Washington, DC
 197. June 22, 2006, Solutions Science in Academia: green chemistry and what it offers biodiversity, Consultative Group on Biodiversity, Estes Park, CO
 198. June 6, 2006, Green Chemistry: making it in the real world, Collaborative on Health and the Environment Web Lecture Series
 199. May 18, 2006, Green Chemistry: systematically dealing with toxics, Great Lakes Binational Toxics Strategy Meeting, Delta Chelsea Hotel, Toronto, Canada
 200. May 9, 2006, Green Chemistry 101 Primer, NSCMP Core Group, Holiday Inn Rosslyn at Keybridge, Arlington VA

201. May 3, 2006, Green Chemistry and Sustainability, Pittsburgh Chemistry Olympics-Chevron Science Center, Pittsburgh, PA
202. April 25, 2006, The Design of Green Catalytic Oxidation Processes, Dickinson College, Carlisle PA
203. March 21, 2006, Green Chemistry 101, Veolia Water Leadership, Moon Township, PA
204. March 7, 2006, Green Chemistry: developing sustainable alternatives to polluting technologies, Society of Toxicologists Meeting, San Diego, CA
205. January 30, 2006, Green Chemistry 101, Presentation to >80 Environmental Advocate Organizations, Hotel Washington, Washington, DC
206. January 30, 2006, Green Chemistry 101, Presentation to \approx 40 Environmental and Health Funding Foundations, Hotel Washington, Washington, DC
207. January 20, 2006, Green Chemistry at Carnegie Mellon University and Thinking about How to Make Pittsburgh the Capital City of the Sustainable Economy *Pittsburgh Green Drinks, Buffalo Blues*, Pittsburgh, PA
208. January 11, 2006, Degradation of Lipitor and Zoloft with Fe-TAML/H₂O₂ presentation with Dr. Yan Xiang, Pfizer Central Research, Groton, CT
209. December 14, 2005, Designing Green Oxidation Processes, Joint Japan-US Workshop on Sustainable Chemical Synthesis, Honolulu, HI
210. November 30, 2005, Design, Study and Applications of Green Oxidation Catalysts, Penn State Erie-The Behrend College, Erie, PA
211. November 5, 2005, Sustaining a High Technology Civilization, Elk Regional Health Center Women's Health Conference, St. Mary's, PA
212. November 4, 2005, Sustaining a High Technology Civilization, Carnegie Mellon University International Festival, Pittsburgh, PA
213. October 28, 2005, Designing Green Oxidation Technologies, Midwest Regional ACS Meeting— Green Chemistry Symposium, October 28, 2005, Joplin, MO
214. October 20, 2005, Design, Study and Applications of Green Oxidation Catalysts, Stanford University, Stanford CA
215. October 14, 2005, Greening Our Civilization Through Science, Bioneers Conference, San Rafael, CA
216. October 7, 2005, Greening Our Civilization Through Science, **PLENARY LECTURE**, Chemistry Discipline Faculty Workshop 2-year and 4-year Colleges of Minnesota State Colleges and Universities System, Minnesota Minneapolis Community and Technical College, Minneapolis MN
217. October 6, 2005, Green Chemistry and the Building of the Sustainable Economy, Activated Carbon Conference, **PLENARY LECTURE**, Moon Township, PA
218. October 4, 2005, Making Pittsburgh the Capital City of the Sustainable Economy, Technology Transfer Conference for Foundations and Economic Development Organizations, Carnegie Mellon University, Pittsburgh PA
219. September 21, 2005, Ethics, Toxicity, Ecotoxicity, Persistence, Bioaccumulation and Green Chemistry, Central Catholic High School, Pittsburgh, PA
220. August 29, 2005, TAML Green Oxidation Catalysis for Safely Destroying Pollutants and Microbes in Water, ACS Meeting, Washington, DC
221. July 30, 2005, Moderator of Panel Presentations on Green Chemistry, The Beckman Scholars Conference, Irvine, CA
222. July 11, 2005, Ethics, Toxicity, Ecotoxicity, Persistence, Bioaccumulation and Green Chemistry: Part II, Exxon Summer School on Green Chemistry, McGill University, Montreal, Canada
223. July 11, 2005, Ethics, Toxicity, Ecotoxicity, Persistence, Bioaccumulation and Green Chemistry: Part I, Exxon Summer School on Green Chemistry, McGill University, Montreal, Canada
224. July 9, 2005, Greening Oxidation Catalysis, Exxon Summer School on Green Chemistry, McGill University, Montreal, Canada
225. June 23, 2005, Designing Green Catalytic Oxidation Technologies, 2nd International Green Chemistry and Engineering Conference, Washington, DC
226. June 22, 2005, The Need for Incorporating Understanding of Toxicity and Ecotoxicity into Chemistry, 2nd International Green Chemistry and Engineering Conference, Washington, DC
227. June 21, 2005, Green Decontamination System for Chemical and Biological Weapons of mass Destruction, 2nd International Green Chemistry and Engineering Conference, Washington, DC
228. June 20, 2005, Greening Oxidation Catalysis—Student Workshop, 2nd International Green Chemistry and Engineering Conference, Washington, DC
229. June 17, 2005, Design, Mechanism of Action, and Applications of Green Oxidation Catalysts, **PLENARY LECTURE**, Annual Meeting of the Pittsburgh-Cleveland Catalysis Society, Pittsburgh, PA
230. June 1, 2005, Greening Oxidation Catalysis, Conference on Knowledge-Based Materials and Technologies for Sustainable Chemistry, **PLENARY LECTURE**, Tallinn, Estonia
231. May 30, 2005, Understanding Homogeneous Oxidation Catalysis: mechanistic investigation of the stability and function of iron-TAML peroxide activators, Eotvos University, Budapest, Hungary
232. May 26, 2005, A Green Oxidative Approach for Rapid Total Degradation of Thiophosphate Pesticides, 8TH HCH and Pesticides Forum for Central European and Eastern European, Caucasus and Central Asia Countries, Sofia, Bulgaria
233. May 19, 2005, Designing Green Oxidation Technologies” Lecture to Environmental Commissioner of Maine (Dawn Gallagher) and leaders of the Maine DEP and pulp and paper industry, Augusta, ME

234. July 29, 2005, **PLENARY LECTURE**, Bayer School of Natural and Environmental Sciences Undergraduate Research Symposium, Duquesne University, Pittsburgh PA
235. April 19, 2005, Sustainability Ethics and Chemistry: How to build a sustainable technology base, **PLENARY LECTURE**, Symposium on Universal Relationships and Responsibilities: Sustainable living practices for social and cultural wellbeing, Perth, Australia
236. March 31, 2005, Designing Green Oxidation Technologies, Commonweal Retreat on Green Chemistry, Bolinas, CA
237. March 30, 2005, Green Chemistry: Solving the Technical Challenges of Sustainability, Commonweal Retreat on Green Chemistry, Bolinas, CA
238. March 13, 2005, Green Oxidation Catalysts for Environmental Applications, Symposium on Environmental Applications of Inorganic Chemistry, San Diego ACS Meeting, San Diego, CA
239. February 25, 2005, Green Chemistry and Agriculture, **PLENARY LECTURE**, Southeastern Leadership Conference, Department of Agriculture, Savannah, GA
240. February 15, 2005, A Superior Decontamination System for Chemical and Biological Warfare and Defense, **KEYNOTE LECTURE**, Rydges Hotel, Melbourne, Australia
241. February 2, 2005, Greening Civilization through Science, lecture to the science students and Pennsylvania-Ohio Border Section of the ACS, New Wilmington, PA
242. December 9, 2004, Designing Green Oxidation Technologies, **PITTSBURGH AWARD ADDRESS**, Sheraton Hotel, Pittsburgh, PA
243. December 3, 2004, Greening Civilization Through Science, To the Science Students, Illinois Wesleyan University, Bloomington, IL
244. November 29, 2004, Designing Green Oxidation Technologies, To Governor John Baldacci & DEP Leadership, Augusta, ME
245. November 29, 2004, Designing Green Oxidation Technologies, To Commissioner Dawn Gallagher & DEP Leadership, Augusta, ME
246. November 18, 2004, Green Chemistry, Steinbrenner Institute Carnegie Mellon University, Pittsburgh, PA
247. November 13, 2004, A Novel Catalytic Oxidative Decontamination System for Chemical and Biological Warfare Defense, SERMACS, Durham, NC
248. November 3, 2004, Greening Our Civilization Through Science, Chatham College, Pittsburgh, PA
249. November 1, 2004, Research in Green Chemistry, SURG Lunch Seminar Series, Carnegie Mellon University, Pittsburgh, PA
250. October 21, 2004, Greening Our Civilization Through Science, **KEYNOTE LECTURE**, Mid-Atlantic Association of Liberal Arts College Teachers Annual Conference, Juniata College, Huntingdon, PA
251. October 20, 2004, The Design, Development and Utility of TAML Activators, Society of Environmental Journalists, Carnegie Mellon University, Pittsburgh, PA
252. October 20, 2004, Greening Our Civilization Through Science, Society of Environmental Journalists, Carnegie Mellon University, Pittsburgh, PA
253. October 19, 2004, Greening Our Civilization Through Science, **UNIVERSITY LECTURE**, Bowdoin College, Brunswick, ME
254. October 19, 2004, Designing Green Oxidation Technology, Bowdoin College, Brunswick, ME
255. October 8, 2004, Designing Green Oxidation Technology, Arch Chemicals, Southington, CT
256. September 30, 2004, Greening the Planet through Science, The Covenant at South Hills, Bower Hill Road, Mt. Lebanon, PA
257. September 20, 2004, Persistence, Bioaccumulation and Endocrine Disruption in Understanding Pollutants and How to Deal with Them, Faculty Workshop, Clemson University, Clemson, SC
258. September 20, 2004, Designing Green Oxidation Technology, Science Technology and Society University Lecture, Clemson University, Clemson, SC
259. September 20, 2004, Green Chemistry: Sustaining a High Technology Civilization, Honors Students Lecture, Clemson University, Clemson, SC
260. August 26, 2004, Greening the Planet through Science, **KEYNOTE LECTURE**, MCS Orientation, Carnegie Mellon University, Pittsburgh, PA
261. August 22, 2004, Designing Green Oxidation Technologies, **PLENARY LECTURE**, Symposium on Sustainability in the Chemical Industry—IEC, 228th ACS Conference, Philadelphia, PA
262. August 22, 2004, Understanding the Persistent Pollutant, Symposium on Green Chemistry for Graduate Students, 228th ACS Conference, Philadelphia, PA
263. August 6, 2004, The Ethics of Green Chemistry, ACS-PRF Green Chemistry Summer School, Carnegie Mellon University, Pittsburgh, PA
264. August 6, 2004, Designing Green Oxidation Technologies, ACS-PRF Green Chemistry Summer School, Carnegie Mellon University, Pittsburgh, PA
265. August 5, 2004, Understanding the Persistent Pollutant, ACS-PRF Green Chemistry Summer School, Carnegie Mellon University, Pittsburgh, PA
266. August 3, 2004, Greening Energy, ACS-PRF Green Chemistry Summer School, Carnegie Mellon University, Pittsburgh, PA

267. May 18, 2004, A Novel Catalytic Oxidative Decontamination System for Chemical and Biological Warfare Defense, Decontamination 2004 Conference, Palm Harbor, FL
268. May 5, 2004, Designing Green Oxidation Technologies, Department of Agriculture, Florence, SC
269. April 30, 2004, Green Chemistry: Sustaining a High Technology Civilization, University of Mexico, Mexico City, Mexico
270. April 21, 2004, Green Chemistry: Sustaining a High Technology Civilization, ACS Student Affiliates Lecture, Bethany College, WV
271. April 14, 2004, Green Chemistry: Sustaining a High Technology Civilization, CleanMed 2004 Conference, Philadelphia, PA
272. March 29, 2004, Green Oxidation Catalysts: Iron-TAML Activators of Oxygen and Peroxides, ACS Symposium on Non-Heme Iron Chemistry in Biology, 227th ACS National Meeting, Anaheim, CA
273. March 27, 2004, Green Chemistry: Sustaining a High Technology Civilization, After-Dinner Lecture DivCHED Annual Banquet, 227th ACS National Meeting, Anaheim, CA
274. March 27, 2004, The Precautionary Principle and Endocrine Disruption: Connections, Lecture to the ACS Committee on Environmental Improvement, 227th ACS National Meeting, Anaheim, CA
275. March 19, 2004, Designing Catalysts for Green Oxidation Technologies, Department of Chemistry, Eotvos University, Budapest, Hungary
276. March 18, 2004, Designing Catalysts for Green Oxidation Technologies, Department of Chemistry, University of Debrecen, Debrecen, Hungary
277. March 13, 2004, Techniques for Attracting Manuscripts, Royal Society of Chemistry Editor's Symposium, Glasgow, Scotland
278. March 5, 2004, Green Chemistry: Sustaining a High Technology Civilization, Department of Chemistry, Baylor University, Waco, TX
279. March 3, 2004, The Problem of the Persistent Pollutant, Southern Methodist University, Dallas, TX
280. March 2, 2004, The Design and Development of Green Oxidation Processes, Southern Methodist University, Dallas, TX
281. March 29, 2004, Designing Catalysts for Green Oxidation Technologies, Society Committee on Education, **EMINENT SCIENTIST LECTURE**, 227th ACS National Meeting, Anaheim, CA
282. March 4, 2004, Designing Chemical Technologies for Sustainability, **UNIVERSITY CONVOCATION ADDRESS**, Baylor University, Waco, TX
283. March 1, 2004, Green Chemistry: Sustaining a High Technology Civilization, Gartner Honors Lecture Series, **UNIVERSITY CONVOCATION ADDRESS**, Southern Methodist University, Dallas, TX
284. February 26, 2004, Green Chemistry: Sustaining a High Technology Civilization, Berea College, Berea, KY
285. February 25, 2004, Designing Chemical Technologies for Sustainability, **UNIVERSITY CONVOCATION ADDRESS**, Berea College, Berea, KY
286. February 20, 2004, The Design and Development of Green Oxidation Processes, ACS Affiliates Lecture, University of Pittsburgh, Pittsburgh, PA
287. February 5, 2004, The Design of Green Oxidation Processes, Science and Humanities Scholars, Carnegie Mellon University, Pittsburgh, PA
288. January 21, 2004, The Design of Green Oxidation Processes, ALCOA Sigma Xi Chapter, New Kensington, PA
289. December 13, 2003, Designing Catalysts for Green Oxidation Technologies, Department of Chemistry, University of Hawaii at Manoa, HI
290. December 2, 2003, Design of Techniques and Technologies that Unite the Future of Chemistry with the Pursuit of a Sustainable Civilization, New Zealand Institute of Chemistry Conference, **PLENARY LECTURE**, Nelson New Zealand
291. November 27, 2003, The Design and Development of Green Oxidation Technologies, Society of Pure and Applied Coordination Chemistry (JAPAN)-10, **PLENARY LECTURE**, Auckland New Zealand
292. November 24, 2003, Designing Catalysts for Green Oxidation Technologies, Department of Chemistry, University of Western Australia, Perth, Australia
293. November 21, 2003, Sustainability Ethics: directions for green chemistry education/R&D, **WHOLE STUDENT BODY LECTURE**, Miranda College, Delhi University, New Dehli, India
294. November 20, 2003, Development of Green Oxidation Catalysis for Water Purification, Indo-US S&T Forum Workshop on Green Chemistry, Connaught Hotel, Delhi, India
295. November 18, 2003, The Design of Green Oxidation Catalysts, Indo-US S&T Forum Workshop on Green Chemistry, Connaught Hotel, Delhi, India
296. November 17, 2003, Sustainability Ethics: directions for green chemistry education/R&D, Indo- US S&T Forum Workshop on Green Chemistry, Connaught Hotel, Delhi, India
297. November 13, 2003, Green Chemistry: Sustaining a High Technology Civilization, Department of Chemistry, University of Leiden, Netherlands
298. November 6, 2003, C&E News Editorial Advisory Board, Sustainability and Innovation: the good future for chemistry, **FOCUS LECTURE FOR BOARD MEETING**, American Chemical Society Headquarters, Washington, DC
299. November 3, 2003, Designing Catalysts for Green Oxidation Technologies, Pfizer Conference on Green Chemistry,

- Groton, CT
300. October 31, 2003, Designing Catalysts for Green Oxidation Technologies, Department of Chemistry, University of North Carolina, Chapel Hill, NC
301. October 15, 2003, Design to Unite Chemical Research with the Pursuit of a Sustainable Civilization, **PLENARY LECTURE**, Annual Conference of the Brazilian Society of Analytical Chemists, Sao Luis, Brazil
302. October 7, 2003, Design to Unite Chemical Research with the Pursuit of a Sustainable Civilization, **COLLEGE CONSORTIUM ADDRESS**: Twelve Small Colleges in the Chicago area at Benedictine University, Lisle, IL
303. October 6, 2003, The Importance of *Sustainability Ethics, Toxicity and Ecotoxicity* in the Training of Future Chemists, Otterbein College, Columbus, OH
304. October 5, 2003, Sustaining Ethics and Green Chemistry: Developing a Sustainable High Technology Civilization, **UNIVERSITY CONVOCATION**, Otterbein College, Columbus, OH
305. October 2, 2003, Green Chemistry: Sustaining a High Technology Civilization, Hendrix College, Conway, AR
306. October 1, 2003, Design to Unite Chemical Research with the Pursuit of a Sustainable Civilization, **UNIVERSITY CONVOCATION ADDRESS**, Hendrix College, Conway, AR
307. September 25, 2003, Design to Unite Chemical Research with the Pursuit of a Sustainable Civilization, **KECK ENDOWED LECTURE**, Allegheny College, Meadville PA
308. July 8, 2003, Sustainability Ethics, Pan American Advanced Studies Institute on Green Chemistry, Montevideo, Uruguay
309. July 8, 2003, Persistence and Bioaccumulation in Understanding Pollutants and How to Deal with Them, Pan American Advanced Studies Institute on Green Chemistry, Montevideo, Uruguay
310. July 8, 2003, The Importance of Moral and Sustainability Ethics in the Chemical Industry: Reflections on "Trade Secrets," Pan American Advanced Studies Institute on Green Chemistry, Montevideo, Uruguay
311. July 8, 2003, Considerations on Safe Energy: Reflections on "Meltdown at Three Mile Island," Pan American Advanced Studies Institute on Green Chemistry, Montevideo, Uruguay
312. July 11, 2003, "The Design of Green Oxidation Catalysts", Pan American Advanced Studies Institute on Green Chemistry, Montevideo, Uruguay
313. July 8, 2003, Pan American Advanced Studies Institute on Green Chemistry, Montevideo, Uruguay
314. June 29, 2003, "The Importance of Sustainability Ethics, Toxicity and Ecotoxicity in the Training of Future Chemists", in ACS Blue Ribbon Education Conference "Exploring the Molecular Vision Washington, DC"
315. June 26, 2003, Training in Sustainability Ethics, Toxicity and Ecotoxicity: Fundamentals of a Safe America, Roundtable on Safety, Green Chemistry & Engineering Conference, Washington, DC
316. May 24, 2003, New Iron Oxygen Chemistry, Eckard Münck 65th Birthday Symposium, Carnegie Mellon University, Pittsburgh, PA
317. May 1, 2003, Designing Green Oxidation Catalysts, Massachusetts Green Chemistry Conference, Andover, MA
318. April 26, 2003, Catalytic Activation of Hydrogen Peroxide for Green Chemical Processes, Society of Analytical Chemists of Pittsburgh Symposium on Green Chemistry, Duquesne University, Pittsburgh, PA
319. April 30, 2003, Eliminating Persistent Pollutants with Green Catalysis, **PLENARY LECTURE**, Massachusetts Green Chemistry Conference, Andover, MA
320. April 10, 2003, Green chemistry: Sustaining a high-technology civilization, **UNIVERSITY CONVOCATION ADDRESS**, University of Tennessee, Martin, TN
321. April 10, 2003 The Problem of Endocrine Disruptors, University of Tennessee at Martin (Honors Students), Martin, TN
322. April 10, 2003 The Problem of The Persistent Pollutant, University of Tennessee at Martin (Honors Students), Martin, TN
323. April 9, 2003, Catalytic Activation of Hydrogen Peroxide for Green Chemical Processes, Kentucky Lake Section of ACS, Union City, TN May 19, 2003, "Catalytic Activation of Hydrogen Peroxide for Green Chemical Processes", **PLENARY LECTURE**, EU COST Workshop on GC and EU Conference on GC, Poitiers, France
324. March 23, 2003, Green chemistry: Sustaining a high-technology civilization, Division of Information Science, Symposium: Librarian Watch: Introduction to New Hot Areas in Chemistry, 225th ACS National Meeting, New Orleans, LA
325. February 4, 2003, Catalytic Activation of Hydrogen Peroxide for Green Chemical Processes, **PLENARY LECTURE**, Australia/New Zealand Biennial Conference on Inorganic Chemistry, University of Melbourne, Melbourne, Australia
326. January 11, 2003, Designing Catalysts for Green Oxidation Technologies, **KEYNOTE ADDRESS**, New York Division of the American Chemical Society, Columbia University, New York, NY
327. November 22, 2002, Catalytic Activation of Hydrogen Peroxide for Green Chemical Processes, New York Academy of Sciences, New York, NY
328. November 12, 2002, Catalytic Activation of Hydrogen Peroxide for Green Chemical Processes, 3rd Green Chemistry Conference of Spain, Barcelona, Spain
329. November 5, 2002, Designing Catalysts for Green Oxidation Technologies, Department of Chemistry, University of Rochester, Rochester, NY
330. October 31, 2002, Green Chemistry: Sustaining a High Technology Civilization, Lectureship Series in Environmental Studies, Brown University, Providence, RI
- 331.

332. October 24, 2002, Catalytic Activation of Hydrogen Peroxide for Green Chemical Processes, 37th Annual Midwest ACS regional Conference, Symposium on Green Catalysis, Lawrence, KS
333. October 15, 2002, Green Chemistry: Achieving a Sustainable Economy, Roundtable Discussion, Conference on Nuevas tecnologías y sostenibilidad, Universidad Internacional Menéndez Pelayo, Valencia, Spain
334. October 16, 2002, Green Chemistry: Sustaining a High Technology Civilization, Conference on Nuevas tecnologías y sostenibilidad, Universidad Internacional Menéndez Pelayo, Valencia, Spain
335. October 9, 2002, Green Chemistry: Sustaining a High Technology Civilization, Central catholic High School (90 mim. Presentation to 8 classes), Pittsburgh, PA
336. September 26, 2002, Green Chemistry: Sustaining a High Technology Civilization, Denison University, Granville, OH
337. September 23, 2002, Catalytic Activation of Hydrogen Peroxide for Green Chemical Processes, **BAYER LECTURE**, Notre Dame University, South Bend, IN
338. September 16, 2002, Catalytic Activation of Hydrogen Peroxide for Green Chemical Processes, Center for Environmental Research and Technology, University of Bremen, Germany
339. September 8, 2002, Catalytic Activation of Hydrogen Peroxide for Green Chemical Processes, Green Chemistry **GORDON CONFERENCE**, Queens College Oxford, United Kingdom
340. August 15, 2002, Designing Catalysts for Green Oxidation Technologies, NSF Workshop on Environmentally Benign Process Research Needs, Jiminy Peak Resort, Berkshires, MA
341. July 26, 2002, Catalysis as a Tool for Replacing Polluting Processes with Green Chemical Technologies, Sixth Annual Beckman Scholars Symposium, Arnold and Mabel Beckman Center of the National Academies of Sciences, Irvine, CA
342. July 22, 2002, Sustainability Science and the Economy of the Future, First German Summer School on Green and Sustainable Chemistry, Freising, Germany
343. July 22, 2002, Designing Catalysts for Green Oxidation Technologies, **PLENARY LECTURE**, First German Summer School on Green and Sustainable Chemistry, Freising, Germany
344. June 26, 2002, Activation of Hydrogen Peroxide for Green Chemical Processes, **PLENARY LECTURE**, Sixth Green Chemistry and Engineering Conference, Georgetown University, Washington, DC
345. May 28, 2002, Activation of Hydrogen Peroxide for Green Chemical Processes, University of Hong Kong, Hong Kong
346. May 22, 2002, Activation of Hydrogen Peroxide for Green Chemical Processes, **PLENARY LECTURE**, 5th International Symposium on Green Chemistry—China, Hefei City, Anhui Province, China
347. May 15, 2002, Green Chemistry: Sustaining a High Technology Civilization, Central Catholic High School, Pittsburgh, PA
348. May 13, 2002, Green Chemistry: Sustaining a High Technology Civilization, Chemical Sciences Roundtable of the national Academy of Sciences, Georgetown, DC
349. April 10, 2002, Catalytic Activation of Hydrogen Peroxide for Green Chemical Processes, Symposium on Agricultural Application in Green Chemistry, 223rd National Meeting of the American Chemical Society, Orlando, FL
350. April 16, 2002, Green Chemistry: Sustaining a High Technology Civilization, **GOLDEN GOGGLES AWARD ADDRESS**, Middle Tennessee State University, Murfreesboro, TN
351. April 7, 2002, Novel Green Chemical Applications of TAML Activators of Hydrogen Peroxide, Symposium on Catalysis in Green Chemistry, 223rd National Meeting of the American Chemical Society, Orlando, FL
352. April 5, 2002, Darkness in El Dorado: interpretations for a better future, **PLENARY LECTURE**, International Conference on “Darkness in El Dorado”, Cornell University, Ithaca, NY
353. April 4, 2002, Green Chemistry: Sustaining a High Technology Civilization, **UNIVERSITY CONVOCATION ADDRESS**, Augustana College, Rock Island, IL
354. March 27, 2002, Green Chemistry at Carnegie Mellon University, Dept. of Biological Sciences, Carnegie Mellon University, Pittsburgh, PA
355. February 14, 2002, Catalytic Activation of Hydrogen Peroxide for Green Chemical Processes, Dept. of Chemical Engineering, Carnegie Mellon University, Pittsburgh, PA
356. December 5, 2001, Catalytic Activation of Hydrogen Peroxide for Green Chemical Processes, National Conference on Molecules for Life, Joint Meeting of the NZ Society for Biochemistry and Molecular Biology, NZ Institute of Chemistry and the NZ Biotechnology Association, Napier, New Zealand
357. November 19, 2001, Sustainability Science and the Economy of the Future, Osaka City University, Osaka, Japan
358. November 17, 2001, Sustainability Science and the Economy of the Future, Commemorative Symposium for KYOUSEI Center, Nara Women’s University, Nara, Japan
359. November 16, 2001, Catalytic Activation of Hydrogen Peroxide for Green Chemical Processes, Green Chemistry Forum, Kyoto, Japan
360. November 15, 2001, Sustainability Science and the Economy of the Future, Osaka Prefecture University, Osaka, Japan
361. November 14, 2001, Catalytic Activation of Hydrogen Peroxide for Green Chemical Processes, Osaka City University, Osaka, Japan
362. October 26, 2001, Allegheny College, Meadville, PA
363. October 19, 2001, Shippensburg University, Shippensburg, PA
364. August 20, 2001, MCC-8: Symposium on metal ions, complexes and clusters in macromolecular systems, Polytechnic University, Brooklyn, NY
365. July 5, 2001, Green Chemistry: Sustaining an High Technology Civilization, Public Lecture, The Museum of Otago,

- Dunedin, New Zealand
366. July 5, 2001, Catalytic Activation of Hydrogen Peroxide for Green Chemical Processes, Department of Chemistry, University of Otago, Dunedin, New Zealand
367. July 2, 2001, 2001, Science and the Ethics of Sustainability, ChemEd Conference 2001, University of Canterbury, Christchurch, New Zealand
368. June 28, 2001, Green Chemistry: On the responsibility of chemists to promote sustainability, 90 Minute Lecture to Canterbury High School Teachers, St. Margaret's College, Christchurch, NZ
369. June 28, 2001, Catalytic Activation of Hydrogen Peroxide for Green Chemical Processes, Department of Chemistry, University of Canterbury, Christchurch, New Zealand
370. June 18, 2001, Green Chemistry: Sustaining an High Technology Civilization, Reckitt-Benkiser, Montvale, NJ
371. December 5, 2001, Green Chemistry and the Economy of the Future, **KEYNOTE LECTURE**, National Conference on Molecules for Life, Joint Meeting of the NZ Society for Biochemistry and Molecular Biology, NZ Institute of Chemistry and the NZ Biotechnology Association, Napier, New Zealand
372. November 13, 2001, Catalytic Activation of Hydrogen Peroxide for Green Chemical Processes, **KEYNOTE LECTURE**, Second National Symposium of the Green & Sustainable Chemistry Network (GSCN), Yokohama, Japan
373. July 4, 2001, Green Chemistry: Sustaining an High Technology Civilization, **PLENARY LECTURE**, ChemEd Conference 2001, Department of Chemistry, University of Canterbury, Christchurch, New Zealand
374. June 29, 2001, Green Chemistry: On the responsibility of chemists to promote sustainability, **MELLOR LECTURE** of the New Zealand Institute of Chemistry and the Royal Society of New Zealand, Wellington, New Zealand
375. May 11, 2001, Green Chemistry: Sustaining an High Technology Civilization, Applied Physics Laboratory, Johns Hopkins University, Baltimore, MD
376. April 24, 2001, Green Chemistry: Sustaining an High Technology Civilization, **KEYNOTE ADDRESS** at the Innovation and pioneering celebration of Bayer USA, Moon, PA
377. April 12, 2001, Green Chemistry: Sustaining an High Technology Civilization, Department of Chemistry, University of Illinois, Urbana-Champaign, IL
378. April 2, 2001, Green Chemistry: On the responsibility of chemists to promote sustainability, 90 Minute Workshop given under auspices of the Society and Education Division, ACS National Meeting, San Diego, CA
379. March 7, 2001, Green Chemistry: Sustaining an High Technology Civilization, Oberlin College, Oberlin, OH
380. January 18, 2001, Green Chemistry: Sustaining an High Technology Civilization, Indian Institute of Technology,, Khargpur, India
381. January 17, 2001, Green Chemistry: Sustaining an High Technology Civilization, Indian Association for the Cultivation of Science, Jadavpur, Calcutta, India
382. January 15, 2001, Green Chemistry: Sustaining an High Technology Civilization, Indian Institute of Technology, Kanpur, India
383. January 13, 2001, Green Chemistry: Sustaining an High Technology Civilization, US Environmental Protection Agency Research Laboratories, Cincinnati, OH
384. January 11, 2001, Green Chemistry: Sustaining an High Technology Civilization, IUPAC Conference on Green Chemistry, **PLENARY LECTURE**, New Dehli, India
385. November 7, 2000, Catalytic Activation of Hydrogen Peroxide for Environmentally Significant Problems, Geneva College, Beaver Falls, PA
386. October 3, 2000, Catalytic Activation of Hydrogen Peroxide for Environmentally Significant Problems, Unilever Research, Chester, England
387. November 1, 2000, Catalytic Activation of Hydrogen Peroxide for Environmentally Significant Problems, Johns Hopkins University, Baltimore, MD
388. October 24, 2000, Catalytic Activation of Hydrogen Peroxide for Environmentally Significant Problems, Yale University, New Haven, CT
389. October 3, 2000, Catalytic Activation of Hydrogen Peroxide for Environmentally Significant Problems, Unilever Research, Chester, England
390. September 22, 2000, Catalytic peroxide activation: Pulp bleaching, color and AOX abatement, 8th International Activated Carbon Conference, Moon Township, PA
391. August 24, 2000, TAML® Peroxide Activators: Chemistry and Applications in Paper and Textile Effluent Treatment, 220th ACS National Meeting, Washington, DC
392. August 10, 2000, Catalytic Activation of Hydrogen Peroxide for Environmentally Significant Problems, Atofina Corporation, King of Prussia, PA
393. August 1, 2000, Green Chemistry: On the Responsibility of Chemists to Promote Sustainability, Biennial Conference on Chemical Education, Ann Arbor, MI July 19, 2000, Catalytic Activation of Hydrogen Peroxide for Environmentally Significant Problems, **GORDON CONFERENCE** on Green Chemistry, (Moderator of this conference for the Gordon Conference Trustees), New London, CT
394. July 11, 2000, Sustaining a High Technology Civilization, Public Lecture 7:30–9:00 pm, Dunedin Public Library, Dunedin, New Zealand
395. July 2–6, 2000, SCICON Conference of New Zealand Science Educators, 90 MINUTE WORKSHOP, Green Chemistry: On the Responsibility of Chemists to Promote Sustainability, June 5, Massey University, Palmerston North,

- New Zealand
396. July 2–6, 2000, SCICON Conference of New Zealand Science Educators, **PLENARY LECTURE**, Sustaining a High Technology Civilization, June 4, Massey University, Palmerston North, New Zealand
397. July 4, 2000, Sustaining a High Technology Civilization, The Royal Society of New Zealand, The Science Museum, Palmerston North, New Zealand
398. June 29, 2000, Sustaining a High Technology Civilization, Public Lecture 7:30–9:00 pm, University of Auckland, Auckland, New Zealand
399. April 20, 2000, Green Chemistry and Sustainability, Environmental Club, Carnegie Mellon University, Pittsburgh, PA
400. March 28, 2000, Catalytic peroxide activation: Pulp bleaching, color and AOX abatement, 219th ACS National Meeting March 26–30, 2000, San Francisco, CA
401. February 22, 2000, The Design of Green Oxidation Systems, Department of Chemistry, University of Michigan, Ann Arbor, MI
402. February 16, 2000, The Design of Green Oxidation Systems, Synthetic Organic Chemical Manufacturers Association Annual Conference, New Orleans, LA
403. January 28, 2000, The Design of Green Oxidation Systems, Department of Chemistry, Youngstown State University, Youngstown, OH
404. January 12, 2000, The Design of Peroxide-Activating Catalysts, Unilever Research Headquarters, Port Sunlight, England
405. November 19, 1999, The Design of Green Oxidation Systems, Department of Chemistry, Virginia Polytechnical University, Blacksburg, VA
406. November 18, 1999, Green Chemistry: Sustaining a High Technology Civilization, Washington and Lee University, Lexington, VA
407. November 2, 1999, Catalysis is a Key to a Better Future for the Pulp and Paper Industry, TAPPI Pulping Conference, Renaissance Orlando, Orlando, FL
408. October 26, 1999, Green Chemistry: Sustaining a High Technology Civilization, Pittsburgh Chemist's Club, Durantes Restaurant, Pittsburgh, PA
409. October 16, 1999, Green Chemistry: Sustaining a High Technology Civilization, Carnegie Mellon Parents Day, Carnegie Mellon University, Pittsburgh, PA
410. October 15, 1999, Green Chemistry: Sustaining a High Technology Civilization, Allegheny Erie Society of Toxicology, Moon, PA
411. September 30, 1999, The Design of Green Oxidation Systems, Department of Chemistry and Biochemistry University of Pennsylvania, Philadelphia, PA
412. September 29, 1999, The Design of Green Oxidation Systems, Rohm and Haas Corporation, Springhouse, PA
413. September 23, 1999, Green Chemistry: Sustaining a High Technology Civilization, Central Catholic High School, Pittsburgh, PA
414. September 13, 1999, The Design of Green Oxidation Systems, Department of Biochemistry, University of Wisconsin, Madison, WI
415. September 8, 1999, The Design of Chemistry Labs of the 21st Century, Meeting of Architectural Firms and Govt. Agencies, Boston MA
416. August 12, 1999, The Design of Sustainable Oxidation Systems, GSF Research Center of München, Ingolstadter Landstr.1, 85764 Neuherberg, Germany
417. July 23, 1999, Green Chemistry: Sustaining a High Technology Civilization, Pennsylvania Governor's Science Institute, **PLENARY LECTURE**, Carnegie Mellon University, Pittsburgh, PA
418. July 1, 1999, The Seven Promises of Catalysis in the Pulp and Paper Industry, Green Chemistry and Engineering Conference, National Academy of Sciences, Washington, DC
419. April 26, 1999, The Seven Promises of Catalysis in the Pulp and Paper Industry, Lecture to the Bleaching Committee of TAPPI, Hattiesburg MS
420. April 22, 1999, The Design of Green Oxidants, To the Chemistry Teachers of Pittsburgh and their most gifted students, Central Catholic High School, Pittsburgh, PA
421. January 28, 1999, The Design of Green Oxidants, **GORDON CONFERENCE** on Metals in Biology, This 2 hour lecture was the Thursday evening after diner speech that both closed the Metals in Biology Gordon Conference and opened the young scientist Gordon Conference on Metals in Biology
422. January 25, 1999, Green Up or Clean Up: The Design of Green Oxidants, Conference on Organometallic Chemistry in the South Pacific to honor Warren Roper on the occasion of his 60th birthday, Auckland, New Zealand
423. November 5, 1998, The Design of Green Oxidants, University of Vermont, Burlington, VT
424. October 28, 1998, New Efficient, Selective, Totally Chlorine Free Wood Pulp Bleaching Technology, 1998 TAPPI Pulp Conference, Montreal, Canada
425. October 23–25, 1998, Green Chemistry: Sustaining a High Technology Civilization, EPA/NSF Green Chemistry Education Kick-off Meeting, National Academy of Sciences, Washington, DC
426. October 20, 1998, The Design of Green Oxidants, Unilever Research, Port Sunlight, England
427. August 25, 1998, New, Selective, Efficient, Totally Chlorine-Free Wood Pulp Bleaching Technology, Symposium to Honor Career of Daryle Busch (Current President-Elect of ACS), 216th ACS Meeting, Boston, MA

428. August 23, 1998, Green Chemistry Education, Green Chemistry Education: International Perspectives, ACS Symposium, ACS Meeting, Boston, MA
429. July 28, 1998, Green Chemistry: Sustaining a High Technology Civilization, **THE PLENARY LECTURER** to Gifted High School Students of Osaka at symposium on Green Earth Science, Osaka-City University, Osaka, Japan
430. July 27, 1998, The Design of Green Oxidants, Department of Material Science Osaka-City University, Osaka, Japan
431. July 25, 1998, The Design of Green Oxidants, **THE PLENARY LECTURER** 5th International Symposium of the Society Of Pure And Applied Coordination Chemistry of Japan, "Molecular Design of Functional Metal Complexes for Green Earth Science", Kogakuin University, Tokyo Japan, July 25, **AWARD LECTURE** for the 1997 Prize of Society of Pure And Applied Coordination Chemistry of Japan
432. July 22, 1998, The Design of Green Oxidants, **GORDON CONFERENCE** on Inorganic Chemistry, Salve Regina College, Newport, RI
433. July 1, 1998, The Design of Green Oxidants, Green Chemistry and Engineering Conference, National Academy of Sciences, Washington, DC
434. June 12, 1998, The Design of Green Oxidants, NSF Inorganometallic Workshop, Knoxville, TN
435. May 12, 1998, Development of Long-Lived Hydrogen Peroxide Activators for Pulp Bleaching, Annual Spring Meeting of the Pulp Bleaching Committee of the Association of The Pulp and paper Industry, Wisconsin Rapids, WI
436. January 30, 1998, The Design of Green Oxidants, **KEYNOTE LECTURE**, Annual Meeting of the Chemistry Department Heads and Full Professors of Australia, Canberra, Australia
437. September 30, 1997, "The Development of Green Oxidants": **PLENARY LECTURE**, International Conference on Green Chemistry: Challenging Perspectives, Venice, Italy
438. June 23, 1997, "The Development of Green Oxidants": **PLENARY LECTURE**, 1997 Green Chemistry and Engineering Conference, Implementing Vision 2020 for the Environment, National Academy of Sciences, Washington, DC
439. 1996, Designing Ligands for Oxidizing Complexes, Department of Civil and Environmental Engineering, Carnegie Mellon University, Pittsburgh, PA
440. November 6, 1996, Academy of Life-Long Learning, Carnegie Mellon University, Pittsburgh, PA
441. September 3, 1996, The Design of Green Oxidants, Department of Chemistry, Victoria University, Wellington, New Zealand
442. September 3, 1996, Ligand-Design Based Approaches for Controlling Exchange Coupling, Department of Chemistry, Victoria University, Wellington, New Zealand
443. July 29–August 30, 1996 Ten lectures, Distinguished Visitor, Department of Chemistry, University of Auckland, Auckland New Zealand
444. August 14, 1996, Distinguished Scientist Seminar, Department of Chemistry, University of Auckland, Auckland New Zealand
445. July 27, 1996, Invited speaker at the First **GORDON CONFERENCE** on Environmentally Benign Organic Chemistry, New England College, Henniker, NH
446. August 7, 1996, Distinguished Scientist Seminar, Department of Chemistry, University of Auckland, Auckland New Zealand
447. March 27, 1996, Massachusetts Institute of Technology, Boston, MA
448. March 17, 1996, North Carolina State University, Raleigh, NC
449. January 30, 1996, International Meeting on Macrocyclic Chemistry, Wellington, New Zealand
450. September 17, 1995, NATO Workshop, *Magnetism: A Supramolecular Function*, Carcans, France
451. June 27, 1995, First Midwest Meeting in Bioinorganic Chemistry Meeting, Minneapolis, MN
452. May 25, 1995, Clorox Chemical Company, Pleasanton, CA
453. May 24, 1995, Electrochemical Society International Meeting, Reno, NV
454. February 24, 1995, Hamilton College, Clinton, NY
455. February 8, 1995, University of Delaware, Newark, DE
456. July 1994, Industrial and Government visitors to the Environmental Open House, Carnegie Mellon University, Pittsburgh, PA
457. September 15, 1994, University of Vermont, Burlington, VT
458. August 2, 1994, 13th Biennial Conference on Chemical Education, Bucknell University, Lewisburg, PA
459. July 13, 1994, EPA Workshop on Green Design, Cincinnati, OH
460. Jan 19, 1994, Air Products Corporation, Allentown, PA
461. October 15, 1993, Baylor University, Waco, TX
462. October 13, 1993, University of Texas, Austin, TX
463. September 30, 1993, Columbia University, New York, NY
464. September 29, 1993, Princeton University, Princeton, NJ
465. September 28, 1993, University of Pennsylvania, Philadelphia, PA
466. March 5, 1993, University of Kansas, Lawrence, KS
467. March 4, 1993, Kansas State University, Manhattan, KS

468. February 26, 1993, ARCO Chemical Company, MD
469. January 19, 1993, Air Products, Allentown, PA
470. October 15, 1992, Gettysburg College, Gettysburg, PA
471. October 1, 1992, Rensselaer Polytechnic Institute, Troy, NY
472. May 7-8, 1992 – Participant in NSF National Workshop on the teaching of Chemistry in Undergraduate Laboratories, Washington, DC
473. April 27, 1992 – ARCO Chemical Company, MA
474. April 8, 1992 – Invited speaker in the Symposium on New Reagents in Inorganic and Organometallic Chemistry, National ACS Meeting, San Francisco, CA
475. November 11, 1991 – Departmental Colloquium, University of Chicago, Chicago, IL
476. October 1, 1991 – Yale University, New Haven, CT
477. April 18, 1991 – Inorganic seminar to faculty and students of University of Akron, Kent State University, Mt. Union College, and several other colleges, Kent, OH
478. March 28, 1991 – Indiana University, Bloomington, IN
479. March 1, 1991 – ARCO Chemical Company, MD
480. February 1, 1991 – **PLENARY LECTURE**, International Conference on Inorganic Chemistry, University of Waikato, Hamilton, New Zealand
481. August, 27 1990 – National ACS Conference – Symposium on “Ligand Design in Regulating Redox Reactions”, Washington, DC
482. April 19, 1990, Pittsburgh/Cleveland Catalysis Soc., Cleveland, OH
483. April 17, 1990 – Pennsylvania State University, College Station, PA
484. †April 27, 1990: Seminar on *ITEC* to Pennsylvania High School and College Teachers at the University of Pittsburgh, Pittsburgh, PA
485. †April 6, 1990 – Seminar on *ITEC* to Pennsylvania Science Educ. Soc. Allegheny College, Meadville, PA
486. †January 11, 1990 – Education Directorate Officers, NSF, Washington, DC
487. December 6, 1989 – University of Delaware, Newark, DE
488. October 24, 1989 – University of Maryland, College Park, MD
489. October 6, 1989 – Duquesne University, Pittsburgh, PA
490. November 18, 1988 – Santa Clara University, Santa Clara, CA
491. †October 11, 1989 – Lord Corporation and Foundation Executives, Pittsburgh, PA
492. †July 26, 1989 – Pittsburgh High School Teachers, Pittsburgh, PA
493. †May 24, 1989 – Presentation to Merck Representatives at CMU (leading ultimately to Corporate Grant), Pittsburgh, PA
494. †May 22, 1989 – Select Group of CMU Trustees, Pittsburgh, PA
495. †March 21, 1989 – International Conference on Global Crises, Chicago, IL
496. November 10, 1988 – W. R. Grace Company, MD
497. October 27, 1988 – Clemsen University, Clemsen, SC
498. October 4, 1988 – Mellon College of Science Research Seminar, Pittsburgh, PA
499. †September 19, 1988, Duquesne University Presentation to High School Teachers, Pittsburgh, PA
500. †July 21 1988, The Chemical Manufacturers Association, The National Science Foundation, The American Chemical Society, Washington, DC
501. †June 28, 1988, The Mobay Corporation Administration, Pittsburgh, PA
502. †May 18, 1988, The Kresge Foundation, Detroit, MI
503. †May 11, 1988, Calgon Carbon Company, Pittsburgh, PA
504. April 20, 1988 – Bucknell University, Lewisburg, PA
505. April 7, 1988 – Kent State University, Kent, OH
506. †April 4, 1988, The Duquesne Club presentation to Pittsburgh Corporate Executives (leading ultimately to Corporate Grant), Pittsburgh, PA
507. †March 29, 1988, The Dreyfus Foundation, New York, NY
508. March 23, 1988 – The University West Virginia, Morgantown, WV
509. February 11, 1988 – The University of Pittsburgh, Pittsburgh, PA
510. December 4 1987 – Baylor University, Waco, TX
511. January 1987 – Standard Oil, Cleveland, OH
512. January 1987 – The University of Southern California, Los Angeles CA
513. November 20, 1986 – Carnegie Mellon University, Pittsburgh, PA
514. November 14, 1986 – Amoco Chemical Company, Chicago, IL
515. November 4, 1986 – Dow Chemical Company, Midland, MI
516. November 3, 1986 – Dow Chemical Company, Midland, MI
517. October 7, 1986 – University of Southern California, Los Angeles, CA
518. September, 1986 – University of Nebraska, Lincoln, NE
519. February 25–27, 1986 – Organizer of and speaker in the Industrial Associates Conference on Oxidation Chemistry held

- at Caltech, Pasadena, CA
520. December 4, 1985 – Simon Fraser University, Burnaby, British Columbia, Canada
521. December 3, 1985 – Departmental Seminar at the University of British Columbia, Vancouver, British Columbia, Canada
522. December 2, 1985 – University of Washington, Seattle, WA
523. November 22, 1985 – University of California, Berkeley, Berkeley, CA
524. November 20, 1985 – University of California, Davis, Davis, CA
525. November 19, 1985 – Stanford University, Stanford, CA
526. November 16, 1985 – Northwestern University, Evanston, IL
527. November 15, 1985 – Northwestern University, Evanston, IL
528. November 14, 1985 – Hope College, Holland, MI
529. November 12–13, 1985 – University of Illinois, Champaign–Urbana, IL
530. November 11, 1985 – SOHIO, Cleveland, OH
531. November 6, 1985 – University of Chicago, Chicago, IL
532. October 24, 1985 – Carleton College, Northfield, MN
533. October 23, 1985 – 3M Company, St. Paul, MN
534. October 22, 1985 – ACS Inorganic Topical Group Seminar, University of Minnesota, St. Paul, MN
535. October 21, 1985 – University of Wisconsin, Madison, Madison, WI
536. October 17, 1985 – Ohio State University, Columbus, OH
537. October 16, 1985 – Iowa State University, Ames, IA
538. October 15, 1985 – University of Iowa, Iowa City, IA
539. October 14, 1985 – Washington University, St. Louis, MO
540. October 10–11, 1985 – Invited speaker in Symposium on Oxidation Chemistry at Monsanto Company, St. Louis, MO
541. July 29–August 2, 1985 – Invited speaker at the Organometallic **GORDON CONFERENCE**, Hawthorne College, Antrim, NH
542. June 10–12, 1985 – Invited speaker in Symposium on Unusual Oxidation States at the ACS Regional Meeting, Purdue University, West Lafayette, IN
543. May 24, 1985 – Harvard/MIT joint seminar in Inorganic Chemistry, Cambridge, MA
544. May 21, 1985 – University of California, Los Angeles, Los Angeles, CA
545. May 17, 1985 – Exxon Research and Engineering Company, Annandale, NJ
546. May 15, 1985 – GTE Laboratories, Waltham, MA
547. May 14, 1985 – Texaco Inc., Beacon Hill, NY
548. May 13, 1985 – Air Products and Chemicals, Inc., Allentown, PA
549. April 22–26, 1985 – Invited speaker at the US/USSR Symposium on Environmentally Related Catalysis, Moscow, USSR
550. April 19, 1985 – Rohm and Haas Company, Spring House, PA
551. April 18, 1985 – Columbia University, New York, NY
552. January 24, 1985 – Departmental Seminar, Harvey Mudd College, Claremont, CA
553. October 26, 1984 – University of California, Santa Barbara, Santa Barbara, CA
554. December 16–21, 1984 – 1984 International Chemical Congress of Pacific Basin Societies, (One of the organizers of and speakers in the Symposium on “New Developments in Coordination Chemistry: Oxygen and Oxidation”), Honolulu, HI
555. September 24–28, 1984 – Invited participant at the Fourth International Symposium on Homogeneous Catalysis, Leningrad, USSR
556. July 9, 1984 – Cambridge University, Cambridge, England
557. July 5, 1984 – Oxford University, Oxford, England
558. June 24–29, 1984 – Member of the International Advisory Committee and speaker in the International Oxidations”, Padova, Italy Symposium and Advanced Research Workshop on “Activation of Dioxygen Species and Homogeneous Catalytic Oxidation Chemistry”; Report Editor
559. June 8, 1984 – Rohm and Haas Company, Spring House, PA
560. June 6, 1984 – Invited speaker at the symposium entitled “Advances in Catalytic Science – New Eyes/New Insights,” University of Delaware, Newark, Delaware and participant in the annual review meeting of the Center for Catalytic Science and Technology, DE
561. June 4, 1984 – E. I. du Pont de Nemours and Company, Wilmington, DE
562. May 30–June 2, 1984 – Invited speaker at the 1984 National Science Foundation Organometallic Chemistry Workshop, The University of North Carolina, Chapel Hill, NC
563. May 29, 1984 – Dow Chemical Company, Midland, MI
564. May, 1984 – University of California, San Diego, La Jolla, CA
565. April 17, 1984 – University of Southern California, Los Angeles, CA
566. April 8–12, 1984 – Invited speaker in Symposium on Carbon Dioxide Chemistry at the 187th National ACS Meeting, St. Louis, MO

- 567. March 15, 1984 – University of California, Irvine, Irvine, CA
- 568. August 8–12, 1983 – Invited speaker at the 1983 Inorganic Chemistry **GORDON CONFERENCE**, (Brewster Academy), Wolfeboro, NH
- 569. April 15, 1983 – California State University, Northridge, Northridge, CA
- 570. March 20–25, 1983 – Session Chairman, 185th National ACS Meeting, Seattle, WA
- 571. March 20–25, 1983 – 185th National ACS Meeting, Seattle, WA
- 572. March 16–18, 1983 – Invited speaker at the Conference on Frontiers of Catalysis, California Institute of Technology, 22 Gates, Pasadena, CA
- 573. February 28, 1983 – Loma Linda University, La Sierra Campus, Loma Linda, CA
- 574. June 23–26, 1981 – Invited speaker at the 1981 NSF National Organometallic Chemistry Workshop, Asilomar, Pacific Grove, CA

Exhibit B

Statement of Miriam L. Diamond

February 6, 2015

I, Miriam L. Diamond, am writing this statement in support of the Petition to the CPSC to regulate four categories of household products containing non-polymeric additive organohalogen flame retardants.

1. Personal Information. I am a Professor in the Department of Earth Sciences at the University of Toronto with cross appointments in the Department of Chemical Engineering and Applied Chemistry, Dalla Lana School of Public Health, School of the Environment, and Department of Physical and Environmental Sciences at the University of Toronto. I received a B.Sc. from the University of Toronto in 1976, a M.Sc. in Zoology from the University of Alberta in Edmonton Alberta in 1980, a M.Sc.Eng. in Mining Engineering from Queen's University in Kingston, Ontario, and a PhD. in Chemical Engineering and Applied Chemistry from University of Toronto in 1990. My research concerns the sources, emissions and fate of environmental chemicals and exposure of these chemicals to humans and ecosystems. I am a Fellow of the Royal Geographic Society. I have served on the Board of Directors and Executive Committee of the Society of Environmental Toxicology and Chemistry, and have been an Associate Editor of the journal *Environmental Science and Technology*, the leading journal in the field, since 2012. I have held the INNOLEC Science Guest Chair in Chemistry, Masarykova Univerzita, Czech Republic, been a visiting scholar in the Department of Applied Environmental Science at Stockholm University, and the Joseph R. Meyerhoff Visiting Professorship at the Weizmann Institute in Israel. In 2008 I was appointed by the Minister of Environment of the Province of Ontario to co-chair the Toxics Reduction Scientific Expert Panel that brought in Canada's first Toxic Reduction Act. I have served on numerous advisory panels for the U.S. Environmental Protection Agency and on a National Academies of Sciences expert panel, and I am a member of the Canadian Chemicals Management Plan Science Committee. I have attached my CV and list of publications.

2. Personal Expertise. A major focus of my research has been documenting emissions and fate of semi-volatile organic compounds or SVOCs (those with boiling points between 240° and 400°C according to WHO 1997¹) in the indoor and outdoor urban environments. In 2005 we published the first paper to show that household dust, and not diet, was a major exposure route of the flame retardant polybrominated diphenyl ethers (PBDEs). This marked a radical shift in understanding sources and pathways of these and other SVOCs that are used in consumer products.² We were also the first to quantitatively estimate the emissions and fate of PBDEs in an indoor environment using a mathematical model that we developed^{3,4} and, in conjunction with Prof. Stuart Harrad of the University of Birmingham, we measured house dust levels of organohalogen flame retardants.^{5,6,7} Additionally, we documented the release into the indoor environment of deca-BDE, although it had not been expected to migrate from the products to which it was added because of its very low vapour pressure.⁸

3. Working with colleagues, we have measured concentrations of PBDEs in indoor dust, and in indoor and outdoor air that originate from indoor products and building materials.^{9,10,11,12} Our data show that PBDEs migrate from consumer products into the indoor air and dust, and from there make it into the outdoor environment. In this study, we measured the geographic pattern of PBDE outdoor air concentrations at locations across Toronto, Canada, and found that it coincides with the inventory of PBDE-containing products found indoors.^{13,14,15} In other words, we determined that PBDEs were migrating from consumer products into the indoor air, and then into outdoor air. The only plausible explanation for this spatial pattern of PBDEs in outdoor air is that the PBDEs migrated out of consumer products, as industries using PBDEs do not have this geographic pattern in Toronto.



4. Other organohalogen flame retardants in addition to PBDEs migrate from consumer products into the indoor environment, including into house dust. We determined this by sampling and analyzing 12 additive organohalogen flame retardants plus PBDEs in the surface wipes of casings of electronic and electrical equipment and the dust of 35 homes in the Toronto area.¹⁶ We found particularly elevated concentrations of penta-, octa- and decaBDE mixtures, tris(1,3-dichloro-2-propyl)phosphate (TDCPP), tetrabromobenzotriazole (TBB), bis(2-ethylhexyl) tetrabromophthalate (TBPH), decabromodiphenyl ethane (DPDPE) and octabromotrimethylphenylindane (OBIND) in both surface wipes and house dust samples.^{17,18,}

19

5. In points 3 and 4, I explained that specific organohalogen flame retardants migrate from consumer products to indoor and outdoor air based on evidence from measurements. We know that organohalogen flame retardants as a class (not just the specific chemicals we identified in house dust) tend to migrate out of consumer products because they are typically used in additive form (i.e. not chemically bonded to the materials containing them) and because of their physical-chemical properties.²⁰ The first critical physical-chemical property is that organohalogen flame retardants are semi-volatile organic compounds (SVOCs) and the second property is that these compounds are persistent indoors:

i) Organohalogen flame retardants as a class are SVOCs²⁰. According to the U.S. EPA,²¹ a chemical can be classified as a SVOC if its boiling point (a physical-chemical property) is greater than that of water and may vapourize (change from liquid or solid phase to vapour phase as measured by a chemical's vapour pressure) at or above room temperatures. A SVOC can exist simultaneously in a solid phase (i.e., as a flame retardant in a polymer), AND in the vapour phase (i.e., in air). The significance of these flame retardants being SVOCs is that over time, some of the molecules of an organohalogen flame retardant added to a polymer will migrate into air. The migration is purely a function of the chemical being a SVOC and that it is added to, rather than reacted with or bound to, the polymer.

ii) Organohalogen flame retardants are persistent indoors. Their persistence is a desired property for a flame retardant, i.e., the molecule will not break down during the life time of the product to which it has been added. However, the implication of this persistence is that the chemical will not break down indoors after it has migrated from the product.

6. The phenomenon of human exposure to constituents in house dust has been well established in the asthma and allergy field.²² As noted above, our exposure analysis demonstrated that house dust is also a major source of human exposure to penta- and octaBDEs.²³ This finding has been corroborated by other exposure studies, including studies of organohalogen flame retardants in addition to PBDEs.^{24,25,26,27} However, the most recent research suggests that organohalogen concentrations in house dust may be a proxy for another exposure pathway, that of direct transfer from product-to-hand, followed by hand-to-mouth transfer.^{28,29} In other words, the most recent research indicates that humans are exposed to organohalogen flame retardants by touching consumer products in which these chemicals are present in additive form and by touching house dust which also contains organohalogen flame retardants. The measurement of organohalogen flame retardants in house dust is thus an indicator of the levels of organohalogen flame retardants in the home that residents come into contact with, both when they touch consumer products containing these chemicals and when they touch or inhale the dust itself.

7. In summary, there is a sufficient body of knowledge to conclude that all organohalogen flame retardants – because they are SVOCs – will tend to migrate out of the consumer products in which they are present in



Earth Sciences
UNIVERSITY OF TORONTO

additive form, resulting in human exposure. Once released indoors, organohalogen flame retardants will accumulate in indoor dust, and they are persistent in the indoor environment. Humans are exposed to organohalogen flame retardants as a result of direct contact with consumer products and with indoor dust containing these compounds. The inevitability of this human exposure, combined with the evidence showing that these compounds have toxicity, leads to the conclusion that all organohalogen flame retardants present in consumer products in additive form pose significant risks to human health.

I therefore urge the CSPC to ban the use of additive organohalogen flame retardants in the four consumer product categories covered in this petition.

Miriam Diamond

Miriam Diamond, Ph.D.
Professor,
University of Toronto



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- ¹ WHO, World Health Organization. 1997. Environmental Health Criteria 192, International Programme on Chemical Safety. Geneva. 81 p. ISBN 9241571926.
- ² JONES-OTAZO H, JP CLARKE, ML DIAMOND, JA ARCHBOLD, G FERGUSON, T HARNER, MG RICHARDSON, JJ RYAN, B WILFORD. 2005. Is house dust the missing exposure pathway for PBDEs? An analysis of urban fate and human exposure to PBDEs. *Environ Sci Technol.* 39:5121-5130.
- ³ ZHANG X., ML DIAMOND, SJ HARRAD, C IBARRA. 2009. Multimedia modeling of PBDE emissions and fate indoors. *Environ Sci Technol.* 43(8):2845-2850.
- ⁴ ZHANG X, M ROBSON, ML DIAMOND, C IBARRA, SJ HARRAD. 2011. Polybrominated diphenyl ethers (PBDEs) and polychlorinated biphenyls (PCBs) indoors in Toronto: concentrations, air/dust distribution, sources and emissions. *Environ Sci Technol.* 45:3268-3274.
- ⁵ ABDALLAH MA-E, S HARRAD, C IBARRA, M DIAMOND, L MELYMUK, M ROBSON, A COVACI. 2008. Hexabromocyclododecanes in indoor dust from Canada, the United Kingdom and the United States. *Environ Sci Technol.* 42(2):459-464.
- ⁶ HARRAD S, C IBARRA, M DIAMOND, L MELYMUK, M ROBSON+, J DOUWES, L ROOSENS, AC DIRTU, A COVACI. 2008. Polybrominated diphenyl ethers in domestic indoor dust from Canada, New Zealand, United Kingdom and United States. *Environ Internat.* 34:232-238.
- ⁷ HARRAD S, C IBARRA, M ROBSON, L MELYMUK, X ZHANG, M DIAMOND, J DOUWES. 2009. Polychlorinated biphenyls in indoor dust from Canada, New Zealand, United Kingdom and United States: implications for human exposure. *Chemosphere.* 76(2):232-238.
- ⁸ BUTT CM, ML DIAMOND, J TRUONG, MG IKONOMOU, AFH TER SCHURE. 2004. Spatial distribution of polybrominated diphenyl ethers in southern Ontario as measured in indoor and outdoor window organic films. *Environ Sci Technol.* 38:724-731.
- ⁹ HARRAD S, C IBARRA, M DIAMOND, L MELYMUK, M ROBSON, J DOUWES, L ROOSENS, AC DIRTU, A COVACI. 2008. Polybrominated diphenyl ethers in domestic indoor dust from Canada, New Zealand, United Kingdom and United States. *Environ Internat.* 34:232-238.
- ¹⁰ HARRAD S, C IBARRA, M ROBSON+, L MELYMUK, X ZHANG, M DIAMOND, J DOUWES. 2009. Polychlorinated biphenyls in indoor dust from Canada, New Zealand, United Kingdom and United States: implications for human exposure. *Chemosphere.* 76(2):232-238.
- ¹¹ ZHANG X, M ROBSON, ML DIAMOND, C IBARRA, SJ HARRAD. 2011. Polybrominated diphenyl ethers (PBDEs) and polychlorinated biphenyls (PCBs) indoors in Toronto: concentrations, air/dust distribution, sources and emissions. *Environ Sci Technol.* 45:3268-3274.
- ¹² MELYMUK L, M ROBSON, PA HELM, ML DIAMOND. 2012. PCBs, PBDEs and PAHs in Toronto air: spatial and seasonal trends and implications for contaminant transport. *Sci Total Environ.* 429:272-280. doi:10.1016/j.scitotenv.2012.04.022
- ¹³ MELYMUK L, M ROBSON, PA HELM, ML DIAMOND. 2012. PCBs, PBDEs and PAHs in Toronto air: spatial and seasonal trends and implications for contaminant transport. *Sci Total Environ.* 429:272-280.
- ¹⁴ MELYMUK L, M ROBSON, PA HELM, ML DIAMOND. 2013. Application of land use regression to identify sources and assess spatial variation in urban SVOC concentrations. *Environ Sci Technol.* 47(4):1887-1895.
- ¹⁵ CSISZAR SA, SM DAGGUPATY, ML DIAMOND. 2013. SO-MUM: a coupled atmospheric transport and multimedia model used to predict intraurban-scale PCB and PBDE emissions and fate. *Environ Sci Technol.* 47:436-445.
- ¹⁶ ABBASI G, SAINI, A, GOOSEY, E, DIAMOND M. Forthcoming. 2014. Halogenated flame retardants in Canadian house dust. *Integr Environ Assess Manag.*



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- ¹⁷ GOOSEY, ER, SANAI A, ABBASI G, CHAUDHURI S, DIAMOND ML. 2013. Sources and multimedia partitioning of BFRs indoors. *Organohalogen Compd.*
- ¹⁸ GOOSEY E., A SAINI, S CHAUDHURI, ML DIAMOND. 2013. Assessment of the prevalence and exposure to new flame retardants (NFRs) in Canadian indoor environments. Report to Health Canada. 93 pp.
- ¹⁹ ABBASI G, SAINI, A, GOOSEY, E, DIAMOND M. Forthcoming. 2014. Halogenated flame retardants in Canadian house dust. *Integr Environ Assess Manag.*
- ²⁰ SERODIO, D. 2015. Novel halogenated and organophosphate flame retardants: do novel flame retardants have the same environmental fate as the compounds they are replacing? M.A.Sc. Thesis, Department of Earth Sciences, University of Toronto.
- ²¹ <http://www.epa.gov/reg3hwmd/bf-lr/regional/analytical/semi-volatile.htm>
- ²² ROBERTS JW, WT BUDD, MG RUBY, D CAMANN, RC FORTMANN, RG LEWIS, LA WALLACE, TM SPITTLER. 1992. Human exposure to pollutants in the floor dust of homes and offices. *J Expo Anal Environ Epi.* 2:127-146.
- ²³ JONES-OTAZO H, JP CLARKE, ML DIAMOND, JA ARCHBOLD, G FERGUSON, T HARNER, MG RICHARDSON, JJ RYAN, B WILFORD. 2005. Is house dust the missing exposure pathway for PBDEs? An analysis of urban fate and human exposure to PBDEs. *Environ Sci Technol.* 39:5121-5130.
- ²⁴ JOHNSON PI, STAPLETON HM, SJODIN A, MEEKER JD. 2010. Relationships between polybrominated diphenyl ether concentrations in house dust and serum. *Environ Sci Technol.* 44:5627-5632.
- ²⁵ KARLSSON M, JULANDER A, VAN BAVEL B, HARDELL L. 2007. Levels of brominated flame retardants in blood in relation to levels in household air and dust. *Environ Int.* 33(1):62-69.
- ²⁶ LORBER M. 2008. Exposure of Americans to polybrominated diphenyl ethers. *J Exposure Sci Environ Epi.* 18(1):2-19.
- ²⁷ WU N, HERMANN T, PAEPKE O, TICKNER J, HALE R, HARVEY E, LA GUARDIA M, MCCLEAN MD, WEBSTER TF. 2007. Human exposure to PBDEs: associations of PBDE body burdens with food consumption and house dust concentrations. *Environ Sci Technol.* 41(5):1584-1589.
- ²⁸ WATKINS DJ, MCCLEAN, MD, FRASER AJ, WEINBERG J, STAPLETON HM, SJODIN A, WEBSTER TF. 2011. Exposure to PBDEs in the office environment: evaluating the relationships between dust, handwipes, and serum. *Environ Health Persp.* 119:1247-1252.
- ²⁹ STAPLETON HM, EAGLE S, SJOEDIN, WEBSTER TF. 2012. Serum PBDEs in a North Carolina toddler cohort: associations with handwipes, house dust, and socioeconomic variables. *Environ Health Persp.* 120(7):1049-1054.

MIRIAM LEAH DIAMOND - CURRICULUM VITAE

A. BIOGRAPHICAL INFORMATION

1. PERSONAL

Name: **Miriam Leah Diamond**

University address: Department of Earth Sciences
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Toronto, Ontario
Canada, M6G 2T3

Phone: (416) 533-1303

Citizenship: Canadian

2. DEGREES

B.Sc., 1976, Biology, University of Toronto, Toronto, Ontario

M.Sc., 1980, Zoology, University of Alberta, Edmonton, Alberta
“Plumage variability in redpolls (*Carduelis flammea* and *C. hornemanni*, L): A test of Rohwer's status signalling hypothesis”.
Thesis supervisor: W.A. Fuller.

M.Sc.Eng., 1984, Mining Engineering, Queen's University, Kingston, Ontario
“An environmental investigation of the Kognak River at Cullaton Lake Gold Mine”.
Thesis supervisor: J.A. Meech

Ph.D., 1990, Chemical Engineering and Applied Chemistry, University of Toronto, Toronto, Ontario
“Modelling the fate and transport of arsenic and other inorganic chemicals in lakes”.
Thesis supervisor: D. Mackay

3. EMPLOYMENT

- 2012-present Associate Editor, *Environmental Science and Technology*
- 2012-present Professor, University of Toronto, Department of Earth Sciences
- 2012-present Cross-appointed to School of the Environment
- 2010-present Cross-appointed to Department of Physical and Environmental Sciences, University of Toronto at Scarborough
- 2003-present Cross-appointed, University of Toronto, Dalla Lana Faculty of Public Health Sciences
- 2007-2012 Cross Appointed to Centre of the Environment
- 2007-2008 Research Director, Centre for Environment
- 2002-2012 Professor, University of Toronto, Department of Geography
- 2001-2002 Acting Director, Collaborative Program in Toxicology, Institute for Environmental Studies
- 1997-2002 Associate Professor, University of Toronto, Department of Geography.
- 1997-present Member, School of Graduate Studies.
- 1999-2003 Associate, Center for Environmental Research, Education and Training, University of Maryland, Baltimore County
- 1993-1997 Assistant Professor, University of Toronto, Department of Geography.
- 1992-present Cross-appointed Professor, Department of Chemical Engineering and Applied Chemistry.
- 1995-1997 Public Health Associate, City of Toronto Department of Public Health.
- 1991-1993 Assistant Professor, University of Toronto, Innis College and Department of Geography.
- 1990-1991 Research Associate, University of Toronto, Institute for Environmental Studies.
- 1990 Post-Doctoral Fellow, University of Toronto, Institute for Environmental Studies.
- 1989 Lecturer, University of Toronto, Institute for Environmental Studies.
- 1985-present Consultant, Self-Employed:
- California Air Resource Board, review of proposal for diesel fuel additive 2010.
 - Lake Onondaga Review panel, 2007-present.
 - Environment Canada, 2004.
 - United States Environmental Protection Agency, 2003.
 - CH2M Hill, Subcontractor for Carson River Superfund Site, 2000-2003.
 - Expert witness, Ontario Municipal Board Hearing, Oak Ridges Moraine, 2001-2002.
 - Health Promotion and Environmental Protection Office, City of Toronto, 2000-2001.
 - Environment Canada, National Water Research Institute, 1998-1999.
 - Environment & Ecology, Inc., Technical Advisor and subcontractor for Carson River Superfund Site, Spring 1993-1998.
 - Minnesota Pollution Control Agency, 1993-1994, 1995-1996.
 - Technical advisor to project funded by the Ontario Min of the Environment, Bay of Quinte RAP, 2001-2003.
 - Ontario Ministry of Environment, Water Resources Branch, 1989-1990.
 - City of Toronto, Environmental Protection Office, 1990, 1991.
 - Environment Canada, National Water Research Institute, 1989-1990.
 - Environment Canada, National Water Research Institute, 1989.
 - Environment Canada, Inland Waters Directorate April-June, 1988.
 - Federal Department of Energy, Mines and Resources, Canada Centre for Remote Sensing, 1985.
- 1984 Limnologist, Ontario Ministry of Natural Resources, Ontario Geological Survey, Geophysics/Geochemistry Section, Toronto, Ontario.

Maternity leaves Sept to Dec 1991, and Feb to May 1995.

Sabbatical leaves January to December 1998, July to Dec 2002, July 2008 to June 2009.

4. HONOURS AND AWARDS

- 2014 Visiting Scientist, Stockholm University, Department of Applied Environmental Science.
2011 INNOLEC Science Guest Chair in Chemistry, Masarykova Univerzita, Czech Republic.
2010 Fellow of the Royal Geographical Society
2007 Canadian Environmental Scientist of the Year, Royal Canadian Geographical Society.
2005 Joseph R. Meyerhoff Visiting Professorship. Weizmann Institute, Israel.
1999-02, 04, 05 Dean's Excellence Award, Faculty of Arts and Science, University of Toronto
1999 2003 Premier's Research Excellence Award, Province of Ontario.
1990 Ontario Ministry of the Environment Excellence in Research Award to Students.
1989-1990 George Burwash Langford Prize for distinctive contributions to environmental research and services to the Institute for Environmental Studies.
1988 John Brown Memorial Prize for Research in Environmental Science and Occupational Health, University of Toronto.
1981-1982 Max Bell Scholarship for Northern Studies, McGill University.
1976 Innis College Medal.

5. PROFESSIONAL AFFILIATIONS AND ACTIVITIES

Current Memberships:

Society of Environmental Toxicology and Chemistry
American Chemistry Society
International Association for Great Lakes Research
Canadian Association on Water Quality

Activities:

- 2014- Binalational Chemicals of Mutual Concern Identification Task Team (ITT) under the Annex 3 of the Great Lakes Water Quality Agreement
2013-2016 Member, Canadian Chemicals Management Plan Science Committee
2013- Member, The Anthropocene Project: Anthropocene Curriculum. Sponsored by Haus der Kulturen der Welt (HKW) in cooperation with the Max Planck Society, Deutsches Museum, the Rachel Carson Center for Environment and Society, and the Institute for Advanced Sustainability Studies.
2012-2013 Co-chair, Ontario Ministry of Environment, "Toxics Reduction Program Living List Multi-Stakeholder Group" (part of activities under the Toxic Reduction Act)
2011 Member, US EPA Science Advisory Board Panel, Review of Technical Support Document, "National-scale Mercury Risk Assessment Supporting the Appropriate and Necessary Finding for Coal- and Oil-Fired Electric Generating Units.
2010-2011 ILSI Risk 21 Project, Working Group on Exposure Science. Sponsored by HESI.
2010-2011 Member, Committee on Blue Water Navy Vietnam Veterans and Agent Orange Exposure. National Academies, Institute of Medicine, U.S. May 2010-June 2011.
2009- , Member, Board of Directors, Canadian Environmental Law Association
2009 US EPA, Review Panel Member, Environmental Sciences Division, May 2009, Las Vegas, Nevada
2008 Co-chair, Toxics Reduction Scientific Expert Panel.
2007-2010 Co-chair, Organizing committee, Annual conference of the International Association of Great Lakes Research held in Toronto May 2010
2007-2011 Member, Science Advisory Board of the International Joint Commission
2006-2013 Member, Canadian Environmental Assessment Agency, Review Panel for Participant Funding Program.
2007-2008 Member, Health-Environment Linkages Expert Panel organized by Statistics Canada

- 2006-2007 Member, Environmental Assessment Working Group sponsored by Health Canada and Environment Canada
- 2006-2011 Member, Editorial Advisory Board, *Environmental Science and Technology*
- 2006-2008 Member of review panel, Water Quality Model of Onondaga Lake.
- 2006 Panel member, Science Advisory Board, U.S. Environmental Protection Agency. Review of EPI Suite models.
- 2005-2008, Member, Board of Directors, Canadian Environmental Law Association
- 2003-2005 Member of local organizing committee, Dioxin 2005. International Conference held in Toronto August 2005.
- 2003-2006 Physical Environment Research Interest Group Director, Centre for Urban Health Initiatives, 6 year support from Canadian Institutes for Health Research.
- 2003 Review committee, Lake Ontario Mass Balance Project
- 2000-2001 Hearing of the Ontario Municipal Board, Oak Ridges Moraine. Expert witness for Save the Rouge Inc.
- 2001-2003 Executive Committee, Board of Society of Environmental Toxicology and Chemistry
- 2000-2003 Board member of Society of Environmental Toxicology and Chemistry
- 1998-2000 Member of Expert Resource Group, for review of Copper and Zinc Smelting Guidelines, Canadian Environmental Protection Act, Environment Canada.
- 1998-2000 Member of Peer Review Panel of Hudson River PCBs RI/FS Phase 2 Reports, Preliminary Model Calibration Report. Sponsored by U.S. EPA.
- 1998-2001 Member of Steering Committee, "How Healthy is the Moira?". In conjunction with the Frost Centre and Environment and Resource Management Dept. of Trent University.
- 1998-2001 Member of Science Review Panel, Lake Michigan Mass Balance Model Project. Sponsored by U.S. EPA.
- 1997-2000 Member of Publications Committee, International Association for Great Lakes Research
- 1996-present Member of Working Group on Fate and Exposure Modeling sponsored by SETAC.
- 1996 Invited participant in 26th Pellston Workshop "Reassessment of Metals Criteria for Aquatic Life Protection: Priorities for Research and Implementation", Society of Environmental Toxicology and Chemistry, Pensacola, Florida, Feb 10-14, 1996.
- 1994-1999 Associate Editor of *Water Quality Research Journal of Canada*.
- 1994-1998 Vice-Chair, Canadian Standards Association Committee on Life Cycle Impact Assessment of Pulp & Paper Production Phase.
- 1993-1994 Member of Working Group on Site Remediation, Waterfront Regeneration Trust.
- 1993-1994 Member of Technical Advisory Committee, International Association of Great Lakes Research.
- 1992 Invited participant in "ASEAN Conference on Women and Technology", CIDA, Bangkok, Thailand.
- 1991-2001 Board Member of the Canadian Environmental Law Association.
- 1991-1992 Member of "Gender, Science and Development", international working group of IFIAS.

B. ACADEMIC HISTORY

6. a. RESEARCH ENDEAVORS

Fate and transport of inorganic and organic contaminants in the environment.

1. Fate of contaminants in lakes.
 - a. Field, experimental and mass balance modelling analysis of the fate and transport of arsenic in Moira Lake, focusing on role of contaminated sediments and sediment-water exchange processes.*
 - b. Experimental analysis of chemical sediment-water exchange and sorption processes.*

- c. Field and experimental analysis of trace metal fate and sediment-water exchange in urban aquatic systems, e.g., stormwater detention ponds.*
 - d. Mass balance modelling of mercury fate in lakes (Great Lakes, shield lakes), and contaminated systems (Lahontan Reservoir, Nevada).*
 - e. Mass balance modelling of contaminants in Arctic and Subarctic lakes and food webs.*
 - i. Collaborator in the Amituk Lake Project, Northern Contaminants Program of the Arctic Environmental Strategy, Dept. of Indian Affairs and Northern Development (1993-1995).*
 - ii. Fate of organic contaminants and mercury in lakes and food webs of the Upper Yukon River Basin and lakes on Bear Island, arctic Norway.*
 - iii. Collaborator in Bear Island (Norway) Project, lake and food web modeling*.
 - iv. Measurement of current use chemicals in Arctic air and water
 - f. Mass balance modelling of contaminants and polyunsaturated fatty acids in Great Lakes and food webs, “Areas of Concern” Bay of Quinte, Hamilton Harbour and Spanish Harbour, and Lake Winnipeg. Contributor to development of Remedial Action Plans (RAPs) and Lake Wide Management Plans (Lake Erie, Lake Ontario).
 - g. Coupling our multispecies mass balance model with chemical speciation-complexation and toxicity models.
2. Fate of contaminants in urban areas.
 - a. Determining ambient concentrations and fate processes of semi-volatile organic contaminants (and metals*) in urban media, including development of analytical methods and event-based sampling of urban streams
 - b. Developing Multimedia Urban Model (MUM) with application to Toronto. Includes spatial and temporal resolution, merging air dispersion module, linkage to GIS.
 - c. Exploring the composition, rate of accumulation, chemical exchange rates, and effects on overall contaminant fate, of thin films on impervious surfaces.*
 3. Fate of contaminants in indoor environments and human exposure.
 - a. Measurement of indoor concentrations and fate of semi-volatile organic compounds, notably halogenated and organophosphate flame retardants, phthalates and PAH.
 - b. Development of Multimedia Indoor Model or MIM.
 - c. Development of indoor passive air sampling methods.
 4. Contaminated site remediation*
 - d. Evaluating environmental and health impacts of site remediation processes.*
 - e. Life-cycle assessment, developing a method to evaluate impacts of site remediation processes. In collaboration with Environmental Protection Office, City of Toronto. *

Exposure and Health Effects of Contaminants in the Environment

5. Evaluating potential health effects
 - a. Collaboration on the toxicology of complex mixtures from urban areas.*
 - b. Development of integrated ecological and human health risk assessment models for the estimation of the effects of urban contaminants.*
 - c. Balancing potential health benefits and risks from omega 3-fatty acids and contaminants in fish.
6. Estimating human exposure
 - a. Estimating human exposure to indoor.
7. Urban agriculture*
 - a. Evaluating health benefits and potential risks from urban agriculture, e.g., Kampala Uganda, Toronto, Ontario.*
8. Life Cycle Assessment
 - a. See 4f.

- b. Within Life Cycle Impact Assessment, development of characterization factors for metals including fate and effects modelling (related to 1g)

Chemical Management

9. Quantifying inventories and Material Flow Analysis of regulated chemicals (PCBs, PBDEs).
10. Analysis of policies, legislation and regulations related to chemical management, as well as flammability codes and standards.
11. Measurement and estimation of physical-chemical properties of semi-volatile organic compounds of concern
12. Planetary Boundary for Chemical Pollution.
13. Chemical Footprint

* Currently inactive

6. b. RESEARCH AWARDS AND CONTRACTS

Awards:

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| 2014-2015 | NSERC Equipment Grant, “Chemical analysis of semi-volatile organic compounds in outdoor and indoor environments” \$150,000. With G Evans, J Wallace, J Siegel. |
| 2014-2016 | Chemical Management Plan (CMP) of Health Canada and Environment Canada. CMP Monitoring and Surveillance Fund. Monitoring Organophosphorus Flame Retardants in Canadian homes. M Diamond, L Jantunen, S Harris. \$100,000 over 2 years. |
| 2014-2017 | Health Canada. Clean Air Regulatory Agenda (CARA) “Monitoring and modelling of residential indoor semi volatile organic compounds.” S Harris (Cancer Care Ontario), Miriam Diamond, Paul Villeneuve (Health Canada), Liisa Jantunen (Environment Canada), \$507,100 over 3 years split between University of Toronto and Cancer Care Ontario |
| 2013-2015 | Ontario Ministry of Environment “Characterizing organophosphorus flame retardants in the air and surface water of the Greater Toronto Area”, ML Diamond with P Helm (Ontario Ministry of Environment), L Jantunen (Environment Canada), \$59,280 over 2 years. |
| 2013-2014 | CIHR Catalyst Grant. “Early-life environment and chronic allergic disease: leveraging a prospective study to discover the epigenetic signature.” AK Ellis (Queen’s), ML Diamond, JR Brook (Environment Canada), MS Kobor (University of British Columbia), ML North (Queen’s), \$100,000 for 1 year. My share is 31%. |
| 2013-2014 | Health Canada “Passive air sampling and personal monitoring for semi-volatile organic compounds” ML Diamond, \$9999. |
| 2013-2014 | Northern Contaminants Program. Dept of Aboriginal Affairs and Northern Development. Polycyclic aromatic compounds, flame retardants and other persistent organic pollutants in Canadian Archipelago air and water. \$33,000 for 1 year. L. Jantunen PI. 5 investigators. |
| 2012-2013 | Health Canada, “Multimedia Indoor Model, literature search and beta version of model”, \$9 360 for 1 year. |
| 2012-2013 | Health Canada, “Passive air sampling and personal monitoring for semi-volatile organic compounds”, \$10,000 for 1 year. |
| 2012-2013 | International Aluminum Institute, “Freshwater Ecotoxicity Characterization Factor for Aluminum – Addressing effects of speciation on fate, exposure & toxicity in Life Cycle Impact Assessment”, \$69,000 for 1 year. |
| 2012-2015 | NSERC Accelerator award, \$40,000/yr for 3 years. |
| 2012-2017 | NSERC Discovery, "Emissions, fate, exposure and management of chemical |

- contaminants indoors, outdoors and globally." \$34,000/yr.
- 2012-2019 Industry Canada, AllerGen Network Centre of Excellence, \$36,500,000. J Denburg PI.
- 2011-2012 Great Lakes Research Initiative, funded by the U. S. Environmental Protection Agency. "Great Lakes Polybrominated Diphenyl Ether (PBDE) Institutional Reduction". A. Soehl, M. Diamond, M. Murray. \$65,000 to Diamond as subcontractor.
- 2011-2012 Health Canada, Sources, "Concentrations and Route of Exposure to New Flame Retardants", M. Diamond \$24,499 for 1 year.
- 2011-2012 AllerGen NCE, Strategic Initiatives Research Funding Opportunities Program. "Method for measuring phthalate concentrations representative of exposure". M. Diamond, J. Brook, T. Takaro, A. Wheeler, \$32,900 for 1 year.
- 2009-2012 Hudson Bay Mining and Smelting "Assessment of metal dynamics and ecotoxicity in Ross Lake (MB, Canada) using a coupled metal fate/transport, speciation toxicity (TRANSPEC-Tox) model", M Diamond, \$64,818 total.
- 2011 Environment Canada "Reconnaissance study of coal tar sealcoat application in the GTA and an estimate of related PAH emissions". M Diamond, \$22,000 for 1 year.
- 2010-2012 Great Lakes Commission, Great Lakes Atmospheric Deposition program "How effective are our chemical management policies in reducing Lake Ontario fish contaminant burdens?", M Diamond, P Helm, S. Backus, L Jantunen, M Shoeib \$90,000 US over 3 fiscal years.
- 2010-2011 Ontario Ministry of Environment, Canada-Ontario Agreement, "Determination of Contaminant Loadings from Toronto's Tributaries", M Diamond, \$36,000 over 2 years
- 2010 Canada Foundation for Innovation. "The Canadian Aerosol Research Network (CARN): Climate, air pollution and human health in 2020", J. Abbott, G. Evans et al., \$15148327.
- 2009-2011 Canadian Chemical Management Plan, through Health Canada, via AllerGen Network Centre of Excellence "Novel Approaches for Assessing Exposure to Phthalates" R Allen, M Brauer, J Brook, M Diamond, G Evans, T Takaro \$702,426 over 2 years.
- 2009-2010 Ontario Ministry of Environment "Determination of the relative importance of urban contaminant input pathways to Lake Ontario for selected contaminants", M Diamond, \$50,000.
- 2008-2010 Ontario Ministry of Environment "The testing, optimization and validation of an in-situ large volume surface water sampling device" M. Diamond, \$50,000.
- 2008-2013 CIHR Emerging Collaborative Grant "Santé tenant compte du genre et du sexe", D Mergler, E Balka, K Lippel, K Messing, SA Ritz, J Saint-Charles, M Diamond et al. \$1 million over 5 years.
- 2007-10 NSERC Collaborative Research & Development Grant "LCIA for metals: Improving toxicity characterization factors and applying it to the Canadian environmental context", M Diamond, D Mackay, \$144,985 over 3 years.
- 2007-09 Great Lakes Commission, Great Lakes Atmospheric Deposition program "Urban sources and loadings of toxics to Lake Ontario from an Integrated Measurements and Modelling Approach", M Diamond, P Helm, P Blanchard, S. Backus, \$149,450 US over 2 years.
- 2007-2012 NSERC Discovery, "Connecting chemical sources, emissions, fate and exposure", \$31,090/yr.
- 2006 Environment Canada, National Water Research Institute "Modeling the distribution and fate of pharmaceuticals in Hamilton Harbour", M Diamond \$10,000.
- 2006-09 SETAC-UNEP "Improvement of characterisation factors in Life Cycle Impact Assessment of ecotoxicity (Fate – Exposure – Effects)", M Diamond, D Van De Meent, et al. \$265,500 over 3 years.
- 2005-06 Health Canada "Contaminant and nutrient concentrations in specialty raw and cooked fish and shellfish", \$20,000.
- 2004-06 Environment Canada "Cities: Contaminant fate and effects" M Diamond, \$18,000.

- 2005-06 Toronto and Region Conservation Authority “Toronto tributary study”, \$30,000.
- 2005-06 Ontario Ministry of Environment “Toronto tributary study, pilot study”. \$50,000.
- 2005 Ontario Ministry of Environment “Modelling of polychlorinated naphthalenes in the Lake Ontario food web”, \$9000.
- 2004-05 Ontario Ministry of Environment “Mass balance modelling of metals in Spanish Harbour”, \$27,000.
- 2004-05 Ontario Ministry of Environment “Mass balance modelling of PCBs in Hamilton Harbour”. \$57,000.
- 2004 NSERC Research Tools and Instruments “Analysis of persistent organic pollutants in impacted systems by GC-MS”. \$113,564.
- 2004-2008 CIHR Research Centre Grant “Centre for Urban Health Initiatives”, \$400,000 per year for 6 years. J. Myles PI, Co-applicant.
- 2004-2006 CORILA (Consortium for Coordination of Research Activities Concerning the Venice Lagoon System) “Contaminant fate in the Venice Lagoon: development of an integrated fate model”. 30,000 Euros per year for 3 years.
- 2004-2006 Quinte Conservation Council “Updating the existing model of contaminant fate in the Bay of Quinte”, \$65,000.
- 2003 Ontario Ministry of the Environment “Review of mercury modelling work drafted for contaminated sediment conditions in Peninsula Harbour”. \$10,000.
- 2003-2007 NSERC Discovery Grant “Multimedia contaminant fate and effect in impacted systems”, \$26,500 per year for 4 years.
- 2003 Canadian Network of Toxicology Centres, Metals in the Environment (MITE), “Modelling of Metal Speciation and Movement in a Shield Watershed and Lake”, with G. Spiers (Laurentian University), \$11,000.
- 2002-2006 NSERC Strategic, “Cities: Contaminant fate and effects”, \$411,218 over 4 years, with Co-investigators B. Branfireun and T. Harner.
- 2002-2005 CRESTech, “Contaminant fate and effects in urban areas: development of a decision-support model”, \$150,000 over 3 years.
- 2002-2003 NSERC, Collaborative Research and Development Grant, “Development of a lake systems fate model”, \$17,392 per year for 2 years, with MDA Consulting.
- 2002-2005 CIDA, “Urban agriculture in Kampala, Uganda – health impact assessment and options for improvements”, \$150,000, Prain G, Cole, DC, Lee-Smith D, Diamond M, Kapinga R.
- 2001-2004 CFCAS, “Improvements to air quality models: airborne pollutant-surface film interactions.” \$320,000 total over 3 years, James Donaldson, PI (UofT Chemistry) and Paul Makar (Environment Canada).
- 2001-2002 Canadian Chlorine Coordinating Committee (C4), “Sources and fate of semi-volatile organic compounds in urban and surrounding areas.” \$78,500 total, with G.A. Stern, Freshwater Institute.
- 2000-2002 NSERC, Collaborative Research and Development Grant, “Modelling metal speciation and fate in mine impacted lakes”, \$26,087 per year for 2 years, with L. Evans, Univ. of Guelph.
- 2000-2002 Hudson Bay Mining and Smelting Co. Limited, “Modelling metal speciation and fate in mine impacted lakes”, \$15,000 per year for 2 years, with L. Evans, Univ. of Guelph. \$10,000 in 2002.
- 2000 NSERC Equipment Grant, Gas chromatograph with ECD/FID detector, \$47,195.
- 1999-2004 Premier’s Research Excellence Award, \$20,000 per year for 5 years.
- 1999-2002 Toxic Substances Research Initiative, “Urban air toxics: Source signature and health effects”, \$148,750 per year for 3 years, PI, with B. McCarry (McMaster), T. Harner, T. Bidleman and T. Dann (Environment Canada), P. Harper (Hospital for Sick Children).
- 1999-2003 NSERC Operating Grant, “Multimedia contaminant fate and dynamics in impacted

- systems”, \$17,850 per year for 3 years.
- 1999 NSERC Equipment Grant, Hydrolab Datasonde 4 (with K. Bolton, J. Desloges, B. Branfireun), \$18,776.
- 1999 Dean’s Instructional Initiative Grant, “Development of innovative teaching methods for non-science students”, \$1,000.
- 1999-2001 Canadian Network of Toxicology Centres, Metals in the Environment (MITE), “Modelling of Metal Speciation and Movement in a Shield Watershed and Lake”, with L. Evans (Univ of Guelph), \$56,500 per year.
- 1995-2000 NSERC Operating Grant, “Contaminant fate and dynamics in aquatic systems”, \$14,300 per year.
- 1998-2000 Canadian Chlorine Coordinating Committee, “Multimedia fate and toxicological impacts of chlorinated organic compounds in urban areas”, \$49,500 per year for 2 years, PI, with McCarry (McMaster), Muir (National Water Research Institute), Stern (Freshwater Institute), Harper (Hospital for Sick Children).
- 1999-2002 Minnesota Department of Transportation “Developing a decision tool to predict the ecotoxicological impacts of transportaiton-related chemicals”, \$US100,000 per year for 3 years, with co-PI D. Biesboer (University of Minnesota).
- 1998-1999 Canadian Network of Toxicology Centres, Metals in the Environment (MITE), “Modelling of Metal Speciation and Movement in a Shield Watershed and Lake”, \$6,133.
- 1998-1999 Department of Indian and Northern Affairs, “Contaminant dynamics in lakes of the Upper Yukon River Basin”, \$15,000.
- 1995-1997 Ontario Ministry of Environment & Energy, “Full cycle assessment of environmental and health impacts of site remediation options”, \$50,000.
- 1995-1996 Ontario Ministry of Environment & Energy, “Quantifying chemical release from in-place pollution”, \$18,000.
- 1995-1997 Friends of the Spanish River, “Spanish Harbour sediment mass balance study - enhanced application of the QWASI fugacity/aquivalence model”, \$25,000
- 1993, 94, 97 Department of Indian and Northern Affairs, student travel grant, \$1,500; \$2,000, \$1900, \$2200.
- 1993 Dean’s Instructional Initiative Grant, “Development of environmental science curriculum for non-science students”, \$1,000.
- 1993 NSERC Equipment Award to J. Desloges (V.R. Timmer, J. Gerits, M. Diamond).
- 1993 Ontario Ministry of the Environment, “Hamilton Harbour sediment mass balance study: enhanced application of the QWASI fugacity/aquivalence model”, \$10,000.
- 1992-1997 Department of Indian and Northern Affairs, “Modelling inorganic and organic contaminants in Arctic freshwater lakes”, 1992, \$22,000; 1993, \$23,000; 1994 \$28,000; 1995 \$9,000; 1996, \$24,000, \$1997 \$20,000.
- 1992-1995 NSERC Operating Grant, “Study of the fate and transport of contaminants in aquatic systems”, \$19,000 per year.
- 1992, 1993 Environmental Youth Corps, \$4,000 each year, 1993 jointly held with E. Fawcett, Dept. of Physics.
- 1991-1993 Connaught Fund, University of Toronto, Phase I New Staff Grant, \$10,000.

Contracts:

- 2014 Environment Canada and Health Canada, Chemical Management Plan. “Review of Draft Screening Assessment Report from the Petroleum Sector Stream”
- 2006-07 Toronto Public Health and International Joint Commission. “Review of air pollution-traffic-health connections”, \$4,500.
- 2004 Environment Canada “Review of mercury contamination in Peninsula Harbour”, \$22,000.

- 2003 United States Environmental Protection Agency, "Guidance document on ecological risk assessment for metals: metal sediment chemistry". \$2,000.
- 2002 International Joint Commission, "Forecast and analysis of urban development in the Great Lakes Basin", \$5,000 for our subcontract with GHK International.
- 2001 Bay of Quinte Conservation Authority, Bay of Quinte Remedial Action Plan, "Assessing the feasibility of updating the Bay of Quinte mass balance model", \$10,000.
- 2001 Environment Canada, "Analysis of Urban Development Impacts", \$5,000.
- 2001-2002 CH2M Hill, Sacramento, California, "Lahontan Reservoir Mercury Project", \$46,900
- 2000-2001 City of Toronto, Health Promotion and Environmental Protection, "Conducting a feasibility study for an environmental GIS for the City of Toronto", \$16,500.
- 1998-1999 National Water Research Institute, "Lake Erie LaMP Pollutant Modelling - Background Review", \$20,000.
- 1995-1997 Ecology & Environment Inc., "Development of mercury mass balance model for the Lahontan Reservoir, Nevada", \$US20,000
- 1993-94,95-96 Minnesota Pollution Control Agency, "Extension of the Minnesota fugacity/aquivalence model to treat multiple, interconverting species", US\$11,950; US\$5,000.
- 1991 City of Toronto, Environmental Protection Office, Assist with development of methodological for constructing historical landuse database, \$3,000. Contract held with S. MacRitchie.
- 1990 City of Toronto, Environmental Protection Office, "Review of potential environmental and health effects of site remediation technologies", \$5,000. Contract held with S. MacRitchie.
- 1989-90,90-91 Ontario Ministry of the Environment, "Development of a mass balance model for the Bay of Quinte", \$37,000, \$28,000. Contract held with D. Mackay, Institute for Environmental Studies, U of T.
- 1989,1990 Environment Canada, National Water Research Institute, "Review and modelling of sediment-water exchange processes", \$6,000, \$12,000.
- 1988 Environment Canada, Inland Waters Directorate "Assessing the feasibility of using evaluative models in the development of Canadian Sediment Quality Guidelines", \$5,000. Contract held with T. Clark, MCM Consulting.

C. SCHOLARLY AND PROFESSIONAL WORK

H Index of 29, Total Citations 2707 (Web of Science,30 April, 2014 excluding self-citations).

7. REFEREED PUBLICATIONS

7. a. Articles

103. POSTUMA L, A BJØRN, MC ZIJP, M BIRKVED, **ML DIAMOND**, MZ HAUSCHILD, MAJ HUIJBREGTS, C MULDER, D VAN DE MEENT. 2014. Beyond safe operating space: Finding chemical footprinting feasible. *Environ Sci Technol* 48(11): 6057-6059. DOI: 10.1021/es501961k

102. NORTH ML, TK TAKARO, **ML DIAMOND**, AK ELLIS. 2014. Effects of phthalates on the development and expression of allergic disease and asthma. *Annals of Allergy, Asthma & Immunology*. 112(6): 496-502. DOI: 10.1016/j.anai.2014.03.013

101. BROMMER S, JANTUNEN L, BIDLAMAN TF, HARRAD S, **DIAMOND ML**. 2014. Determination of vapor pressures for organophosphate esters. *J Chem Eng Data*. 59(5): 1441-1447. DOI: 10.1021/je401026a10.1021/je401026a In press.

100. MELYMUK L, M ROBSON, SA CSISZAR, PA HELM, G KALTENECKER, B GILBERT, S BACKUS, L BRADLEY, P BLANDARD, L JANTUNEN, **ML DIAMOND**. 2014. From the city to the lake: loadings of PCBs, PBDEs, PAHs and PCMs from Toronto to Lake Ontario. *Environ Sci Technol* 48(7): 3732–3741.
99. GANDHI N, **ML DIAMOND**, R RAZAVI, SP BHAVSAR, EM HODGE, SB GEWURTZ, GB ARHONITSIS. 2014. A modeling assessment of contaminant fate in the Bay of Quinte, Lake Ontario: 2. Organic chemicals. *Aquatic Ecosys Health Management* 17(2): 137-150. DOI: 10.1080/14634988.2014.910442
98. CSISZAR SA, **ML DIAMOND**, SM DAGGUPATY. 2014. The magnitude and spatial range of current-use urban PCB and PBDE emissions estimated using a coupled multimedia and air transport model. *Environ Sci Technol* 48:1075-1083.
97. MELYMUK* L, M ROBSON+, PA HELM, **ML DIAMOND**. 2013 Application of land use regression to identify sources and assess spatial variation in urban SVOC concentrations. *Environ Sci Technol*. 47(4): 1887-1895. <http://pubs.acs.org/doi/abs/10.1021/es3043609>
96. PANTAZOPOULOS P, JM SAWYER*, ME TURYK, **M DIAMOND**, SP BHAVSAR, D MERGLER, S SCHANTZ, N RATYNAYAKE, DO CARPENTER. 2013. Fatty acids in Great Lakes trout and whitefish. *J Great Lakes Res* 39: 120-127.
95. RYAN MJ, KA KIDD, MV CROFT, S GEWURTZ*, **M DIAMOND**, L KINNEAR, P ROACH. 2013. Biotic interactions in temporal trends (1992-2010) of organochlorine contaminants in the aquatic food web of Lake Laberge, Yukon Territory. *Sci Total Environ* 44:80-92.
94. RAWN DFK, K BREAKELL, V. VERIGIN, S A TITTELMIER, L DEL GOBBO*, **M DIAMOND**, L VANDERLINDEN, D. SIT. 2013. Impacts of cooking technique on polychlorinated biphenyl and polychlorinated dioxins/furan concentrations in fish and fish products with intake estimates. *J Agric Food Chem* 61: 989-997. <http://pubs.acs.org/doi/abs/10.1021/jf304010n>
93. CSISZAR* SA, SM DAGGUPATY, **ML DIAMOND**. 2013. SO-MUM: a coupled atmospheric transport and multimedia model used to predict intraurban-scale PCB and PBDE emissions and fate. *Environ Sci Technol*.47: 436-445. <http://pubs.acs.org/doi/ipdf/10.1021/es3033023>
92. MELYMUK* L, M ROBSON+, PA HELM, **ML DIAMOND**. 2012. PCBs, PBDEs and PAHs in Toronto air: spatial and seasonal trends and implications for contaminant transport. *Science of the Total Environment* 429: 272-280. doi:10.1016/j.scitotenv.2012.04.022
91. CSISZAR* SA, **ML DIAMOND**, LJ THIBODEAUX. 2012. Modeling urban films using a dynamic multimedia fugacity model. *Chemosphere*. 87: 1024-1031.
90. TURYK ME, SP BHAVSAR, W BOWERMAN, E BOYSEN, M CLARK, **ML DIAMOND**, D MERGLER, P PANTAZOPOULOS, S SCHANTZ, DO CARPENTER. 2012 Risks and benefits of consumption of Great Lakes fish. *Environ Health Persp* 120: 11-18. doi:10.1289/ehp.1003396
89. KLÁNOVÁ J, **M DIAMOND**, K JONES, G LAMMEL, R LOHMANN, N PIRRONE, M SCHERINGER, C BALDUCCI, T BIDLEMAN, KAREL BLÁHA, L BLÁHA, K BOOIJ et al. 2011. Identifying the research and infrastructure needs for the global assessment of hazardous chemicals ten years after establishing the Stockholm Convention. *Environ Sci Technol* 45(18): 7617-7619.

88. GANDHI* N, SP BHAVSAR*, **ML DIAMOND**. 2011. Critical load analysis in hazard assessment of metals using a unit lake model. *Environ Toxicol & Chem* 30(9): 2157–2166.
87. GANDHI* N, **ML DIAMOND**, MAJ HUIJBREGTS, J GUINEE, WJGM PEIJNENBURG, D VAN DE MEENT. 2011. Implications of considering metal bioavailability in estimates of freshwater ecotoxicity: Examination of two case studies. *Int J LCA* 16(8): 774-787. DOI:10.1007/s11367-011-0317-3.
86. ZHANG* X, M ROBSON+, **ML DIAMOND**, C IBARRA, SJ HARRAD. 2011. Polybrominated diphenyl ethers (PBDEs) and polychlorinated biphenyls (PCBs) indoors in Toronto: concentrations, air/dust distribution, sources and emissions. *Environ Sci Technol* 45: 3268-3274.
85. MELYMUK* L, M ROBSON+, **ML DIAMOND**, L BRADLEY, S BACKUS. 2011. Wet deposition loadings of organic contaminants to Lake Ontario: assessing the influence of precipitation from urban and rural sites. *Atmos Environ.* 45(28): 5042-5049. DOI: 10.1016/j.atmosenv.2011.02.007
84. CSISZAR* S, N GANDHI*, R ALEXYS, DT BENNIE, J STRUGER, C MARVIN, **ML DIAMOND**. 2011. Equivalence revisited – an activity based model to assess environmental behaviour of ionic compounds and its application to pharmaceuticals in Hamilton Harbour. *Environment International* 37(5): 821-828.
83. GANDHI* N, **DIAMOND ML**, RAZAVI* R, BHAVSAR* SP, HODGE* EM. 2011. A modeling assessment of contaminant fate in the Bay of Quinte, Lake Ontario: 1. Metals. *Aquatic Ecosystem Health and Management*. 14(1):85-93.
82. MELYMUK* L., M. ROBSON+, P. HELM, **M.L. DIAMOND**. 2011. Evaluation of passive air sampler calibrations: selection of sampling rates and implications for the measurement of persistent organic pollutants in air. *Atmos Environ.* 45(10):1867-1875.
81. GANDHI* N, M HUIJBREGTS, D VAN DE MEENT, W PEIJNENBURG, J GUINEE, E WEBSTER, D MACKAY, **ML DIAMOND**. 2011. Implications of geographic variability on estimating comparative toxicity potentials of Cu, Ni and Zn in freshwaters of Canadian ecoregions. *Chemosphere* 82(2):268-77.
80. GANDHI* N, **ML DIAMOND**, D VAN DE MEENT, M HUIJBREGTS, A DE KONING J GUINEE, W PEIJNENBURG. 2010. A new method for calculating metals' comparative toxicity potentials for freshwater ecotoxicity: application to copper, nickel and zinc. *Environ Sci Technol.* 44(13):5195-5201.
79. ROBSON+ M, L MELYMUK*, S CSISZAR*, A GIANG*, **ML DIAMOND**, PA HELM. 2010. Continuing sources of PCBs: the significance of building sealants. *Environ Internat* 36:506-513.
78. HARRAD S, C DE WIT, M A-E ABDALLAH, C BERGH, JA BJ BJORKLUND, A COVACI, PO DARNERUD, J DE BOER, **M DIAMOND**, S HUBER, P LEONARDS, M MANDALAKIS, C OSTMAN, LS HAUG, C THOMSEN, TF WEBSTER. 2010. Indoor contamination with hexabromocyclodecanes, polybrominated diphenyl ethers, and perfluoroalkyl compounds: an important exposure pathway for people? *Environ Sci Technol.* 44(9):3221-3231.
77. **DIAMOND ML**, MELYMUK*, L., S. CSISZAR*, M. ROBSON+. 2010. Estimation of PCB stocks,

emissions and urban fate: will our policies be effective? *Environ Sci Technol* 44(8):2777–2783.

76. SOMMERFREUND* J, **ML DIAMOND**, M FRIGNANI, G CAPODAGLIO, M GERINO, L BELLUCI, S GIULIANI, C MUGNAI+. 2010. Contaminant fate and transport in the Venice Lagoon: results from a multi-segment model. *Environ Ecotox Safety*. 73: 222-230. “Highlighted Article”

75. SOMMERFREUND* J, GB ARHONDITSIS, **ML DIAMOND**, M FRIGNANI, G CAPODAGLIO, M GERINO, L BELLUCCI, S GIULIANI, C MUGNAI+. 2010. Examination of the uncertainty in contaminant fate and transport modeling: a case study in the Venice Lagoon. *Environ Ecotox Safety*.73:231-239. “Highlighted article”

74. **DIAMOND ML**, GANDHI* N, WJ ADAMS, SP BHAVSAR, C BULLE, P CAMPBELL, A DUBREIL, A FAIRBROTHER ET AL. 2010. The Clearwater Consensus: The estimation of metal hazard in fresh water. *Internat J LCA* 15(2): 143-147. DOI 10.1007/s11367-009-0140-2

73. DEL GOBBO* L, ARCHBOLD J, ECKLEY C, ROBSON+ M, **DIAMOND M**, VANDERLINDEN L. 2010. Mercury and Omega-3 fatty acid concentrations of fish sampled from markets in Toronto: consumption scenarios balancing risks and benefits for childbearing women. *Can J Dietetic Practice and Res*. 71(1): 41-46.

72. GEWURTZ SB, SP BHAVSAR, PW CROZIER, **ML DIAMOND**, PA HELM, CH MARVIN, EJ REINER. 2009. Perfluoroalkyl contaminants in window film from Toronto, Ontario, Canada, and an assessment of carpet as a possible source. *Environ Sci Technol*. 43:7317-7323.

71. HARRAD S, C IBARRA, M ROBSON+, L MELYMUK*, X ZHANG*, **M DIAMOND**, J DOUWES. 2009 Polychlorinated biphenyls in indoor dust from Canada, New Zealand, United Kingdom and United States: implications for human exposure. *Chemosphere*. 76(2):232-238.

70. ZHANG* X., **ML DIAMOND**, SJ HARRAD, C IBARRA. 2009. Multimedia modeling of PBDE emissions and fate indoors. *Environ Sci Technol* 43(8): 2845-2850.

69. WONG* F, ROBSON+ M, **ML DIAMOND**, S HARRAD, J TRUONG+. 2009. Concentrations and chiral signature of POPs in soils and sediments: a comparative urban vs. rural study in Canada and UK. *Chemosphere* 74: 404-111.

68. GEWURTZ* SB, N GANDHI*, GN CHRISTENSEN, A EVENSET, D GREGOR, **ML DIAMOND**. 2009. Application of a food web model to determine the relative influence of lake morphology, nutrients, and contaminant loadings on the dynamics of polychlorinated biphenyls in a high arctic food web. *Environ. Sci. Pollut. Res*. 16(2):176-190.

67. DEL GOBBO* L, TITTEMIER S, PEPPER K, TAGUE B, VANDERLINDEN L. **DIAMOND, M**. 2008. Cooking reduces perfluorinated compound concentrations in fish. *J Agricult Food Chem*. 56(16):7551-7559.

66. ECKLEY CS, B BRANFIREUN, **M DIAMOND**, PC VAN METRE, F HEITMULLER. 2008. Atmospheric mercury accumulation and washoff processes on impervious urban surfaces. *Atmos Environ* 42:7429-7438.

65. WU* R, T HARNER, **ML DIAMOND**. 2008. Evolution rates and PCB content of surface films that develop on impervious urban surfaces. *Atmos. Environ*. 42(24):6131-6143.

64. WU* RW, T HARNER, **ML DIAMOND**, B WILFORD. 2008. Partitioning characteristics of PCBs in urban surface films. *Atmos. Environ.* 42(22):5696-5705.
63. BHAVSAR SP, N GANDHI, **ML DIAMOND**, AS LOCK, G SPIERS, MC ALFARO DE LA TORRE. 2008. Effects of estimates from different geochemical models on metal fate predicted by coupled speciation-fate models. *Environ. Toxicol. Chem.* 27(5):1020-1030.
62. HARRAD S, C IBARRA, **M DIAMOND**, L MELYMUK*, M ROBSON+, J DOUWES, L ROOSENS, AC DIRTU, A COVACI. 2008. Polybrominated diphenyl ethers in domestic indoor dust from Canada, New Zealand, United Kingdom and United States. *Environ Internat.* 34: 232-238.
61. ABDALLAH MA-E, S HARRAD, C IBARRA, **M DIAMOND**, L MELYMUK*, M ROBSON+, A COVACI. 2008. Hexabromocyclododecanes in indoor dust from Canada, the United Kingdom and the United States. *Environ. Sci. Technol.* 42(2):459-464.
60. BHAVSAR* SP, N GANDHI*, **ML DIAMOND**. 2008. Extension of coupled multispecies metal transport and speciation (TRANSPEC) model to soil. *Chemosphere* 70(5):914-924.
59. GANDHI* N, S BHAVSAR*, **ML DIAMOND**, JS KUWABARA, M MARVIN-DIPASQUALE. 2007. Development of mercury speciation, fate and bioaccumulation (BIOTRANSPEC) model: application to the Lahontan Reservoir. *Environ. Toxicol. Chem.* 26(11): 2260-2273.
58. MOREAU-GUIGON E, A MOTELAY-MASSEI, T HARNER, K POZO, **M DIAMOND**, M CHEVREUIL, H BLANCHOU. 2007. Vertical and Temporal Distribution of Persistent Organic Pollutants in Toronto. 1. Organochlorine Pesticides. *Environ Sci Technol* 41(7):2172-2177.
57. ARCHBOLD* JA, R HULL, **ML DIAMOND**. 2007. Potential importance of inhalation exposures for wildlife using screening-level ecological risk assessment. *Human Ecol. Risk Assess.* 13(4):870-883.
56. **DIAMOND ML**, EM HODGE*. 2007. From source to effect: urban contaminant dynamics. *Environ. Sci Technol.* Feature article. 41(11): 3796-3805.
55. GALARNEAU* E, PA MAKAR, M SASSI, **ML DIAMOND**. 2007. Estimation of atmospheric emissions of six semivolatile PAHs in Canada and the U.S.A. by use of an emissions processing system. *Environ. Sci. Technol.* 41:4205-4213.
54. KWAMENA N-O, JP CLARKE*, TF KAHAN, **ML DIAMOND**, DJ DONALDSON. 2007. Assessing the importance of heterogeneous reactions of polycyclic aromatic hydrocarbons in the urban atmosphere using the Multimedia Urban Model. *Atmos. Environ.* 41(1):37-50.
53. GEWURTZ* SB, N GANDHI*, GA STERN, WG FRANZIN, B ROSENBERG, **ML DIAMOND**. 2006. Dynamics of PCBs in the food web of Lake Winnipeg. *J. Great Lakes Res.* 32:712-727.
52. GANDHI* N, S BHAVSAR*, SB GEWURTZ*, **ML DIAMOND**, A EVENSET, GN CHRISTENSEN, D GREGOR. 2006. Development of a multi-chemical food chain model: application to PBDE in Lake Ellasjoen, Bear Island, Norway. *Environ. Sci. Technol.* 40:4714-4721.

51. NABULO G, H ORYEM-ORIGA, **M DIAMOND**. 2006. Assessment of lead, cadmium and zinc contamination of roadside soils, surface films and vegetables in Kampala City, Uganda. *Environ. Res.* 101:42-52.
50. KLEIN G, EM HODGE*, **ML DIAMOND**, T DANN, G STERN, MS DENISON, P HARPER. 2006. Gas-phase ambient air contaminants exhibit significant dioxin- and estrogen-like activity in vitro. *Environ Health Perspec.* 114(5): 697-703.
49. HARNER T, M SHOEIB, **M DIAMOND**, M IKONOMOU, G STERN. 2006. Passive sampler derived air concentrations of PBDEs along an urban-rural transect: spatial and temporal trends. *Chemosphere* 64:262-267.
48. HARRAD SJ, **ML DIAMOND**. 2006. Exposure to polybrominated diphenyl ethers (PBDEs) and polychlorinated diphenyls (PCBs): Current and future scenarios. *Atmos. Environ.* 40:1187-1188.
47. GEWURTZ* SB, R LAPOSA*, **ML DIAMOND**, N GANDHI*, GN CHRISTENSEN, T SKOTVOLD. 2006. A comparison of contaminant dynamics in arctic and temperate fish: a modelling approach. *Chemosphere* 63:1328-1341.
46. SIMPSON AJ, B LAM*, **ML DIAMOND**, DJ DONALDSON, B LEFEBVRE, A MOSER, A WILLIAMS, N LARIN, M KVASHA. 2005. Assessing the molecular composition of urban surface films through a symbiotic array of nuclear magnetic resonance approaches. *Chemosphere.* 63(1):142-152.
45. JONES-OTAZO* H, **ML DIAMOND**, M RICHARDSON. 2005. An international comparison of screening-level risk assessment approaches. *Risk Analysis.* 25(4): 841-853.
44. LAM* B, **ML DIAMOND**, AJ SIMPSON, PA MAKAR, J TRUONG+, NA HERNANDEZ-MARTINEZ*. 2005. Chemical composition of surface films and implications for atmospheric chemistry. *Atmos. Environ.* 39: 6578–6586.
43. MOTELAY-MASSEI A, T HARNER, M SHOEIB, **M DIAMOND**, G STERN, B ROSENBERG. 2005. Using passive air samplers to assess urban-rural trends for persistent organic pollutants and polycyclic aromatic hydrocarbons. 2. Seasonal trends for PAHs, PCBs, and organochlorine pesticides. *Environ. Sci. Technol.* 39:5763-5773.
42. JONES-OTAZO* H, JP CLARKE*, **ML DIAMOND**, JA ARCHBOLD*, G FERGUSON, T HARNER, MG RICHARDSON, JJ RYAN, B WILFORD. 2005. Is house dust the missing exposure pathway for PBDEs? An analysis of urban fate and human exposure to PBDEs. *Environ. Sci. Technol.* 39: 5121-5130.
41. RAYNE S, MG IKONOMOU, CM BUTT*, **ML DIAMOND**, J TRUONG+. 2005. Chlorinated dioxins and furans from the World Trade Center attacks contaminated Lower Manhattan. *Environ. Sci. Technol.* 39:1995-2003.
40. **DIAMOND ML**, SP BHAVSAR*, P HELM, G STERN, M ALAEE. 2005. Fate of organochlorine contaminants in arctic and subarctic lakes. *Sci. Total Environ.* 342(1-3):245-259.
39. RYAN ML, GA STERN, **M. DIAMOND**, MV CROFT, P ROACH, K KIDD. 2005. Temporal trends of organochlorine contaminants in burbot and lake trout from three selected Yukon lakes. *Sci. Total Environ.* 342:501-522.

38. HARNER T, M SHOEIB, **M DIAMOND**, G STERN, ROSENBERG. 2004. Using passive air samplers to assess urban-rural trends for persistent organic pollutants (POPs): 1. Polychlorinated biphenyls (PCBs) and organochlorine pesticides (OCPs). *Environ. Sci. Technol.* 38:4474-4483.
37. BHAVSAR* SP, **ML DIAMOND**, N GANDHI*. 2004. Dynamic coupled metal TRANSPort-SPECiation (TRANSPeC) model: application to assess a zinc contaminated lake. *Environ Toxicol Chem.* 23:2410-2420.
36. BUTT* CM, **ML DIAMOND**, J TRUONG+, MG IKONOMOU, PA HELM, GA STERN. 2004. Semi-volatile organic compounds in window films from Lower Manhattan after the September 11th WTC attacks. *Environ Sci Technol.* 38(13):3514-3524.
35. BHAVSAR* SP, **ML DIAMOND**, LJ EVANS, N GANDHI*, J NILSEN, P ANTUNES. 2004. Development of a coupled metal speciation-fate model for surface aquatic systems. *Environ. Toxicol. Chem.* 23:1376-1385.
34. WONG* F, T HARNER, Q-T LIU, **ML DIAMOND**. 2004. Using experimental and forest soils to investigate the uptake of polycyclic aromatic hydrocarbons (PAH) along an urban-rural gradient. *Environ. Pollut.* 129:387-398.
33. BUTT* CM, **ML DIAMOND**, J TRUONG+, MG IKONOMOU, AFH TER SCHURE. 2004. Spatial distribution of polybrominated diphenyl ethers in southern Ontario as measured in indoor and outdoor window organic films. *Environ Sci Technol* 38:724-731.
32. GEWURTZ* SA, **ML DIAMOND**. 2003. Distribution and burdens of bioaccumulative contaminants in the Lake Erie food web: A review. *Environ Rev.* 11:141-160.
31. HODGE* EM, **ML DIAMOND**, BE MCCARRY, GA STERN, PA HARPER. 2003. Sticky windows: Chemical and biological characteristics of the organic film derived from particulate and gas-phase air contaminants found on an urban impervious surface. *Archiv. Environ. Contam. Toxicol.* 44:421-429.
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22. TAKARO TK, **M DIAMOND**, F GOBAS, V OTTON, H SHU. 2010. Critical review of phthalates in Canadian indoor environments. Report to Health Canada. 124pp.
21. **DIAMOND ML**, P HELM, M ROBSON, SA CSISZAR, L MELYMUK. 2010. Urban Sources and Loadings of Toxics to Lake Ontario from Integrated Measurements and Modeling. Report to the Great Lakes Commission. 163 pp.
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16. **DIAMOND, M.L.**, J. DOUGAN, N. HELFERTY, E. HODGE, P. NIBLETT, M. ROSE and S. ROWE. 2002. Natural heritage systems in urbanizing settings: Sustainable practices for the Oak Ridges Moraine. Prepared on behalf of Save the Rouge Valley System Inc. and the City of Toronto. <http://www.hardystevenson.com/projects/profileproject.html>.
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13. BURCHFIELD, M. and **M.L. DIAMOND**. 2001. A feasibility study for the development of an environmental GIS for the City of Toronto. Report prepared for Health Promotion and Environmental Protection Office, Toronto Public Health, City of Toronto. 57pp.
12. **DIAMOND, M.**, C. PAGE, M. CAMPBELL and S. MCKENNA. 1998. Life Cycle Framework for Contaminated Site Remediation Options. Ontario Ministry of the Environment, PIBS 3613E, ISBN 0-7778-6940-3.

11. **DIAMOND, M.** and M. GANAPATHY. 1996. Mercury dynamics in the Lahontan Reservoir: Application of QWASI fugacity/aquivalence multispecies model. Report submitted to Ecology & Environment, Inc. as a subcontract to, and reviewed by U.S. Environ. Protection Agency.
10. **DIAMOND, M.** 1994. Review of the Level III Minnesota Model and its extension to mercury. Report submitted to Minnesota Pollution Control Agency, Air Quality Division.
9. MACKAY, D., S. SANG, **M. DIAMOND**, P. VLAHOS, E. VOLDNER and D. DOLAN. 1993. Mass Balancing and Virtual Elimination. A Peer Review Workshop at University of Toronto, Dec, 1992. Background document to Virtual Elimination Strategy Task Force Report, Int. Joint Com. 54 pp.+ Fig.
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4. **DIAMOND, M.L.** and A. MUDROCH. 1990. Review of techniques for quantifying the transfer of contaminants and nutrients from bottom sediments. Environment Canada, National Water Research Institute, Burlington, Ontario. Contribution No.90-43. 106 pp.
3. CLARK, T. and **M. DIAMOND**. 1988. The feasibility of using evaluative models in the development of Canadian Sediment Quality Guidelines. Unpubl. Report for Environ. Canada, Inland Waters Directorate. 45pp.+ App.
2. **DIAMOND, M.L.** and J.A. ORTH. 1985. Image analysis of the Natal Lake Geobotanical Test Site. Unpubl. Report for Canada Centre for Remote Sensing, Ottawa. DSS File No. 23413-4-8187. 34 pp.+ App.
1. SMITH, V.H., F.H. RIGLER, O. CHOULIK, **M. DIAMOND**, S. GRIESBACH and D. SKRABA. 1984b. A manual for eutrophication control in the subarctic. Final report to the Dept. of Indian and Northern Affairs, Ottawa. Environ. Studies No. 33, QS-8360-000-EE-A1, Cat. No. R71-19/33-1985E. 32 pp.

9. MANUSCRIPTS ACCEPTED, SUBMITTED OR IN PREPARATION

DIAMOND ML, CA DE WIT, S MOLANDER, M SCHERINGER, T BACKHAUS, R LOHMANN, R ARVIDSSON, Å BERGMAN, M HAUSCHILD, I HOLOUBEK, L PERSSON, B SUZUKI, M VIGHI,

C ZETZSCH. Exploring the planetary boundary for chemical pollution. *Environment International* Submitted July 2014.

BJØRN A, **ML DIAMOND**, M BIRKVED, MZ HAUSCHILD. Development of a chemical footprint indicator as a measure of the planetary boundary for chemical pollution of freshwater ecosystems. Resubmitted ES&T. Sept 2014.

ABBASI G, AM BUSER, A SOEHL, M MURRAY, ML DIAMOND. Stocks and flows of PBDEs from use to waste in U.S. and Canada from 1970-2020. *Environ Sci Technol* Submitted Aug 2014.

MOCHUNGONG P, G ABBASI, ML DIAMOND, J ZHU. Polybrominated diphenyl ethers and alternative brominated flame retardants in furniture and electric and electronic devices collected from the Greater Toronto Area, Canada. *J Hazardous Mat* Submitted Sept 2014.

SAWYER JM, MT ARTS, G ARHONDITSIS, **ML DIAMOND**. A general model of polyunsaturated fatty acid (PUFA) uptake and loss in freshwater fish. *Environ Modelling* Under revision 2014.

GANDHI H, ML DIAMOND. Freshwater ecotoxicity characterization factors for aluminum. *J Int LCA* In prep.

CHAUDHURI SR, H QI, E GOOSEY, A SAINI, Z JIANG, J BROOK, ML DIAMOND. Phthalate ester concentrations in indoor media and microenvironment variability. In prep.

SAWYER JM, N GANDHI, MT ARTS, G ARHONDITSIS, M KOOPS, **ML DIAMOND** A General Model of Polyunsaturated Fatty Acids (PUFAs) in Freshwater Ecosystems. In prep.

YACOOB S, **ML DIAMOND**, R SANTORE, H SONNENBERG. Investigating Toxicity Using Single and Metal Mixture BLM Models: A Case Study at Ross Lake. In prep.

YACOOB S, **ML DIAMOND**, R SANTORE, H SONNENBERG Comparing DGT Measurements and WHAM Estimates of Zinc and Copper: A Case Study at Ross Lake in Northern Canada. In prep.

10. CONFERENCE PRESENTATIONS, including published abstracts

Krol A, Serodio A, Diamond ML. 2014. Improving the multimedia indoor model for svocs with a multi-layered foam furniture submodel. REF FOR DIOXIN CONF.

Okeme JO, Poole J, Jantunen L, Serodio, D, Diamond ML. 2014. Vapor pressures and octanol-air partition coefficients of novel brominated flame retardants, organophosphate flame retardants, and selected polybrominated biphenyl ethers. REF FOR DIOXIN CONF.

Serodio D, Diamond ML, Zhang X, Bonnell 4, Sundin N. 2014. Alternative halogenated and organophosphate flame retardants: estimated physical-chemical properties and environmental persistence of 86 novel flame retardants. REF FOR DIOXIN CONF.

Diamond M, 2014. Flame retardants: what have we learned? Invited presentation 97th Canadian Chemistry Conference, Vancouver, International Symposium Chemicals of Emerging Concern.

Abbasi G., Buser A., De Leon F., Diamond M. 2014. Global Flow of Contaminants: From Our Products in North America to Our Waste Around the World. SETAC Europe, 24th Annual meeting; 2014 May 11-15, Basel,

Switzerland. Platform.

ABBASI G, DE LEON F, SAINI A, GOOSEY E, BUSER A, MOUCHONGONG P, ZHU J, SOEHL A, MURRAY M, DIAMOND M. 2014. Global flow of contaminants: from consumer products in North America to landfills in developing countries. SETAC Europe, 24th Annual meeting; 2014 May 11-15, Basel, Switzerland. Platform.

VIGHI M, BACKHAUS T, DIAMOND M, HAUSCHILD M, HOLUBECK I, LOHMANN R, MOLANDER S, PERSSON L, SALA S, SCHERINGER M, VILLA S, ZETZSCH C. 2014. Defining planetary boundaries for chemicals: a proposal for persistent Organic Contaminants (POPs). SETAC Europe, 24th Annual Meeting, Basel, Switzerland. Poster.

Serodio, D. **Diamond, M.L.**, Krol, A., Zhang, X., Bonnell, M., Sundin, N. 2014. Alternate halogenated and organophosphate flame retardants: Estimated physical-chemical properties and environmental persistence. SETAC Europe, 24th Annual Meeting, Basel, Switzerland. Poster.

Saini A, Okeme J, **Diamond ML**, Rauert C, Harrad S. 2014. Sorption of SVOCs to fabrics: Towards determining the role of clothing in human exposure. SETAC Europe, 24th Annual meeting; 2014 May 11-15, Basel, Switzerland. Platform.

Diamond M, Bjørn A, Birkved M, Hauschild MZ. 2014. Chemical footprint assessment: presentation of method and application to a case study involving different spatial scales. SETAC Europe 24rd Annual Meeting, Basel, Switzerland. Platform.

ABBASI G, R. WEBER, ML DIAMOND. 2013. Flow of PBDEs in WEEE from US & Canada to Nigeria. 34th Annual Meeting of SETAC North America, Nashville Nov. 17-21, 2013. Poster

GANDHI N. M.L. DIAMOND. 2013. Aluminum: Development of Comparative Toxicity Potentials for Freshwater Archetypes to be used in Environmental Impact Assessments. SETAC North America 34th Annual Meeting, Nashville.

DIAMOND ML, E GOOSEY, G ABBASI, A SAINI, F DE LEON, D SERODIO. 2013. Can we get beyond PBDEs: what have we learned?? SETAC North America, 34th Annual Meeting, Nashville.

DIAMOND ML, M SCHERINGER, C DE WIT, R LOHMANN. 2013. How should we define a planetary boundary for chemical pollution. SETAC Europe, 23rd Annual Meeting, Glasgow UK. Oral presentation.

BJORN A, M. HAUSCHILD, M BIRKVED, **M DIAMOND**. 2013. Approaching the planetary boundary for chemical pollution through a chemical footprint indicator – exploring feasibility via two case studies. SETAC Europe, 23rd Annual Meeting, Glasgow UK. Poster Corner Presentation.

GOOSEY E, S CHAUDHURI, **M DIAMOND**, A SAINI. 2013. Flame retardant (FR) and phthalate spatial variability indoors. SETAC Europe, 23rd Annual Meeting, Glasgow UK. Oral Presentation.

ABBASI G, **M DIAMOND**, R WEBER. 2013. Assessing the mass flow of PBDEs from North America to Nigeria via “used” products. SETAC Africa. South Africa, September.

GOOSEY E, S CHAUDHURI, M DIAMOND, A SAINI. 2013. Flame retardant spatial variability indoors: dust, air and window wipes. 6th International Symposium on Flame Retardants. San Francisco April 7-10, 2013. Poster.

ABBASI G, A BUSER, A SOEHL, M MURRAY, ML DIAMOND. 2013. The fate of PBDEs in the use and waste phases following changes of PBDE levels in products; a SFA application. 6th International Symposium on Flame Retardants. San Francisco April 7-10, 2013. Poster.

Goosey, E., A. Saini, G. Abbasi, L. Melymuk, M.L. Diamond, 2012 Out with the old in with the new: BFRs in Toronto. Proceedings of the 33rd SETAC North America Annual Meeting, pp. 215-216. Available from: SETAC Portal: SETAC Digital Library.

Abbasi G., Goosey E., Saini A., Diamond M., Buser A., Soehl A., Murray M., Zhu j., Mouchungong P. 2012. Estimation of the inventory of PBDEs in municipalities adjacent to the Great Lakes. SETAC North America Conference. Long Beach, USA 2012. Oral presentation.

CSISZAR SA, DAGGUPATY S, DIAMOND ML. 2012. Modeling urban areas as a source of PCBs and PBDEs to surrounding regions using a coupled multimedia and atmospheric transport model. SETAC North America Conference. Long Beach, USA 2012. Oral presentation.

Abbasi G., Buser A., Diamond M., Soehl A., Murray M. Present and future of PBDE inventory in Toronto; An SFA application. SETAC North America Conference. Long Beach, USA 2012. Poster

Chaudhuri, S.R., A. Saini, E. Goosey, H. Qi, M. Venier, M. Diamond. 2012 Phthalates and flame retardants: indoor concentrations, dermal wipes and urine biomonitoring. SETAC North America Conference. Long Beach, USA. Poster.

Yacoob S, ML Diamond, R. Santore. 2012. Assessing metal toxicity based on a combined unit world and kinetic modeling approach. SETAC North America Conference. Long Beach, USA. Poster.

DIAMOND ML, G. ABBASI, E GOOSEY, A SAINI, A BLUM, M VENIER, A SOEHL, M MURRAY. 2012. The actors and plot of the flame retardant story. 13th Annual Workshop on Brominated and Other Flame Retardants. Winnipeg, June 4-5, 2012. Oral.

GOOSEY E, ML DIAMOND, A SAINI, SR CHAUDHURI, G ABBASI. 2012. “Novel” flame retardants in Toronto; homes, work and in the park”. 13th Annual Workshop on Brominated and Other Flame Retardants. Winnipeg, June 4-5, 2012. Oral.

∅**DIAMOND ML.** 2012. A planetary boundary for chemical pollution. SETAC Europe 22nd Annual Meeting and SETAC World Congress. Platform Presentation. Berlin, May 20-24, 2012.

∅**DIAMOND ML, L MELYMUK, S CSISZAR, E GOOSEY, G ABBASI, PA HELM.** 2012. Tracing contaminants from urban sources to fate. SETAC Europe 22nd Annual Meeting and SETAC World Congress. Platform Presentation. Berlin, May 20-24, 2012.

YACOOB S, ML DIAMOND, C GUEGEN. 2012. What’s causing toxicity at a zinc-copper mine site? SETAC Europe 22nd Annual Meeting and SETAC World Congress. Poster Presentation. Berlin, May 20-24, 2012.

∅**DIAMOND ML.** 2011. The history of environmental chemistry – the Mackay era and beyond. SETAC North America 32st Annual Meeting, Boston, USA, November 13 - 17. Invited oral presentation.

DIAMOND ML, HELM PA, CSISZAR SA, MELYMUK L, ROBSON M, BACKUS S, DAGGUPATY

S, GIANG A. 2011. What we found in our backyard. SETAC North America 32st Annual Meeting, Boston, USA, November 13 - 17. Oral presentation.

MELYMUK L et al. PCBs, PBDEs, and PAHs in the urban atmosphere: spatial and seasonal trends and implications for contaminant transport. SETAC North America 32st Annual Meeting, Boston, USA, November 13 - 17. Poster presentation.

GOOSEY E, CSISZAR S, CATCHING C, ZHU J et al. 2011. Reconnaissance study of sealcoat application in Toronto, Canada and an estimate of related PAH emissions. SETAC North America 32st Annual Meeting, Boston, USA, November 13 - 17. Poster presentation.

HELM PA, GILBERT B, M ROBSON, L MELYMUK, DIAMOND ML. 2011. Transport of PCBs, PBDEs, PAHs, and Polycyclic musks via urban tributaries to Lake Ontario, Canada. SETAC North America 32st Annual Meeting, Boston, USA, November 13 - 17. Oral presentation.

CSISZAR SA, DAGGUPATY S, DIAMOND ML. 2011. Predicting urban scale atmospheric PCB and PBDE emissions and fate using the BLFM-MUM model. SETAC North America 32st Annual Meeting, Boston, USA, November 13 - 17. Oral presentation.

CHAUDHURI S, S. VERKOYEON, DIAMOND ML. 2011. Intensive indoor measurements and biomonitoring of phthalates: implications for exposure. SETAC North America 32st Annual Meeting, Boston, USA, November 13 - 17. Poster presentation.

SAWYER J, ML DIAMOND, M ARTS, G ARHONDITSIS, N GANDHI. 2011. Modelling polyunsaturated fatty acids (PUFA) in freshwater fishes: a kinetic approach. SETAC North America 32st Annual Meeting, Boston, USA, November 13 - 17. Poster presentation.

YACOOB S, ML DIAMOND, N GANDHI. 2011. What's Causing Toxicity at a Zinc – Copper Mine Site? SETAC North America 32st Annual Meeting, Boston, USA, November 13 - 17. Poster presentation.

GANDHI N, MAJ HUIJBREGTS, D VAN DE MEENT, WJGM PEIJNENBURG, J GUINEE, ML DIAMOND. 2011. Development of a new modeling framework to address issues of metal fate and effects in LCIA. SETAC Europe, Milan, May 2011. Platform presentation.

GANDHI N, MAJ HUIJBREGTS, D VAN DE MEENT, WJGM PEIJNENBURG, J GUINEE, ML DIAMOND. 2011. Revised method of hazard and ecological risk assessments for calculating Comparative Toxicity Potentials of metals for which BLMs are not available. SETAC Europe, Milan, May 2011. Poster presentation.

DIAMOND ML, HELM PA, CSISZAR SA, MELYMUK L, ROBSON M, BACKUS S, BRADLEY L, GILBERT B, DAGGUPATY S, JANTUNEN LM. 2011. From sources to urban fate: a contrast of PCBs, PBDEs, PAHs and synthetic musks. SETAC Europe, Milan, May 2011. Platform presentation.

HELM P, M ROBSON, G KALTENECKER, B GILBERT, ML DIAMOND, L MELYMUK, C BRIMACOMBE, T CHEN, T KOLIC, EJ REINER 2011. Urban tributaries as a pathway of PCBs, PBDEs, PAHs, and polycyclic musks to adjacent Lake Ontario, Canada. SETAC Europe, Milan, May 2011. Poster presentation.

DIAMOND ML, CHAUDHURI S, MUKWEDEYA E. 2011. Measurement and modelling of phthalates indoors". AllerGen, Allergy, Genes and Environment Network. Sixth Annual Research Conference,

February 6-8,2011, Vancouver, BC.

SAWYER J, N GANDHI, **ML DIAMOND**, G ARHONDITSIS, M KOOPS. 2010. Transfer and accumulation of polychlorinated biphenyls and polyunsaturated fatty acids through the Bay of Quinte and Hamilton Harbour food web. SETAC North America 31st Annual Meeting, Portland, USA, November 7 - 11.

GANDHI N, SB GEWURTZ, PA HELM, SP BHAVSAR, **ML DIAMOND**. 2010 Application of a food web model to evaluate mechanisms controlling biomagnifications of polychlorinated naphthalenes in a Lake Ontario food web. SETAC North America 31st Annual Meeting, Portland, USA, November 7 - 11.

GANDHI N, MAJ HUIJBREGTS, D VAN DE MEENT, WJGM PEIJNENBURG, J GUINEE, **ML DIAMOND**. 2010 Development of a new framework to address issues of metal fate and effects in hazard/risk assessment tools for regulatory evaluations. SETAC North America 31st Annual Meeting, Portland, USA, November 7 - 11.

GANDHI N, MAJ HUIJBREGTS, D VAN DE MEENT, WJGM PEIJNENBURG, J GUINEE, **ML DIAMOND**. 2010 Application of a new method for calculating ecotoxicity potentials of metals in global freshwaters – A critical analysis of metal hazard assessment. SETAC North America 31st Annual Meeting, Portland, USA, November 7 - 11.

GANDHI N, MAJ HUIJBREGTS, D VAN DE MEENT, WJGM PEIJNENBURG, J GUINEE, **ML DIAMOND**. 2010. Implications of geographic differences on estimating exposure and ecotoxicity potential of metals – Application to freshwaters of Canadian ecoregions. SETAC North America 31st Annual Meeting, Portland, USA, November 7 - 11.

GANDHI N, MAJ HUIJBREGTS, D VAN DE MEENT, WJGM PEIJNENBURG, J GUINEE, **ML DIAMOND**. 2010. Revised method of hazard and Life Cycle Impact assessments for calculating Comparative Toxicity Potentials of metals for which BLMs are not available. SETAC North America 31st Annual Meeting, Portland, USA, November 7 - 11.

Robson, M.E., Melymuk, L.E., Gilbert, B., Helm, P.A. Csiszar, S.A., **Diamond, M.L.** 2010. Polycyclic Musks in the urban environment: Sources trends and fate Poster, SETAC North America 31st Annual Meeting, Portland, USA, November 7 - 11.

Melymuk L, ME. Robson, **ML Diamond**, PA Helm. 2010. Atmospheric Fate and Transport of Selected Organic Pollutants in the Greater Toronto Area. SETAC North America 31st Annual Meeting, Portland, USA, November 7 - 11.

Melymuk, L.E., Robson, M., Csiszar, S.A., Diamond, M.L. , Daggupaty, S., Helm,P.A., Backus, S. Bradley, L. and Jantunen, L 2010. Urban Sources and Loadings of Toxics to Lake Ontario from an Integrated Measurements and Modeling Approach. SETAC North America 31st Annual Meeting, Portland, USA, November 7 - 11.

Csiszar, S.A., S. Daggupaty, **M.L. Diamond**, L. Melymuk, M. Robson 2010. BLFM-MUM: A coupled atmospheric transport and multimedia model used to study PCBs in Toronto. Platform presentation submitted to the SETAC North America 31st Annual Meeting, Portland, USA, November 7 - 11

Csiszar, S.A., S. Daggupaty, M.L. Diamond, L. Melymuk, M. Robson. 2010 BLFM-MUM: A coupled atmospheric transport and multimedia model used to study PCBs in Toronto: Modeling Urban Films.

Poster Urban Environmental Pollution Conference, Boston, USA, June 20 - 23.

Robson, M.E., Melymuk, L.E., Gilbert, B., Helm, P.A. Csiszar, S.A., Diamond, M.L. 2010. Persistent organic pollutants in rivers: The effects of urbanization and high flow events. Poster, Urban Environmental Pollution Conference, Boston, MA.

Diamond, M.L., S.A. Csiszar, L. Melymuk, M. Robson, P.A. Helm S. Backus, S. Daggupaty, L. Jantunen, P. Blanchard. 2010. Concentrations, Emissions and Fate of Legacy and Current Use/Production POPs from Toronto, Canada. Oral presentation. Urban Environmental Pollution Conference, Boston, USA, June 20 - 23.

Melymuk, L.E., Robson, M.E., Csiszar, S.A., Diamond, M.L., Helm, P.A. 2010. Atmospheric fate and transport of selected organic pollutants in the Greater Toronto Area. Poster, Urban Environmental Pollution Conference, Boston, MA

Melymuk, L.E., Robson, M.E., Diamond, M.L., Bradley, L., Backus, S. 2010. Urban sources and loadings of organic contaminants to Lake Ontario: assessing the influence of precipitation from urban and rural sites. Poster, Urban Environmental Pollution Conference, Boston, MA

Robson, M., Melymuk, L.E., Csiszar, S.A., Diamond, M.L.*, Daggupaty, S., Helm, P.A., Backus, S, Jantunen, L. 2010. Urban Sources and Loadings of Toxics to Lake Ontario from an Integrated Measurements and Modeling Approach. Poster, SETAC, European Annual Meeting, Seville, Spain.

DIAMOND, ML, SA CSISZAR, N GANDHI, R ALEXYY, DT BENNY, J STRUGER, C MARVIN. 2010. Equivalence revisited – an activity based model to assess environmental behaviour of ionic compounds. Platform presentation, Soc. Environ. Toxicol. Chem. (SETAC) Europe, Annual Meeting, Seville, Spain.

Robson M, Melymuk LE, Csiszar SA, **Diamond ML**, Daggupaty S, Helm PA, Backus S and Jantunen L. 2010. Urban Sources and Loadings of Toxics to Lake Ontario from an Integrated Measurements and Modeling Approach. Poster. Soc. Environ. Toxicol. Chem. (SETAC) Europe, Annual Meeting, Seville, Spain.

Gandhi N, M Huijbregts, D van de Meent, W Peijnenburg⁴, J Guinée, E Webster, D Mackay, ML Diamond. 2010. Implications of Geographic Variability on Estimating Comparative Toxicity Potentials of Metals in Freshwaters of Canadian Ecoregions. Platform presentation. Soc. Environ. Toxicol. Chem. (SETAC) Europe, Annual Meeting, Seville, Spain.

N Gandhi, M Huijbregts, D van de Meent, W Peijnenburg, J Guinée, ML Diamond. 2010. Application of the New Method for Calculating Comparative Toxicity Potential of Metals in Global Freshwater-types. Poster presentation. Soc. Environ. Toxicol. Chem. (SETAC) Europe, Annual Meeting, Seville, Spain.

Csiszar, S.A., S. Daggupaty, **M.L. Diamond**. 2010 BLFM-MUM: A coupled atmospheric transport and multimedia model used to study PCBs in Toronto: Modeling Urban Films. Poster IAGLR 53rd Annual Conference on Great Lakes Research, Toronto, May 17 - 21.

Melymuk, L.E., Robson, **M.**, **Diamond**, M.L., Bradley, L., Backus, S, 2010. Urban Sources and Loadings of Organic Contaminants to Lake Ontario: assessing the influence of precipitation from urban and rural sites. Oral presentation, International Association for Great Lakes Research Annual Conference, Toronto, ON.

Robson, M., Melymuk, L.E., Helm, P.A., Gilbert, B., **Diamond, M.L.**, Backus, S, Jantunen, L. 2010. Urban Sources and Loadings of Toxics to Lake Ontario from the Greater Toronto Area. Poster, International Association for Great Lakes Research Annual Conference, Toronto, ON.

ROBSON M, L MELYMUK, **ML DIAMOND**, PA HELM, S BACKUS, P BLANCHARD. 2009. Polycyclic musks in Toronto rivers: the effects of urbanization and high flow events. International Association of Great Lakes Research, 52nd Annual Conference, Toledo, Ohio.

DEL GOBBO L, J SAWYER, C ECKLEY, **M DIAMOND**, J ARCHBOLD, L VANDERLINDEN, G TOMY. 2009. How much of which fish should we eat? Consumption guidance for Toronto market fish based on contaminants and omega-3 fatty acids. International Association of Great Lakes Research, 52nd Annual Conference, Toledo, Ohio.

MELYMUK L, M ROBSON, A GIANG, S CSISZAR, **M DIAMOND**, P HELM. 2009. Continuing sources of PCBs: the significance of building sealants. International Association of Great Lakes Research, 52nd Annual Conference, Toledo, Ohio.

Robson, M., Melymuk, L.E., Diamond, M. Helm, P., Gilbert, B. 2008. Comparison of Chemical Profiles in Urban Rivers during Base Flow and Storm Events”. Oral presentation, International Association for Great Lakes Research Annual Conference, Peterborough, ON.

DIAMOND ML. 2009. Science meets policy – and politics! 44th Central Canadian Symposium on Water Quality Research.

DIAMOND ML. 2009. An overview of Bisphenol A. Special Symposium on Bisphenol A. 44th Central Canadian Symposium on Water Quality Research.

GANDHI*, N., M.L. DIAMOND, D. VAN DE MEENT, M. HUIJBREGTS, A. DE KONING, J. GUINEE, W. PEIJNENBERG. 2008. New method for calculating metal characterization factors in Life Cycle Impact Assessment. Soc. Environ. Toxicol. Chem. (SETAC) North America, Annual Meeting, Tampa, Florida. Platform.

DIAMOND, ML. 2008. A long range view of long range transport of POPs. Soc. Environ. Toxicol. Chem. (SETAC) North America, Annual Meeting, Tampa, Florida. Invited platform presentation to open session.

MUGNAI, C., SOMMERFREUND, J.K., G.B. ARHONDITSIS, **M.L. DIAMOND**, M. FRIGNANI, G. CAPADAGLIO, M. GERINO, L. BELLUCCI and S. GIULIANI. 2008. Modeling Venice Lagoon fate and transport of POPs and metals in two different wind regimes. Soc. Environ. Toxicol. Chem. (SETAC) North America, Annual Meeting, Tampa, Florida. Poster.

GANDHI*, N., M.L. DIAMOND, D. VAN DE MEENT, M. HUIJBREGTS, A. DE KONING, J. GUINEE, W. PEIJNENBERG. 2008. Influence of aquatic chemistry on fate and toxicity estimates of metals in hazard assessment. Soc. Environ. Toxicol. Chem. (SETAC) North America, Annual Meeting, Tampa, Florida. Platform.

DIAMOND, ML, CSISZAR S, ZHANG X. 2008. Where is my bisphenol A coming from? Soc. Environ. Toxicol. Chem. (SETAC) North America, Annual Meeting, Tampa, Florida. Platform.

ZHANG*, X., **M.L. DIAMOND**, S. HARRAD and C. IBARRA. 2008. Polybrominated diphenyl ethers (PBDEs) and polychlorinated biphenyls (PCBs) in indoor environments in Toronto. Soc. Environ. Toxicol. Chem. (SETAC) North America, Annual Meeting, Tampa, Florida. Poster.

ROBSON, M, L MELYMU, P HELM, A GIANG, ML DIAMOND. 2008. Continuing sources of PCBs: the significance of building sealants. Soc. Environ. Toxicol. Chem. (SETAC) North America, Annual Meeting, Tampa, Florida. Poster.

GANDHI, N., M.L. DIAMOND, D. VAN DE MEENT, M. HUIJBREGTS, A. DE KONING, J. GUINEE, W. PEIJNENBERG, B. KOELMANS. 2008. Improvements in estimating metal characterization factors in Life Cycle Impact Assessment – Incorporation of metal speciation into fate and effects calculations. Platform presentation. Soc. Environ. Toxicol. Chem. (SETAC) Europe, Annual Meeting, Warsaw, Poland.

GEWURTZ S., N. GANDHI*, S. BHAVSAR, G. TOMY, **M. DIAMOND**, K. LAW. 2008. Application of a multi-chemical food web model to assess the dynamics of PBDEs in the food web of Lake Winnipeg, Canada. Brominated Flame Retardants Workshop, Victoria, B.C.

ZHANG, X*, Z., ROBSON*, M., **M. DIAMOND**, S. HARRAD, C. IBARRA. 2008. What controls the emissions and fate of PBDEs indoors. Brominated Flame Retardants Workshop, Victoria, B.C.

GALARNEAU, E., P.A. MAKAR and **M.L. DIAMOND**. 2008. Atmospheric fate of semivolatile PAHs in North America. Abstract submitted to SETAC World Congress, Australia.

Robson, M., Melymuk, L., Diamond, M. Helm, P., Gilbert, B., 2007. Persistent organic pollutants in urban environments Invited Presentation, Urban Atmosphere Workshop, hosted by Baltimore Ecosystem Study, National Science Foundation. Baltimore, MA.

GANDHI*, N., **M.L. DIAMOND**, D. VAN DE MEENT, W. PEIJNENBURG, M. HUIJBREGTS, j. GUINEE, G. HUPPES and B. KOELMANS. 2007. Estimation of characterization factors for metals in Life-cycle Impact Assessment of ecotoxicity – analysis of metal speciation, fate and effects issues. Platform presentation. Soc. Environ. Toxicol. Chem. (SETAC), 28th Annual Meeting, Milwaukee.

DIAMOND*, M.L., S. HARRAD, X. ZHANG, L. MELYMU, S. CSISZAR, J.P. CLARKE, N. GANDHI, S. GEWURTZ, H. JONES-OTAZO. 2007. Cities: from contaminant emissions to exposure. Symposium presentation. Soc. Environ. Toxicol. Chem. (SETAC), 28th Annual Meeting, Milwaukee.

ZHANG*, X., **M.L. DIAMOND**, S. HARRAD and C. IBARRA. 2007. PBDEs – Behaviour in indoor environment – a mass balance fugacity model approach. Symposium presentation. Soc. Environ. Toxicol. Chem. (SETAC), 28th Annual Meeting, Milwaukee.

MELYMU*, L., M. ROBSON, **M.L. DIAMOND** and P. HELM. 2007. Concentrations and fluxes of persistent organic pollutants to Lake Ontario via the Greater Toronto Area. Symposium presentation. Soc. Environ. Toxicol. Chem. (SETAC), 28th Annual Meeting, Milwaukee.

GEWURTZ*, S., P. CROZIER, **M.L. DIAMOND**, et al. 2007. Perfluoroalkyl contaminants in window film before and after a carpet installation. Platform presentation. Soc. Environ. Toxicol. Chem. (SETAC), 28th Annual Meeting, Milwaukee.

CSISZAR*, S., N. GANDHI, **M.L. DIAMOND**, R. ALEXY, D. BENNIE, J. STRUGER and C. MARVIN. 2007. New model for pharmaceuticals: description and application to Hamilton Harbour.

Platform presentation. Soc. Environ. Toxicol. Chem. (SETAC), 28th Annual Meeting, Milwaukee.

GAHNDI*, N. S. BAHVSAR*, **M.L. DIAMOND**. 2007. Development of a generic method for hazard analysis of substances: Addressing metal speciation, fate and Ecotoxicity Issues. Mining and the Environment International Conference" held in Sudbury during October 19 - 26, 2007. Gandhi won second prize for the best student oral presentation.

MELYMUK, L., S. CSISZAR, J.P. CLARKE, **M.L. DIAMOND***, B. BRANFIREUN, P. HELM and T. HARNER. 2007. Are PCBs legacy POPs? Platform presentation. Soc. Environ. Toxicol. Chem. (SETAC) Europe, Annual Meeting, Porto, Portugal.

GANDHI*, N., **M.L. DIAMOND**, D. VAN DE MEENT, M. HUIJBREGTS, J. GUINEE, G. HUPPES, W. PEIJNENBERG and B. KOELMANS. 2007. Estimation of characterization factors for metals in Life Cycle Impact Assessment of ecotoxicity – addressing metal fate, exposure and effects. Poster presentation. Soc. Environ. Toxicol. Chem. (SETAC) Europe, Annual Meeting, Porto, Portugal.

CSISZAR*, S.A., **M.L. DIAMOND**, J.P. CLARKE, M.A. BELMONT, L.E. MELYMUK, S.J. HARRAD, P.C. VAN METRE, F.T. HEITMULLER, M. RAO, T. HARNER and B. BRANFIREUN. 2007. Estimating emissions and fate of PCBs and PBDEs from European and North American cities. Platform presentation. 50th Annual Conf Internat. Assoc. Great Lakes Res. Pittsburgh, Penn.

SOMMERFREUND, J.K., G.B. ARHONDITSIS, **M.L. DIAMOND***, M. FRIGNANI, G. CAPADAGLIO, M. GERINO, L. BELLUCCI and S. GIULIANI. 2007. Uncertainty, data limitations and modelling: case study of contaminant fate modelling in the Venice Lagoon. Platform presentation. 50th Annual Conf Internat. Assoc. Great Lakes Res. Pittsburgh, Penn.

MELYMUK*, L., S.A. CSISZAR, **M.L. DIAMOND**, P. HELM, T. HARNER and B. BRANFIREUN. 2007. Are PCBs legacy POPs? An assessment of current PCB use in urban areas. Platform presentation. 50th Annual Conf Internat. Assoc. Great Lakes Res. Pittsburgh, Penn.

GANDHI*, N., R. ALEXY, S. CSISZAR, M. BELMONT, **M.L. DIAMOND**, D. BENNIE, J. STRUGER, C. MARVIN. 2007. New Model for pharmaceuticals: description and application to Hamilton Harbour. 50th Annual Conf Internat. Assoc. Great Lakes Res. Pittsburgh, Penn.

GALARNEAU*, E., MAKAR, P.A., SASSI, M., **DIAMOND, M.L.** 2007. Atmospheric Emissions and Modelled Regional Fate of Semivolatile Polycyclic Aromatic Hydrocarbons (PAHs) in the Great Lakes Basin. Abstract submitted to 50th Annual Conf Internat. Assoc. Great Lakes Res. Pittsburgh, Penn.

MELYMUK, L., S. CSISZAR, J.P. CLARKE, **M.L. DIAMOND***, B. BRANFIREUN, P. HELM and T. HARNER. 2007. Are PCBs legacy POPs? Platform presentation. Soc. Environ. Toxicol. Chem. (SETAC) Europe, Annual Meeting, Porto, Portugal.

GANDHI*, N., **M.L. DIAMOND**, D. VAN DE MEENT, M. HUIJBREGTS, J. GUINEE, G. HUPPES, W. PEIJNENBERG and B. KOELMANS. 2007. Estimation of characterization factors for metals in Life Cycle Impact Assessment of ecotoxicity – addressing metal fate, exposure and effects. Poster presentation. Soc. Environ. Toxicol. Chem. (SETAC) Europe, Annual Meeting, Porto, Portugal.

CSISZAR*, S.A., R. ALEXY, N. GANDHI, M. BELMONT, **M.L. DIAMOND**, D.T. BENNIE, J. STRUGER and C. MARVIN. 2007. Pharmaceuticals as environmental contaminants: modelling, distribution and fate (Triclosan, Naproxen, Ibuprofen and Gemfibrozil in Hamilton Harbour). Poster

presentation. Pharmaceuticals and personal care products in the Canadian Environment: Research policies and directions. Niagara-on-the-Lake, Canada.

SOMMERFREUND, J.A., ARHONDITSIS, G. and **DIAMOND***, M.L. 2007. A probabilistic approach for contaminate fate and transport modelling. Canadian Assoc. Water Quality, Burlington, Ont. Platform.

GEWURTZ, S.B., N. GANDHI, S.P. BHAVSAR*, M.L. **DIAMOND**, G.T. TOMY and K. LAW. 2006. Application of a multi-chemical food web model to assess the dynamics of PBDEs in the food web of Lake Winnipeg, Canada. Soc. Environ. Toxicol. Chem. (SETAC), 27th Annual Meeting, Montreal.

DIAMOND, M.L., L. MELYMUK, S. CSISZAR, M. BELMONT, P. HELM and J.P. CLARKE. 2006. Are PCBs legacy POPs? Assessment of current use in an urban area. Poster presentation. Soc. Environ. Toxicol. Chem. (SETAC), 27th Annual Meeting, Montreal.

ROBSON*, M., L. MELYMUK, M. **DIAMOND**, B. GILBERT, P. HELM and T. CHEN. 2006. Concentrations of Polycyclic Aromatic Hydrocarbons in River Sediments in the Greater Toronto Area. Poster presentation. Soc. Environ. Toxicol. Chem. (SETAC), 27th Annual Meeting, Montreal.

DIAMOND*, M.L., M.A. BELMONT, L.E. MELYMUK*, J.P. CLARKE*, S.J. HARRAD, P.C. VAN METRE, F.T. HEITMULLER, M. RAO and T. HARNER. 2006. More on the fate of PBDEs in cities — a Tale of 3 cities. Oral presentation. Soc. Environ. Toxicol. Chem. (SETAC), 27th Annual Meeting, Montreal.

DIAMOND, M.L., S.P. BHAVSAR and N. GANDHI. 2006. Advances in coupled fate and speciation modeling of metals. Oral presentation. Soc. Environ. Toxicol. Chem. (SETAC), 27th Annual Meeting, Montreal.

GANDHI*, N., S. BHAVSAR, J.P. CLARKE, L. MELYMUK, S. CSISZAR and M.L. **DIAMOND**. 2006. Assessing the long-term cycling of PCBs in Hamilton Harbour. Oral Presentation. Soc. Environ. Toxicol. Chem. (SETAC), 27th Annual Meeting, Montreal.

GANDHI, N., S.P. BHAVSAR, M.L. **DIAMOND**, D. VAN DE MEENT, M. HUIJBREGTS, J. GUINEE, H. HUPPES, W. PIJNENBERG and B. KOELMANS. 2006. Estimation of Characterization Factors for Metal Fate, Exposure and Effects Issues. Oral presentation. Soc. Environ. Toxicol. Chem. (SETAC), 27th Annual Meeting, Montreal.

DIAMOND, M.L., N. GANHDI, S.P. BHAVSAR, R. RAZAVI, E. HOGDE, J.P. CLARKE, H. LING. 2006. Modelling toxics in Areas of Concern: Lessons learned from Bay of Quinte, Hamilton Harbour. 49th Annual Conf. Internat. Assoc. Great Lakes Res. Windsor, Ont. Platform presentation.

CLARKE, J.P. and M.L. **DIAMOND***. 2006. PCB Dynamics in a city: Application of Multi-media Urban Model. 49th Annual Conf. Internat. Assoc. Great Lakes Res. Windsor, Ont. Platform presentation.

RAZAVI, R., E. HODGE, M.L. **DIAMOND***, G. ARHONDITSIS. 2006. Contaminant fate in Bay of Quinte: A modelling assessment. 49th Annual Conf. Internat. Assoc. Great Lakes Res. Windsor, Ont. Platform presentation.

SOMMERFREUND*, J., M.L. **DIAMOND**, S. GUILANI, M. FRIGNANI, G. CAPODAGLIA. 2006. Modelling contaminants in the Venice Lagoon. 49th Annual Conf. Internat. Assoc. Great Lakes Res. Windsor, Ont. Platform presentation.

THIBODEAUX*, L. and **M. DIAMOND**. 2006. An air-to-surface film chemodynamic model for PAH partitioning to urban surfaces. SETAC Europe, Den Haag, Netherlands. Platform presentation.

BHAVSAR, S.P., **M.L. DIAMOND***, N. GANHDI. 2006. A coupled multispecies metal transport and speciation (TRANSPEC II) model for soil and water. SETAC Europe, Den Haag, Netherlands. Platform presentation.

J.P. CLARKE, **M.L. DIAMOND***. 2006. PCB dynamics in a city: Application of the Multi-media Urban Model (MUM-Fate). SETAC Europe, Den Haag, Netherlands. Poster presentation.

SOMMERFREUND*, J., **M.L. DIAMOND**, S. GUILANI, M. FRIGNANI, G. CAPODAGLIA. 2006. Modelling contaminants in the Venice Lagoon. SETAC Europe, Den Haag, Netherlands. Poster presentation.

Bhavsar, S, Gandhi, N, ***Diamond, M.** 2005. Estimating Critical Loads of metals to surface aquatic systems using a coupled metal TRANsport-SPECiation-TOXicity (TRANSPEC-TOX) model. Oral presentation. Soc. Environ. Toxicol. Chem. (SETAC), 26th Annual Meeting, Baltimore, Maryland.

*Gewurtz, S., Helm, P., Gandhi, N., Bhavsar, S., **Diamond, M.**, Marvin, C., Whittle, D. 2005. Application of a food web model to evaluate the mechanisms controlling polychlorinated naphthalene concentrations in a Lake Ontario food web. Oral presentation. Soc. Environ. Toxicol. Chem. (SETAC), Baltimore, Maryland.

Gandhi, N., Bhavsar, S., Gewurtz, S., ***Diamond, M.**, Evenset, A., Christensen, G., Gregor, D. 2005. Development of a multi-chemical food chain model: Application to study debromination and bioformation of PBDEs. Oral presentation. Soc. Environ. Toxicol. Chem. (SETAC), 26th Annual Meeting, Baltimore, Maryland.

*Sommerfreund, J., Gandhi, N., Bhavsar, S., Gewurtz, S., **Diamond, M.**, Guiliani, S. and M. Frignani. 2005. A fugacity based assessment of fate and transport of organic contaminants in the Venice Lagoon, Italy. Poster presentation. Soc. Environ. Toxicol. Chem. (SETAC), 26th Annual Meeting, Baltimore, Maryland.

Hernandez-Martinez, N., J. Truong and **M.L. Diamond**. 2005. Variability in surface films on impervious surfaces. Poster presentation. Soc. Environ. Toxicol. Chem. (SETAC), 26th Annual Meeting, Baltimore, Maryland.

DIAMOND, M.L., J. ARCHBOLD, S. BHAVSAR, J. CLARKE, E. HODGE, H. JONES-OTAZO, T. LABENCKI, J. TRUONG, F. WONG and M. MONABBATI 2005. Contaminants in cities: fate, exposure and potential health effects. 4th Annual Urban Health Conference, Toronto. Poster presentation.

*KENNEDY, C. and **M.L. DIAMOND** 2005. Sources and fate of chemical in the urban metabolism. 55th Annual Canadian Chemical Engineering Conference. Toronto, Oct. Oral presentation.

*SOMMERFREUND J., N. GANDHI, S. BHAVSAR, S. GEWURTZ, S. GUILANI, M. FRIGNANI and **M.L. DIAMOND**. 2005 A fugacity/aquivalence-gased assessment of contaminant fate and transport I the Venice Lagoon, Italy. 55th Annual Canadian Chemical Engineering Conference. Toronto, Oct. Poster presentation.

***DIAMOND, M.L.**, J.P. CLARKE, N. HERNANDEZ-MARTINEZ, T. LABENCKI, B. LAM, E. HODGE, H. JONES-OTAZO. 2005. Contaminants in the city: sources and fate. 55th Annual Canadian Chemical Engineering Conference. Toronto, Oct. Oral presentation.

BHAVSAR, S., N. GANDHI and **M.L. DIAMOND***. 2005. Connecting metal loadings with ecotoxicity in lakes using a coupled modelling approach. 55th Annual Canadian Chemical Engineering Conference. Toronto, Oct. Oral presentation.

***DIAMOND, M.L.**, C. BUTT, B. LAM, J. TRUONG, N. HERNANDEZ-MARTINEZ, T. LABENCKI, R. WU, A. SIMPSON. 2005. The Composition and implications of atmospherically-derived films on impervious surfaces. Israel Society of Ecology and Environmental Quality and Science, Annual Meeting, Rehovot, Israel.

*RAZAVI, R., N. GANDHI, S.P. BHAVSAR, S.B. GEWURTZ, B. JONES and **M.L. DIAMOND**. 2005. Chemical dynamics in the Bay of Quinte, Lake Ontario: a comparative modelling approach. 48th Annual Conf. Internat. Assoc. Great Lakes Res. Chicago, Il. Poster presentation.

*BHAVSAR, S.P., **DIAMOND, M.L.**, and GANDHI, N. 2005. Extension of coupled multispecies metal TRANsport and SPECiation (TRANSPeC) model to soil compartment. 48th Annual Conf. Internat. Assoc. Great Lakes Res. Chicago, Il. Oral presentation.

GEWURTZ, S.B., GANDHI, N., CHRISTENSEN, G.N., EVENSET, A., GREGOR, D., STERN, G.A., FRANZIN, W.G., RYAN, M., and **DIAMOND, M.L.** 2005. A Comparison of the mechanisms controlling PCB bioaccumulation in lakes of different latitudes: a modeling approach. 48th Annual Conf. Internat. Assoc. Great Lakes Res. Chicago, Il. Oral presentation.

*GANDHI, N., BHAVSAR, S.P., GEWURTZ, S.B., **DIAMOND, M.L.**, RUSMIR-WOODS, C., and BOYD, D. 2005. Assessing long-term PCB cycling in Hamilton Harbour - An application of integrated fate-transport and food web model. 48th Annual Conf. Internat. Assoc. Great Lakes Res. Chicago, Il. Oral presentation.

*GANDHI, N., BHAVSAR, S.P., **DIAMOND, M.L.**, MORASH, P., and ANDERSON, J. 2005. Impacts of metal dissolution kinetics on recovery of metal contaminated sediments – an application of extended TRANSPeC model to Spanish Harbour. 48th Annual Conf. Internat. Assoc. Great Lakes Res. Chicago, Il. Oral presentation.

HERNANDEZ-MARINTEZ, N., J. TRUONG, M.L. DIAMOND. 2005. Variability and temporal trends in urban film composition. 48th Annual Conf. Internat. Assoc. Great Lakes Res. Chicago, Il. Poster presentation.

*WU, R.W., T. HARNER, **M.L. DIAMOND**, A. MOTELAY-MASSEI, C.M. BUTT. 2005. Surface organic films: growth dynamics and response to meteorology. Oral presentation. SETAC Europe. Lille France.

*MOTELAY-MASSIE, A. T. HARNER, P. VAN METRE, C. ECKLEY, B.J. MAHLER, **M. DIAMOND**, B. BRANFIREUN. 2005. Diurnal variations of air-surface exchange for organic pollutants in urban areas. Abstract submitted for oral presentation. SETAC Europe. Lille France.

*GEWURTZ, S.B., N. GANDHI, G.N. CHRISTENSEN, A. EVENSET, D. GREGOR, G.A. STERN, W. FRANZIN, M. RYAN. **M.L. DIAMOND**. 2004. A comparison of the mechanisms controlling POP

bioaccumulation in lakes of different latitudes: a modelling approach. Oral presentation. Soc. Environ. Toxicol. Chem. (SETAC), 25th Annual Meeting, Portland, Oregon.

*BHAVSAR, S.P., N. GANHDI, J. ARCHOLD, M.L. DIAMOND, R. GOULET. 2004. BIOTRANSPEC-ERA: A model to estimate metal speciation-fate-bioaccumulation and toxicological hazard for LCIA. Oral presentation. Soc. Environ. Toxicol. Chem. (SETAC), 25th Annual Meeting, Portland, Oregon.

*BHAVSAR, S.P., M.L. DIAMOND, N. GANDHI. 2004. Extension of coupled multispecies metal TRANsport and SPECiation (TRANSPEC) model to soil compartment. Oral presentation. Soc. Environ. Toxicol. Chem. (SETAC), 25th Annual Meeting, Portland, Oregon.

*GEWURTZ, S.B., R. LAPOSA, N. GANDHI, G. CHRISTENSEN, A. EVENSET, D. GREGOR, M.L. DIAMOND. 2004. Accumulation of POPs in a high arctic food web: influence of temperature, nutrients, and loadings. Poster presentation. Soc. Environ. Toxicol. Chem. (SETAC), 25th Annual Meeting, Portland, Oregon.

*LAM, B., *M.L. DIAMOND, A.J. SIMPSON, J. TRUONG, N.A. HERNANDEZ, J.D. DONALDSON. 2004. Chemical composition of surface films and their related implications to atmospheric chemistry. Poster presentation. Soc. Environ. Toxicol. Chem. (SETAC), 25th Annual Meeting, Portland, Oregon.

*HERNANDEZ, N.A., M.L. DIAMOND, J. TRUONG, J. DONALDSON. 2004. Variability and reproducibility of surface films on impervious urban surfaces. Poster presentation. Soc. Environ. Toxicol. Chem. (SETAC), 25th Annual Meeting, Portland, Oregon.

WONG, F., M.L. DIAMOND*, M. ROBSON, S.J. HARRAD, T.F. BIDLAMAN, J. TRUONG. 2004. Chiral signature of PCBs and organochlorine pesticides along an urban-rural transect. Oral presentation. Soc. Environ. Toxicol. Chem. (SETAC), 25th Annual Meeting, Portland, Oregon.

*GANDHI, N., S.B. *GEWURTZ, S.P. BHAVSAR, G.N. CHRISTENSEN, A. EVENSET, D. GREGOR, T. SKOTVOLD, M.L. DIAMOND. 2004. A coupled fate-transport and food chain model for PBDEs in the High Arctic: application to Lake Ellasjoen, Bear Island, Norway. 3rd International Workshop on Brominated Flame Retardants. Toronto, Canada. Poster.

JONES-OTAZO, H., J.P. CLARKE, J. ARCHBOLD, M.L. DIAMOND, J.J. RYAN, G. FERGUSON. 2004. A preliminary comparison of Canadian PBDE exposures from oral and inhalation routes. 3rd International Workshop on Brominated Flame Retardants. Toronto, Canada. Poster.

ARCHBOLD, J.A., R.N. HULL, M.L. DIAMOND. 2004. Take a deep breath – its time to reconsider wildlife inhalation risk. SETAC Laurentian, Ottawa, Canada. Poster.

*GEWURTZ, S.B., N. GANDHI, G.A. STERN, W. FRANZIN, M.L. DIAMOND. 2004. Dynamics of POPs in the biota of Lake Winnipeg: a modeling approach. 47th Annual Conf. Internat. Assoc. Great Lakes Res. Waterloo, Ont. Oral presentation.

*GEWURTZ, S.B., R. LAPOSA, N. GANDHI, G.N. CHRISTENSEN, A. EVENSET, D. GREGOR, T. SKOTVOLD, M.L. DIAMOND. 2004. A comparison of contaminant dynamics in arctic and temperate fish. 47th Annual Conf. Internat. Assoc. Great Lakes Res. Waterloo, Ont. Poster presentation.

*HERNANDEZ, N. M.L. DIAMOND, J. TRUONG, D.M. LAPIERRE, B.L. FRYER. 2004.

Contaminant fate in organic films on impervious urban surfaces. 47th Annual Conf. Internat. Assoc. Great Lakes Res. Waterloo, Ont. Poster presentation.

*LABENCKI, T.L., **M.L. DIAMOND**, J. TURONG, D.M. LAPIERRE, B.A. BRANFIREUN. 2004. Characterization of wash-off from urban impervious surfaces. 47th Annual Conf. Internat. Assoc. Great Lakes Res. Waterloo, Ont. Oral presentation.

*GANDHI, N. S.P. BHAVSAR, **M.L. DIAMOND**, D. GREGOR, A. EVENSET, G.N. CHRISTENSEN. 2004. Concentrations in the aquatic food chain of Lake Ellasjoen, Bear Island, Norway. 47th Annual Conf. Internat. Assoc. Great Lakes Res. Waterloo, Ont. Poster presentation.

JONES-OTAZO, H., J.P. CLARKE, ***M.L. DIAMOND**, J. ARCHBOLD, J. RYAN, E.M. HODGE, Q.-T. LIU, J. TRUONG, C.M. BUTT, M. IKONOMOU. 2004. Predicted urban loadings and risk of human health effects from multimedia exposure to semi-volatile organic contaminants. 47th Annual Conf. Internat. Assoc. Great Lakes Res. Waterloo, Ont. Oral presentation.

BUTT, C.M., R.W. *WU, T. HARNER, **M.L. DIAMOND**, B.A. BRANFIREUN. 2004. Characterization of surface organic films in urban centers. 47th Annual Conf. Internat. Assoc. Great Lakes Res. Waterloo, Ont. Poster presentation.

*CAMPBELL, L.M., D.G. DIXON, M. EVANS, **M.L. DIAMOND**, S.B. GEWURTZ, R.E. HECKY, K.A. KIDD, L. LOCKHART, D.C.G. MUIR, G.A. STERN. 2004. Mercury trophodynamics across latitudes. 47th Annual Conf. Internat. Assoc. Great Lakes Res. Waterloo, Ont. Oral presentation.

*BHAVSAR, S.P., J. TRUONG, **M.L. DIAMOND**, B.J. FRYER. 2004. Spatial and temporal variations of metals in film on exterior surfaces of glass windows: a promising passive air sampler. 47th Annual Conf. Internat. Assoc. Great Lakes Res. Waterloo, Ont. Oral presentation.

MAKAR, P.A., **M. DIAMOND**, D.J. DONALDSON, J. TRUONG, A. ASAD, N.H. MARTINEZ, E. DEMOU and H. VISRAM. 2004. Organic absorptive partitioning: theoretical predictions and comparisons to measurements. European Geophysical Union Annual Meeting, Nice, France.

WONG, F., **M. DIAMOND***, J. TRUONG, M. ROBSON, S. HARRAD, T. BIDDLEMAN. 2003. Accumulation and chiral analysis of organic chemicals in forest soils along an urban-rural gradient. Soc. Environ. Toxicol. Chem. (SETAC) 24th Annual Meeting in North America, Austin, TX. Oral presentation.

* **DIAMOND, M.L.**, J.A. ARCHBOLD, S.P. BHAVSAR, M. MONABBATI. 2003. Fugacity in the city: MUM-Fate and MUM-Risk. Soc. Environ. Toxicol. Chem. (SETAC), 24th Annual Meeting, SETAC in North America, Austin, TX. Oral presentation.

*LABENCKI, T., **M. DIAMOND**, J. TRUONG, D. LAPIERRE, B. BRANFIREUN. 2003. Characterization of wash-off from urban impervious surfaces. Soc. Environ. Toxicol. Chem. (SETAC), 24th Annual Meeting in North America, Austin, TX. Poster presentation.

*GANDHI, N., S.P. BHAVSAR, **M.L. DIAMOND**, E. BYRON, J.S. KUWABARA, M. MARVI-DIPASQUALE, W. PRASKINS. 2003. Application of BIOTRANSPEC model to estimate mercury speciation, fate and bioaccumulation in Lahontan Reservoir, Nevada. Soc. Environ. Toxicol. Chem. (SETAC), 24th Annual Meeting in North America, Austin, TX. Oral presentation.

*JONES-OTAZO, H., **M.L. DIAMOND**, J. CLARKE, G.M. RICHARDSON. 2003. An international comparison of screening-level risk assessment modelling approaches. Soc. Environ. Toxicol. Chem. (SETAC), 24th Annual Meeting in North America, Austin, TX. Oral presentation.

BHAVSAR, S.P., CHENG, T. **M.L. DIAMOND**, H.E. ALLEN, N. GANDHI*, M.C. ALFARO-DE LA TORRE. 2003. Sensitivity of metal fate and transport results to speciation estimates from different chemistry models. Soc. Environ. Toxicol. Chem. (SETAC), 24th Annual Meeting in North America, Austin, TX. Oral presentation.

* BUTT, C.M., **M.L. DIAMOND**, J. TRUONG, M.G. IKONOMOU. 2003. PBDE & PCDD/F trends in organic films on interior and exterior windows along an urban-rural transect. Soc. Environ. Toxicol. Chem. (SETAC), 24th Annual Meeting in North America, Austin, TX. Oral presentation.

*BUTT, C.M., **M.L. DIAMOND**, B. BAHAVAR, G.A. STERN. 2003. Seasonal trends in surface organic films along an urban-rural transect. Soc. Environ. Toxicol. Chem. (SETAC), 24th Annual Meeting in North America, Austin, TX. Oral presentation.

*RYAN, M.L. G.A. STERN, **M. DIAMOND**, M. CROFT, S.GEWURTZ, P. ROACH. 2003. Temporal changes in contaminants and trophic levels in biota from Yukon subarctic lakes. Soc. Environ. Toxicol. Chem. (SETAC), 24th Annual Meeting in North America, Austin, TX. Poster presentation.

BUTT, C.M., J. TRUONG, **M.L. DIAMOND***, M.G. IKONOMOU. 2003. PBDE and PCDD/F concentrations in organic window films from southern Ontario. Dioxin 2003, Boston. Oral presentation.

BUTT, C.M. **M.L. DIAMOND***, J. TRUONG, M.G. IKONOMOU. 2003. PBDE concentrations in organic films from two North American cities. Brominated Flame Retardants Workshop, Boston. Oral presentation.

Diamond ML, Dupuy D, Gladki J, Hodge E, Jones-Otazo H, Labencki T. 2003. The impact of urban population growth on contaminant loadings. 46th Conf. Internat. Assoc. Great Lakes Res., DePaul, IL. Manitoba. Oral presentation.

*Gewurtz SB, Stern GA, Franzin W, **Diamond M**. 2003. Dynamics of persistent organic pollutants in the biota of Lake Winnipeg. 46th Conf. Internat. Assoc. Great Lakes Res., DePaul, IL. Manitoba. Oral presentation.

*Clarke JP, **Diamond ML**, Butt C, Liu Q-T, Truong J, Hodge E. 2003. Multimedia distribution of PCBs and PAH along an urban-rural transect. 46th Conf. Internat. Assoc. Great Lakes Res., DePaul, IL. Manitoba. Oral presentation.

*GANDHI, N., S.P. BHAVSAR, and **M.L. DIAMOND**. 2003. Development of mercury speciation, fate and bioaccumulation model. An Ecosystem Approach to the Health Effects of Mercury in the Great Lakes Basin. IJC Workshop. Windsor, ON. Poster presentation.

GEWURTZ, S.B., G.A. STERN, W. FRANZIN, L. LOCKHART, M. STANTON and ***M.L. DIAMOND**. 2002. Dynamics of organohalogen contaminants and mercury in the biota of Lake Winnipeg. Soc. Environ. Toxicol. Chem. (SETAC), 23th Annual Meeting in North America, Salt Lake City, UT. Oral presentation.

*GANDHI, N., **M.L. DIAMOND**, W. PRASKINS, E. BYRON, M. MARVIN-DIPASQUALE and J.

KUWABAR. 2002. Development of mercury speciation, fate and bioaccumulation model: application to the Lahontan Reservoir, Nevada. Soc. Environ. Toxicol. Chem. (SETAC), 23th Annual Meeting in North America, Salt Lake City, UT. Oral presentation.

* **DIAMOND, M.L.** 2002. Lake and life: fugacity in the water. Soc. Environ. Toxicol. Chem. (SETAC), 23th Annual Meeting in North America, Salt Lake City, UT. Oral presentation.

HARNER, T., M. SHOEIB, N. FARRAR, G. STERN, M. IKONOMOU, F.A.C.P. GOBAS, K.C. JONES and **M. DIAMOND**. 2002. Passive air sampling for POPs on an urban-rural transect north of L. Ontario. Soc. Environ. Toxicol. Chem. (SETAC), 23th Annual Meeting in North America, Salt Lake City, UT. Oral presentation.

***BHAVSAR, S.L., M.L. DIAMOND**, M. MONABBATI and J. ARCHBOLD. 2002. Multimedia Urban Model (MUM) and its application to metals and SOCs. Soc. Environ. Toxicol. Chem. (SETAC), 23th Annual Meeting in North America, Salt Lake City, UT. Oral presentation.

***DIAMOND, M.L.**, C. BUTT, T. DANN, T. HARNER, P. HARPER, G. KLEIN, Q. LIU, G.A. STERN. 2002. Urban-rural gradient study: atmospheric contaminant signatures and potential toxicity. Soc. Environ. Toxicol. Chem. (SETAC), 23th Annual Meeting in North America, Salt Lake City, UT. Oral presentation.

ARCHBOLD, J.A., **M.L. DIAMOND** and M. MONABBATI. 2002. Screening-level ecological risk assessment decision support system: an urban case study. Soc. Environ. Toxicol. Chem. (SETAC), 23th Annual Meeting in North America, Salt Lake City, UT. Oral presentation.

***JONES-OTAZO, H.A., J.A. ARCHBOLD** and **M.L. DIAMOND**. 2002. Development of an integrated ecological and human risk assessment model for urban areas. Soc. Environ. Toxicol. Chem. (SETAC), 23th Annual Meeting in North America, Salt Lake City, UT. Poster presentation.

***ARCHBOLD, J.A., M.L. DIAMOND**, M. MONABBATI, S.B. GEWURTZ. 2002. Development and application of a screening-level ecological risk assessment decision support-tool. 45th Conf. Internat. Assoc. Great Lakes Res., Winnipeg, Manitoba. Oral presentation.

***BUTT, C.M., M.L. DIAMOND**, B. BAHAVAR, Q.-T. LIU, T. DANN, G.A. STERN. 2002. Atmospheric deposition from urban areas inferred from organic films on impervious surfaces. 45th Conf. Internat. Assoc. Great Lakes Res., Winnipeg, Manitoba. Oral presentation.

***GEWURTZ, S.B., W.G. FRANZIN, G.A. STERN, M.L. DIAMOND**. 2002. Mercury and stable isotopes in the Lake Winnipeg fish community. 45th Conf. Internat. Assoc. Great Lakes Res., Winnipeg, Manitoba. Oral presentation.

HARNER, T., M. SHOEIB, N. FARRAR, K.C. JONES, ***M.L. DIAMOND**, G.A. STERN, F.A.C.P. GOBAS, M. IKONOMOU, 2002. Passive air sampling for POPs on an urban-rural transect north of Lake Ontario. 45th Conf. Internat. Assoc. Great Lakes Res., Winnipeg, Manitoba. Oral presentation.

HARNER, T., M. SHOEIB, M. IKONOMOU, **M.L. DIAMOND**, K. KANNAN. 2002. Investigation of PFOS and PBDEs in air: indoor vs outdoor, urban vs. rural and partitioning to environmental organic phases. 45th Conf. Internat. Assoc. Great Lakes Res., Winnipeg, Manitoba. Oral presentation.

LIU, Q.-T., **M.L. DIAMOND**, B.E. MCCARRY, G.A. STERN, J. TRUONG. 2002. Multimedia

concentrations of semi-volatile organic compounds (SOC) along an urban-rural gradient. Soc. Environ. Toxicol. Chem. (SETAC) Europe Meeting, Vienna. Poster presentation.

LIU, Q.-T., R. CHEN, B.E. MCCARRY, M.L. DIAMOND, C.M. BUTT, J. TRUONG. 2002. Source signatures of polar compounds in atmospherically derived organic films on an impervious surface. Soc. Environ. Toxicol. Chem. (SETAC) Europe Meeting, Vienna. Poster presentation.

*ARCHBOLD, J.A., **M.L. DIAMOND**, M. MONABBATI, M. BURCHFIELD. 2001. Integrated ecological risk assessment decision support-system: an urban case study. Soc. Environ. Toxicol. Chem. (SETAC), 22th Annual Meeting, Baltimore, MD. Poster presentation.

LIU, Q.-T., B.E. MCCARRY, R. CHEN and ***M.L. DIAMOND**. 2001. Polar compounds in organic films on an impervious surface: indoor activities and seasonal variation. Soc. Environ. Toxicol. Chem. (SETAC), 22th Annual Meeting, Baltimore, MD.

*SCHRYER, D.W., **M.L. DIAMOND**, B. MCCARRY, G. STERN, Q.-T. LIU and C. BUTT. 2001. Multimedia Urban Model: validation and uncertainty analysis using a dynamic Monte Carlo method. Soc. Environ. Toxicol. Chem. (SETAC), 22th Annual Meeting, Baltimore, MD.

*BUTT, C., **M.L. DIAMOND**, B. BHAHAVAR, T. DANN, G.A. STERN 2001. Seasonal trends in atmospherically derived organic films along an urban-rural gradient. Soc. Environ. Toxicol. Chem. (SETAC), 22th Annual Meeting, Baltimore, MD.

MONABBATI, M., ***M.L., DIAMOND**, M. BURCHFIELD, Q.-T. LIU, D. BIESBOER, P. CAPEL, W. FOREMAN and MAJEWSKI. 2001. Spatially distributed multimedia urban model for Minneapolis: Calibration and testing. Soc. Environ. Toxicol. Chem. (SETAC), 22th Annual Meeting, Baltimore, MD.

*BHAVSAR, S.P., **M.L. DIAMOND**, L. EVANS, C. RUDNITSKI and CYPAS. 2001. Estimating metal fate using dynamic coupled equivalence multispecies fate and speciation/complexation models. Soc. Environ. Toxicol. Chem. (SETAC), 22th Annual Meeting, Baltimore, MD.

HODGE*, E.M., **M. L. DIAMOND**, B.E. MCCARRY, G.A. STERN and P.A. HARPER. 2001. Sticky windows: chemical and biological characteristics of organic film on Toronto windows. E.hormone 2001 Conference. Center for Bioenvironmental Research, Tulane University, New Orleans, LA.

*KLEIN, G., P. HARPER, **M.L. DIAMOND** and T. DANN 2001. The interaction of air pollutants with the aryl hydrocarbon receptor and the estrogen receptor. 2001. E.hormone 2001 Conference. Center for Bioenvironmental Research, Tulane University, New Orleans, LA.

*BHAVSAR, S.P., **M.L. DIAMOND**, L.J. EVANS, P. CYPAS, K. RUDNITSKI and J. NILSEN. 2001. Estimating the fate of metals in lakes using a coupled QWASI equivalence multispecies and speciation models. 6th Internat. Conf. Biogeochem. of Trace Elements. Guelph, Ontario.

*LIU, Q.-T., **M.L. DIAMOND**, S.A. GINGRICH, J.M. ONDOV, P. MACIEJCZYK and G.A. STERN. 2001. Metals and semi-volatile organic compounds detected on an urban impervious surface. 6th Internat. Conf. Biogeochem. of Trace Elements. Guelph, Ontario.

*HODGE, E., P. HARPER, **M. DIAMOND**, B. MCCARRY, G. STERN. 2001. Sticky windows: chemical and biological characteristics of organic film on Toronto windows. Soc. Environ. Toxicol. Chem. (SETAC), 22th Annual Meeting, Baltimore, MD.

*KLEIN, G., P. HARPER, T. HARNER, B. MCCARRY, T. DANN, T. BIDLEMAN, and **M.L. DIAMOND**. 2001. The interaction of air pollutants with the aryl hydrocarbon receptor and the estrogen receptor. Canadian Federation of Biological Societies (CFBS), 44th Annual Meeting, Ottawa, ON. June 2001.

*HODGE, E., P. HARPER, **M. DIAMOND**, B. MCCARRY, G. STERN. 2001. Sticky windows: chemical and biological characteristics of organic film on Toronto windows. Canadian Federation of Biological Societies (CFBS), 44th Annual Meeting, Ottawa, ON. June 2001.

*LIU, Q.-T., **M.L. DIAMOND**, S.A. GINGRICH, J.M. ONDOV, P. MACIEJCZYK and G. STERN. 2001. Metals and semivolatile organic compounds detected on an urban impervious surface. 11th SETAC Europe Annual Meeting, Madrid, Spain. May 2001.

*LIU, Q.-T., **M.L. DIAMOND**, B.E. MCCARRY, R. CHEN. 2001. Composition of polar compounds in the organic film on exterior and interior surfaces of windows. 11th SETAC Europe Annual Meeting, Madrid, Spain. May 2001.

*BURCHFIELD, M.L., F. CSILLAG, M. MONABBATI, **M. DIAMOND**, B. JOHNSON and D. BELLUCK. 2000. Characterizing changes in scale of an urban land cover classification and its effects on the Multimedia Urban Model (MUM). Soc. Environ. Toxicol. Chem. (SETAC), 21th Annual Meeting, Nashville, Tenn.

MONABBATI, M., ***M.L. DIAMOND**, D. BIESBOER, M. BURCHFIELD, J. ELFERING, B. JOHNSON, M. JORDAHL and D. BELLUCK. 2000. Coupling multimedia and air dispersion models with GIS to estimate SOC fate in an urban area. Soc. Environ. Toxicol. Chem. (SETAC), 21th Annual Meeting, Nashville, Tenn.

*GINGRICH, S.E., **M.L. DIAMOND**, G.A. STERN and B.E. MCCARRY. 2000. Trends in atmospherically derived organic surface films from three North American cities. Soc. Environ. Toxicol. Chem. (SETAC), 21th Annual Meeting, Nashville, Tenn.

*HODGE, E.M., P.A. HARPER, **M.L. DIAMOND**, B.E. MCCARRY and G.A. STERN. 2000. Significance of the organic film on an urban impervious surface to endocrine disruption. Soc. Environ. Toxicol. Chem. (SETAC), 21th Annual Meeting, Nashville, Tenn.

*BHAVSAR, S.P., **M.L. DIAMOND**, L. EVANS, P. CYPAS and C. RUDNITSKI. 2000. Coupling QWASI multispecies and speciation models to estimate the fate of metals in lakes. Soc. Environ. Toxicol. Chem. (SETAC), 21th Annual Meeting, Nashville, Tenn.

DIAMOND, M.L., Q. LIU, T. HARNER, G. STERN, B. BAHAVAR and J. TRUONG. 2000. Estimating indoor air concentrations of POPs using the organic film on windows. Soc. Environ. Toxicol. Chem. (SETAC), 21th Annual Meeting, Nashville, Tenn.

BAHAVAR, B., ***M.L. DIAMOND**, T. DANN, G.A. STERN and B.E. MCCARRY. 2000. Characterization of organic films on impervious surfaces along an urban-rural gradient. Soc. Environ. Toxicol. Chem. (SETAC), 21th Annual Meeting, Nashville, Tenn.

*HARNER, T., M. SHOEIB and **M.L. DIAMOND**. 2000. Indoor air uptake comparison of several passive sampling media for detecting POPs. Soc. Environ. Toxicol. Chem. (SETAC), 21th Annual Meeting, Nashville, Tenn.

Meeting, Nashville, Tenn.

*BURCHFIELD, M.L., F. CSILLAG, M. MONABBATI and **M. DIAMOND**. 2000. Characterizing scale dependent changes in spatial pattern of an urban land cover classification and the effects on a chemical fate and transport model. 4th International Conference on Integrating Geographic Information Systems (GIS) and Environmental Modeling (GIS/EM4), The Banff Centre for Conferences, Banff, Alberta, Canada.

PRIEMER, D.A. and ***M.L. DIAMOND**. 2000. Developing a multimedia model of chemical dynamics in an urban area. Abstract submitted for presentation at International Conf. Great Lakes Res., Cornwall, Ontario.

LAW, S. and ***M.L. DIAMOND**. 2000. A comparison of enantioselective degradation of alpha-hexachlorocyclohexane in arctic and temperate aquatic systems. International Conf. Great Lakes Res., Cornwall, Ontario.

*GINGRICH, S.E., M.L. DIAMOND, G.A. STERN and B.E. MCCARRY. 2000. Wash-off of organic contaminants from urban surface films. International Conf. Great Lakes Res., Cornwall, Ontario.

*MONABBATI, M., **M.L. DIAMOND** and B.L. JOHNSON. 2000. Atmospheric dispersion coupled with multimedia distribution of semi-volatile organic compounds. International Conf. Great Lakes Res., Cornwall, Ontario.

GINGRICH*, S.E., **M.L. DIAMOND**, B.E. MCCARRY and G.A. STERN. 1999. The composition of urban organic films collected from impervious surfaces. Soc. Environ. Toxicol. Chem. (SETAC), 20th Annual Meeting, Philadelphia, PA.

PRIEMER*, D.A. and **M.L. DIAMOND**. 1999. Multimedia Urban Model: fate and transport of SOCs in urban areas. Soc. Environ. Toxicol. Chem. (SETAC), 20th Annual Meeting, Philadelphia, PA.

MONABBATI*, M. and **M.L. DIAMOND**. 1999. A chemical-particle transport model for sediment-water exchange of arsenic and salinity. Soc. Environ. Toxicol. Chem. (SETAC), 20th Annual Meeting, Philadelphia, PA.

HELM*, P.A., **M.L. DIAMOND** and R. SEMKIN. 1999. Fate of organochlorines in a high arctic lake: results from mass balance modelling. Soc. Environ. Toxicol. Chem. (SETAC), 20th Annual Meeting, Philadelphia, PA.

CHAKRABORTY, A., **M.L. DIAMOND** and M. ALAEE. 1999. The fate of organochlorines in the lakes of the Upper Yukon River Basin. Poster presented at Northern Contaminants Workshop, White Rock B.C. Sept/Oct.

DIAMOND, M.L., S.E. GINGRICH, B.E. MCCARRY, G.A. STERN and G. TOMY. 1999. Evidence for an organic film on impervious urban and rural surfaces. Dioxin'99, Venice, Italy. Vol. 41:pp.

MCCARRY, B.E., **M.L. DIAMOND**, S. GINGRICH and G. STERN. 1999. Evidence for an organic film on impervious surfaces. Paper presented at Canadian Soc. Chemistry Conf. & Exhibition, Toronto, Ontario.

TAM, E.K.L., **M.L. DIAMOND** and S. PAINTER. 1999. Dioxins and furans in the Lake Erie watershed:

A preliminary budget for urban areas. Paper presented at "Lake Erie at the Millennium" Binational Conference, Univ. of Windsor, Windsor, Ontario.

VICKERS*, S., K. BOLTON and **M.L. DIAMOND**. 1999. Sediment-water exchange of metals in an urban wet detention pond. Poster presentation at 34th Central Canadian Symposium Water Pollution Research, Burlington, Ontario.

◊**DIAMOND***, **M.L.**, N.L. LAW and S.E. GINGRICH. 1998. Quantifying atmospheric contaminant loads from urban areas: results from a multi-media model of Toronto. Paper presented at 41th Conf. of Internat. Assoc. for Great Lakes Research, Hamilton, Ontario.

◊GINGRICH*, S.E., **M.L. DIAMOND**, B.E. MCCARRY and G.A. STERN. 1998. Contaminant exchange between air and impervious surfaces in urban areas. Paper presented at 41th Conf. of Internat. Assoc. for Great Lakes Research, Hamilton, Ontario.

MONABBATI*, M., **M.L. DIAMOND** and K. BOLTON. 1998. Effect of organic matter content on the sediment-water exchange of arsenic. Paper presented at 41th Conf. of Internat. Assoc. for Great Lakes Research, Hamilton, Ontario.

DIAMOND*, **M.L.**, C.A. PAGE, M. CAMPBELL and S. MCKENNA. 1997. Life cycle approaches to contaminated site remediation: generic assessments and development of toxicity assessment approaches. Paper presented at Soc. Environ. Toxicol. Chem. (SETAC), 18th Annual Meeting, San Francisco, CA.

◊HELM*, P., **M. DIAMOND**, and R. SEMKIN. 1997. Factors affecting enantioselective degradation of α -Hexachlorocyclohexane in arctic watersheds. Paper presented at Soc. Environ. Toxicol. Chem. (SETAC), 18th Annual Meeting, San Francisco, CA.

GANAPATHY*, M. and **M.L. DIAMOND**. 1997. A multi-media model of the fate of mercury in the Lahontan Reservoir, Nevada. Paper presented at Soc. Environ. Toxicol. Chem. (SETAC), 18th Annual Meeting, San Francisco, CA.

MONABBATI*, M. and **M.L. DIAMOND**. 1997. Effect of salinity and organic matter on arsenic mobility in sediment-water systems. Poster presented at Soc. Environ. Toxicol. Chem. (SETAC), 18th Annual Meeting, San Francisco, CA.

DIAMOND*, **M.L.** and C. PAGE. 1997. Life cycle framework for assessment of site remediation options: Evaluation of six remedial options. Paper presented at Air and Waste Management Association's 90th Annual Meeting and Exhibition, Toronto.

DIAMOND, M.L.* and W. TAN. 1997. Assessing the response time of aquatic systems to changes in loadings. Paper presented at 40th Conf. of Internat. Assoc. for Great Lakes Research, Buffalo, N.Y.

LAW, N.L.* and **M.L. DIAMOND**. 1997. Using a mass balance approach to characterize urban areas as chemical sources to the Great Lakes. Paper presented at 40th Conf. of Internat. Assoc. for Great Lakes Research, Buffalo, N.Y.

MONABBATI, M.* and **M.L. DIAMOND**. 1997. The influence of secondary factors on sediment-water exchange. Paper presented at 40th Conf. of Internat. Assoc. for Great Lakes Research, Buffalo, N.Y.

GOMES, G.* and **M.L. DIAMOND**. 1997. A simple model of multimedia chemical fate in a wet

detention pond. Paper presented at 32nd Central Canadian Symp. Water Pollution Research, Burlington, Ontario.

DIAMOND*, M.L., C.A. PAGE, M. CAMPBELL AND S. MCKENNA. 1997. Using a Life Cycle Assessment approach for assessing contaminated site remediation options. Paper presented at 32nd Central Canadian Symp. Water Pollution Research, Burlington, Ontario.

EATON, S.* and **M.L. DIAMOND**. 1997. Use of a mass balance model to evaluate remedial options for a contaminated urban lake. Paper presented at 32nd Central Canadian Symp. Water Pollution Research, Burlington, Ontario.

DIAMOND*, M.L. and M. GANAPATHY. 1996. Mercury dynamics in the Lahontan Reservoir - Application of QWASI fugacity/aquivalence multispecies model. Paper presented at Soc. Environ. Toxicol. Chem. (SETAC), 17th Annual Meeting, Washington, D.C.

PAGE*, C., **M. DIAMOND**, M. CAMPBELL, R. LALL and S. MCKENNA. 1996. Life cycle assessment of site remediation options: An investigation of environmental and health impacts. Paper presented at Soc. Environ. Toxicol. Chem. (SETAC), 17th Annual Meeting, Washington, D.C.

LAW, N.L. and **M.L. DIAMOND***. 1996. Modeling the distribution of organic contaminants in an urban watershed. Paper presented at Soc. Environ. Toxicol. Chem. 17th Annual Meeting, Washington, D.C.

DIAMOND*, M.L. and N. LAW. 1996. A conceptual model for evaluating the role of impervious surfaces in stormwater runoff. Workshop: Recent Improvements in Understanding Characteristics of Stormwater Runoff, Stormwater BMPs, and receiving waters. Sponsored by Ontario Ministry of Transportation, Toronto.

GIBBS, L. and **M.L. DIAMOND***. 1996. Remedial action planning: projecting the response time of Spanish Harbour sediments to loading reductions. Paper presented at 39th Conf. of Internat. Assoc. for Great Lakes Research, Mississauga, Ontario. p.36.

HELFIELD, M.J. and **M.L. DIAMOND***. 1996. Implications of wetland restoration in an urban watershed. Paper presented at 39th Conf. of Internat. Assoc. for Great Lakes Research, Mississauga, Ontario. p.54.

LAW*, N. and **M.L. DIAMOND**. 1996. Using a fugacity approach to model the distribution of organic contaminants in an urban watershed. Paper presented at Stormwater & Water Quality Management Modeling Conference, Toronto.

DIAMOND*, M.L., H.M. FREITAS, M. KAWAI and R. LAPOSA. 1995. Organochlorine dynamics in arctic and subarctic lakes. Invited paper in Workshop. Second SETAC World Congress, Vancouver.

DIAMOND, M.L. 1995. Atmospheric contributions to whole lake contaminant dynamics: from the Great Lakes to the Arctic. National Atmospheric Deposition Program (NRSP-3), Technical Committee Meeting, Toronto.

HELFIELD*, J. M. and **M.L. DIAMOND**. 1995. Marsh restoration: Potential consequences for water quality and the aquatic community of the Lower Don River, Toronto, Ontario. Paper No. 54, Internat. Conf. Society for Ecological Restoration, Seattle, Washington.

FREITAS*, H.M. and **M.L. DIAMOND**. 1994. Estimating the fate of organochlorines in Arctic lakes. Paper presented at Soc. Environ. Toxicol. Chem., 15th Annual Meeting, Denver, Colorado.

GIBBS*, L., M. FAYE, **M.L. DIAMOND** and M. SCROGGIE. 1994. Seasonal changes in arsenic dynamics in a contaminated lake in eastern Ontario. Paper presented at Soc. Environ. Toxicol. Chem., 15th Annual Meeting, Denver, Colorado.

DIAMOND, M.L. and F. OLIAEI. 1994. Application of the Minnesota Fugacity/Aquivalence Model to Mercury. Poster presented at Soc. Environ. Toxicol. Chem., 15th Annual Meeting, Denver, Colorado.

FREITAS*, H.M., R.R. LAPOSA and **M.L. DIAMOND**. 1994. A Model of Contaminant Movement and Bioaccumulation in Arctic Lakes. Paper presented at 37th Conf. of Internat. Assoc. for Great Lakes Research, Windsor, Ontario.

FAYE, M.S. and **M.L. DIAMOND**. 1994. Temporal variation in the sedimentation of arsenic in a temperate lake. Poster presented at 37th Conf. of Internat. Assoc. for Great Lakes Research, Windsor, Ontario.

DIAMOND, M.L. 1993. Quantifying sediments as sources of contaminants using mass balance models. Paper presented at Interactions between Sediments and Water, Sixth International Symposium, Santa Barbara, California.

FREITAS, H., R. LAPOSA and **M.L. DIAMOND**. 1993. A model of mercury movement and bioaccumulation in Arctic lakes. Poster presented at 9th International Conf. of Heavy Metals in the Environment, Toronto.

LING, H., **M. DIAMOND*** and D. MACKAY. 1993. Application of the QWASI fugacity/aquivalence model to assessing the fate of trace metals in the water and sediments of Hamilton Harbour. Paper presented at 9th International Conf. of Heavy Metals in the Environment, Toronto.

MACKAY*, D., S. SANG, **M.L. DIAMOND**, P. VLAHOS, D. DOLAN and E. VOLDNER. 1993. Virtual elimination of toxic and persistent chemicals from Lake Superior, a mass balance study. 36th Conf. of Internat. Assoc. for Great Lakes Research, DePere, Wisconsin.

LING*, H., **M. DIAMOND** and D. MACKAY. 1993. Application of the QWASI fugacity/aquivalence model to assessing the fate of contaminants in the water and sediments of Hamilton Harbour. 36th Conf. of Internat. Assoc. for Great Lakes Research, DePere, Wisconsin.

DIAMOND*, **M.L.**, D. MACKAY and S. SANG. 1993. A mass balance view of mercury in Lakes Ontario and Superior. 36th Conf. of Internat. Assoc. for Great Lakes Research, DePere, Wisconsin.

DIAMOND*, **M.L.** and S. SANG. 1992. A model of the fate and transport of mercury in Lake Ontario. Paper presented at Soc. Environ. Toxicol. Chem., 13th Annual Meeting, Cincinnati, Ohio.

LAPOSA, R., H. FREITAS and **M.L. DIAMOND***. 1992. Contaminant behaviour in Arctic lakes. Paper presented at CAGONT, Toronto.

DIAMOND*, **M.L.** and D. MACKAY. 1992. Modelling the fate and transport of mercury in lakes: application of the fugacity/aquivalence approach. Paper presented at Mercury as a Global Pollutant, Monterey, California.

- MACKAY*, D., **M. DIAMOND**, S. SANG, F. GOBAS and D. DOLAN. 1992. Mass balancing as a strategy for virtual elimination. Paper presented at 35th Conf. of Internat. Assoc. for Great Lakes Research, Waterloo, Ontario.
- MACRITCHIE*, S.M. and **M.L. DIAMOND**. 1991. Identification of potential environmental and health concerns of soil remediation technologies. Paper presented at Canadian Waste Management/WasteTech '91 Conference, Toronto.
- DIAMOND***, **M.L.**, D. MACKAY, D. POULTON and F. STRIDE. 1991. Modelling organic and inorganic chemicals in the Bay of Quinte. Paper presented at 34th Conf. of Internat. Assoc. for Great Lakes Research, Buffalo, New York.
- MACKAY*, D. and **M. DIAMOND**. 1991. The role of mass balancing in Great Lakes management of toxic chemicals. Paper presented at 34th Conf. of Internat. Assoc. for Great Lakes Research, Buffalo, NY.
- DIAMOND***, **M.L.** and D. MACKAY. 1990. Quantifying chemical sources and fate in the Bay of Quinte: An application of mass balance models. Paper presented at Soc. Environ. Toxicol. Chem., 11th Annual Meeting, Arlington, Virginia.
- DIAMOND***, **M.L.**, M. COQUERY and P.M. STOKES. 1990. Development of a regional model of mercury accumulation in sport fish. Paper presented at Internat. Conf. Mercury as an Environmental Pollutant, Gavle, Sweden.
- DIAMOND***, **M.L.** and D. MACKAY. 1990. Modelling seasonal variations in contaminant dynamics in a small lake. Paper presented at 33rd Conf. of Internat. Assoc. for Great Lakes Research, Windsor, Ontario.
- DIAMOND***, **M.L.** and D. MACKAY. 1990. Modelling arsenic dynamics in a small lake: An examination of seasonal influences. Paper presented at 10th Annual SLANT/TRESLA Conference, Quebec City, Quebec.
- MACKAY*, D., **M.L. DIAMOND** and W. STIVER. 1990. Modelling sediment-water interactions. Paper presented at Symp. on Organic Substances in Sediments and Water, Amer. Chem. Soc. Meeting, Boston, Mass.
- DIAMOND***, **M.L.**, W. STIVER and D. MACKAY. 1989. The Linear Additivity Principle and its use for assessing chemical contributions from contaminated sediments. Paper presented at Soc. Environ. Toxicol. Chem., 10th Annual Meeting, Toronto.
- MACKAY*, D., W.Y. SHIU and **M.L. DIAMOND**. 1989. Characteristics of contaminant condensation in cold climates. Paper presented at Soc. Environ. Toxicol. Chem., 10th Annual Meeting, Toronto.
- DIAMOND***, **M.L.** and D. MACKAY. 1989. Extending the fugacity approach to inorganic chemical behaviour in lakes: estimating contributions from contaminated sediments. Paper presented at 40th Amer. Inst. Biol. Sci. Meeting, Toronto.
- DIAMOND***, **M.L.** and D. MACKAY. 1989. Modelling chemicals in the Great Lakes: Applying a novel equilibrium criterion, "equivalence". Paper presented at 32nd Conf. of Internat. Assoc. for Great Lakes Research, Madison, Wisconsin.

MACKAY*, D., M.L. DIAMOND and W. STIVER. 1989. A simple method for estimating chemical profiles in sediments. Paper presented at 32nd Conference of Internat. Assoc. for Great Lakes Research, Madison, Wisconsin.

MACKAY*, D. and M.L. DIAMOND. 1988. Aquivalence: A “new improved” substitute for fugacity in environmental modeling and interpretation. Paper presented at Soc. Environ. Toxicol. Chem., 9th Annual Meeting, Arlington, Virginia.

DIAMOND*, M.L., D. MACKAY, S. LANDSBERGER, and A.G. CHENG. 1988. Modelling arsenic dynamics in a contaminated lake. Paper presented at Internat. Conf. Trace Metals in Lakes, Hamilton.

DIAMOND*, M.L. and D. MACKAY. 1988. Modelling the movement of inorganic chemicals in lakes. Paper presented at 31st Conf. of Internat. Assoc. for Great Lakes Research, Hamilton, Ontario.

DIAMOND*, M.L., D. MACKAY, D. PHALP and S. LANDSBERGER. 1988. First a sink, then a source: arsenic dynamics in Moira Lake sediments. Paper presented at Conf. Can. Soc. Limnol., Ottawa.

DIAMOND*, M.L., R.J. CORNETT and D. MACKAY. 1986. Modelling the fate of arsenic in lakes. Poster presented at Technology Transfer Conf., Ontario Ministry of the Environment, Toronto.

* author presenting the paper

∅ invited presentation

11. INVITED LECTURES

- 2014 “What have we learned (or not learned) from PBDEs?”, Institute for Chemical and Bioengineering, ETH (Swiss Federal Institute of Technology) Zurich. May 8, 2014. 1 hour.
- 2014 “What have we learned (or not learned) from PBDEs?”, Swedish University of Agriculture, Stockholm. May 6, 2014. 1 hour.
- 2013 “Following the paths travelled by halogenated flame retardants”, University of Manitoba, March 15, 2013. 1 hour.
- 2013 “Following the paths travelled by halogenated flame retardants”, Brace Centre for Water Resources Management, McGill University, January 31, 2013. 1 hour.
- 2013 “The Flame Retardant Story”, McMaster University, McMaster Institute for Environment and Health. January 19, 2013 1 hour.
- 2013 “The Flame Retardant Story”, Environment Canada, Air Quality Research Division. 1 hour.
- 2012 “Recent advances in metal characterization”, co-sponsored by University of Copenhagen (Faculty of Sciences) and Danish Technical University (Dept of Environ Engineering)
- 2012 “The flame retardant story”. Stockholm University. In the series “Lectures in Contaminant Science”, and a 2nd lecture at IVL Swedish Environmental Research Institute, Stockholm.
- 2011 “Tracing chemicals from source to exposure”. Lecture & webinar at Ontario Agency for Health Protection and Promotion. May 2011.
- 2011 “Stockholm Convention in the context of preventative engineering, alternatives assessment, and sustainability re: POPs”. Plenary address at “RECETOX Workshop. Identifying the research needs in the global assessment of toxic compounds ten years after the signature of the Stockholm Convention”. Brno, Czech Republic, 22-24 May 2011.
- 2011 Emerging pollutants. Innolec Lectures. Masarykova Univerzita, Czech Republic.
- 2010 Where are chemicals in the lakes coming from and what does it mean? Toronto and Region Conservation Authority, Great Lakes Evening,
- 2010 Sources of brominated flame retardants: BFRs - from source to lake. Webinar organized

- by the Great Lakes Commission.
- 2010 Tracing the pathways of polybrominated diphenyl ethers. CML Leiden University, The Netherlands.
- 2010 Connecting metal emissions with ecotoxicology through modelling. Departments of Chemistry and Physics, Trent University.
- 2010 Where the water hits the road – urban water pollution issues. University of Maryland at Baltimore.
- 2009 Contaminants in Us -- Much Ado about Nothing or Serious Stuff? Dept of Chemistry, University of Winnipeg. Departmental seminar.
- 2009 The Science, Art and Politics of Chemical Management. SETAC Laurentian Annual Meeting, Plenary Talk.
- 2009 Source to sink to management and beyond: the story of PCBs. Dept. of Chemistry, UmeÅ University, Sweden.
- 2009 Can we manage our toxics? From science to policy to politics. Duke University, North Carolina.
- 2008 The Simpsons, Toxic Chemicals and the Future. Centre for Environment, University of Toronto.
- 2008 The Simpsons, the Chemical Management and the Future of the World. Ontario Ministry of Environment.
- 2008 Bisphenol A and Ontario’s Toxic Reduction Strategy”, Ontario Ministry of Environment, Drinking Water Division, Drinking Water Symposium, Toronto, June 17, 2008,
- 2008 How did that chemical that was inside my computer get inside me? Royal Canadian Institute seminar series.
- 2008 Urban Thin Films. AirUCI* Annual Workshop, Invited opening talk, University of California at Irvine. *Atmospheric Integrated Research: Understanding Chemistry at Interfaces.
- 2007 Approaching sustainability: cities, contaminants and health. University of Saskatchewan
- 2007 Tress and People in Cities: How do we best achieve health benefits? International Congress “A Global Vision of Forestry in the 21st Century”, Faculty of Forestry, University of Toronto.
- 2007 Connecting the dots between contaminant emissions and exposure in cities. CEAS Seminar Series. Dept. of Chemical Engineering. University of Manchester.
- 2007 Connecting the dots between contaminant emissions and exposure. Division of Environmental Health and Risk Management. University of Birmingham.
- 2006 POPs in the City. Plenary lecture, 1st Network Conference on Persistent Organic Pollutants: human exposure and impacts, University of Birmingham.
- 2006 Chemical contaminants in Toronto: Concentrations to potential effects. Health Canada Workshop, Place Matters: Health Difference in Ontario Cities and Neighbourhoods.
- 2006 Brominated flame retardants – from source to exposure. Environmental Physician’s Group of Ontario Medical Association, seminar series “Clinical Reviews”.
- 2005 Brominated flame retardants: environmental pathways and human exposure. Dept. of Environmental Chemistry and Energy, Weizmann Institute, Israel.
- 2005 Tracing contaminant sources and potential health effects: the Toronto experience. Environment & Health seminar series, Institute for Environmental Studies, University of Toronto.
- 2004 9/11: The chemical signature. University of Birmingham.
- 2004 The fate, exposure & potential risks of persistent organic pollutants in urban areas. Makerere University.
- 2004 Air pollution-health connections: complexity at its best. Guest speaker, Symposium on Windsor Air Quality, sponsored by Windsor Essex County Environment Committee,

- Windsor, Ontario.
- 2003 Surface films on impervious surfaces: implications for contaminant fate and effects. PPG Industries (Pittsburgh Plate and Glass), Glass Technology Center, Pittsburgh, PA.
- 2003 Cities: The Good, the Bad and the Ugly. Invited seminar, Great Lakes Institute for Environmental Research, University of Windsor.
- 2003 Multimedia Movement and Risk of Contaminants in Urban Areas. SETAC, Laurentian Chapter. Keynote address.
- 2002 Contaminant Fate and Effects in Urban Areas. Invited seminar, Meteorological Service of Canada, Environment Canada.
- 2002 Cities: Contaminant Fate and Effects. Invited seminar, Health Canada.
- 2002 Urban Toxics Monitoring in Toronto. Binational Toxics Strategy Integration Workgroup Meeting, co-sponsored by Environment Canada and the United States Environmental Protection Service. Windsor.
- 2002 Estimating the fate, bioavailability and potential toxicological risk posed by metals in the environment. Keynote address, International Workshop on Life Cycle Assessment and Metals. Co-sponsored by UNEP, SETAC, APEC-GEMEED, ICMM and NRCan. Montreal.
- 2002 Methods of Model Validation: Principles and Examples. Invited presentation at International Workshop on "Design of exposure multi-media models and conditions for application to soil pollutants: an international workshop." Organized by Institut de Veille Sanitaire, France.
- 2001 Urbanization: Effects on Contaminant Fate. Dept. of Environmental Engineering, Ryerson University.
- 2000 Current issues in urban air pollution. Presentation to the Environmental Assessment and Appeal Board of the Ontario Ministry of the Environment.
- 2000 Multimedia models: description and assessment for air quality modelling. Workshop on Combining Environmental Fate and Air Quality Modeling, Sponsored by the Reactivity Research Working Group Subgroup 3 on Atmospheric Availability and Environmental Fate, Research Triangle Park, NC.
- 2000 Chemical contaminants in urban areas and their potential impacts on human and ecosystem health. Issues in Urban Health. 22nd University College Symposium. Jan 31 to Feb 4, 2000.
- 1999 Fate and transport of toxics in urban ecosystems. Department of Geography, University of Maryland, Baltimore County and Baltimore Ecosystem Study.
- 1999 Behaviour of arsenic in Moira Lake. "How Healthy is the Moira" workshop, Trent University.
- 1999 Contaminants in urban areas: movement and effects. Environment and Health Seminar Series, Institute for Environmental Studies and Gage Occupational and Environmental Health Unit, University of Toronto.
- 1998 The multi-media movement of contaminants in urban areas and their accumulation on impervious surfaces. York University, Department of Geography Graduate Programme.
- 1997 Multi-media chemical distribution in urban areas: the role of organic films. State University of New York at Albany, Department of Environmental Health and Toxicology, School of Public Health.
- 1997 An overview of multi-media modelling and its use as a decision-making tool. Minnesota Department of Transportation.
- 1997 Mercury in aquatic systems. Invited presentation at "Mercury elimination and reduction symposium", Organized by Pollution Probe. Toronto, Ontario.
- 1997 Mercury cycling in the environment and its toxicological implications. Environment and Health Seminar Series, Institute for Environmental Studies and Gage Occupational and Environmental Health Unit, University of Toronto.

- 1996 Can we build habitable cities without damaging the environment? Public forum on “Mitigation of Environmental Impacts of Urban Development”. Co-sponsored by the York Chapter, Professional Engineers Organization and the Rotary Club of Richmond Hill.
- 1996 Mercury: what models can tell us. Seminar sponsored by: Severson Environmental Services, Inc., Dept. of Civil Engineering, Great Lakes Program and NYS Center for Hazardous Waste Management, University of Buffalo.
- 1994 Contaminants in Arctic Lakes: Behaviour and Fate. Ecology Seminar Series, Co-sponsored by Departments of Botany and Zoology, University of Toronto.
- 1992 A simple model of mercury dynamics in a lake. Ontario Hydro, Research Division, Toronto.

D. LIST OF COURSES

12. a. UNDERGRADUATE COURSES TAUGHT

- 2014-present ESS 299Y. UNDERGRADUATE RESEARCH OPPORTUNITY. Clara Thaysen. Contaminant-Fabric Dynamics: Experiments assessing sorption and release.
- 2013-present BIG 102Y. THE INTERNET: SAVING CIVILIZATION OR TRASHING THE PLANET? One of three instructors for this high profile 1st year course.
- 2010-2013, 2015 GGR 308. PHYSICAL ASPECTS OF THE CANADIAN ARCTIC AND SUBARCTIC. Chief cook and bottle washer.
- 2009-2013 JGE 236Y. HUMAN INTERACTIONS WITH THE ENVIRONMENT. Course coordinator, co-taught. 2012 offered as a ½ course.
- 2006-2008 JEG 221Y ENVIRONMENTAL AND SUSTAINABLE DEVELOPMENT. Course coordinator (with S. Scharper in 2006-07). Delivery of 1/3 of lectures plus participation in 3 panel discussions, review, etc. Jointly offered by Geography and Centre for Environment.
- 2001-02, 04 GGR 307S SOIL AND WATER: LANDSCAPE PROCESSES. Responsible for course that includes lectures, group research projects, problem set and exam.
- 2000-07 SCI 199Y1 ENVIRONMENTAL CHANGE. Co-taught with Tony Davis or Danny Harvey. IMAGES AND INDICATORS: MEASURING ENVIRONMENTAL PERFORMANCE. Co-taught with Virginia Maclaren.
- 1997-98 GGR 299Y RESEARCH OPPORTUNITY PROGRAM. Diane Leal and John Roppa.
- 1994-2006 GGR 233Y ENVIRONMENTAL MANAGEMENT FOR SUSTAINABLE DEVELOPMENT. Spring term. Co-lectured with J. Newton in 1994. Enrolment starts at 200, with about 150 finishing. Enrolment in 2003 is 180. Responsible for lectures, supervising T.A.s, assignments and final exam (marked part thereof). The course introduces students in the Environment and Resource Management Program with the scientific (basic and applied) basis of environmental issues.
- 1994-95 GGR 491Y INDEPENDENT RESEARCH I. Lisa Sumi (co-supervised with J. Gerits and M. Alae, National Water Research Institute).

- 1997-98 Katina Kominos.
 1992-93 Andrew Rodie (co-supervised with J. Gerits);
 2003 Alison Bodurtha.
 2013 Brielle Carriero (half credit)
- 1993-2002 ENV 221Y APPROACHES TO ENVIRONMENTAL ISSUES I. Team taught with Prof. J. Grant, Prof. S. Scharper and Dr. M. Winfield. My component is 6 weeks. Enrolment 60 to 85. Provides students with the approaches taken to environmental issues by various disciplines, using a case study as a unifying theme. I teach the environmental science/physical geography component, discussing the scientific concepts and approaches specific to the case study.
- 1993-97 ENV 200Y ASSESSING GLOBAL CHANGE: SCIENCE AND THE ENVIRONMENT. Prof. A. Zimmerman coordinates and lectures for most of the course, with my component being 2 to 3 weeks. Enrolment about 300. Science breadth course. Goal is to expose non-science students with the science behind environmental issues.
- 2008-09 ENV 498Y INDEPENDENT RESEARCH IN ENVIRONMENT. David Berliner
 2000 Christina Lee (co-supervised with D. MacDonald).
 1995-96 Jean-Guy Pageau
 1997-98 Kirsten Fertuck
- 1993-94 INI 491Y INDEPENDENT STUDY. Tulio Bugada, Steve Drescher, Steven Ogilvie.
 1992-93 Neil Banerjee (co-supervised with S.D. Scott, Geology, Geotechnical Engineering); Maria Terra (co-supervised with L. Grima).
 1991-92 Leslie Megson (co-supervised with R. Shimizu, Institute for Environmental Studies), Michelle Perera.
- CHE 499Y THESIS (CHEMICAL ENGINEERING)
 2010-11 Evelyn Mukwedeya "Spatial and temporal variations of phthalate concentrations in Vancouver homes"
 2009-10 Vivian Cheung
 2005-06 Jennifer Sears
 2004-05 Queenie Cheung
 2003-04 Bushra Drir
 2001-02 Ian Collins
 1999-00 Liam Moore, Trinh Tieu
 1993-94 Alan Teare
- 1992-2012 GGR 409F CONTAMINANTS IN THE ENVIRONMENT. Enrolment up to 30. From 1993 to present, physical science course. Responsible for all components of course. Lectures are supplemented with tutorials to provide students with a scientific understanding of the processes and factors controlling contaminant behaviour and effects in the environment. Problem sets introduce quantitative methods to estimate chemical fate, including simple mathematical modelling.
- 1992 (spring), 1992-93 INI 220Y ENVIRONMENTAL FACTORS AND DECISION MAKING.
 Enrolment 100. Responsible for lectures, supervising T.A.s, assignments and final exam (marked the latter). Provided students with tools for environmental assessment and sectoral impacts. Included guest lectures.

1992, 1993 INI 320Y CANADIAN ENVIRONMENTAL ISSUES. Spring term. Enrolment 80. Responsible for lectures, course organization, supervising T.A.s and marking portion of student reports. Co-taught with Dr. Beth Savan in 1992-93. Using principles of adult education, students were guided through two research projects in the term.

12. b. GRADUATE COURSES TAUGHT

1992-2013 JGE 1212H CONTAMINANTS IN THE ENVIRONMENT. Offered in conjunction with GGR 409 in 1992-93 and 1994-95, 1995-onwards (science version), offered as stand-alone social science course in 1993-94 and 1995-96. Enrolment varies from 5 to 13. Course has shifted from first catered to all graduate students, next for social science and planning students, and finally for science and health students. Course introduces scientific concepts behind environmental concerns and discusses policy and scientific aspects of selected environmental topics. Now offered as JGE 1212H, jointly listed with Centre for Environment.

2010 GGR 1200F PHYSICAL GEOGRAPHY CORE COURSE. Co-taught with W. Gough.

1996-1997 GGR 1213S FATE OF CONTAMINANTS IN LAND AND WATER. Co-taught with K. Bolton in 1996. Physical science course covering contaminant-soil interactions (Bolton) and multimedia contaminant dynamics (Diamond).

1995-1997 GGR 1400H CURRENT RESEARCH APPROACHES IN ENVIRONMENTAL GEOGRAPHY. Introduction to research methods, and development and vetting of research proposal. Directly supervise my graduate students and contribute to lectures.

1995-96, 01, 03 GGR 1149H READINGS IN SELECTED TOPICS. Judy Fedorowick, Sherry Eaton, Sarah Gewurtz, Lise Sabatier

1994-95 GGR 1400H CURRENT RESEARCH APPROACHES IN ENVIRONMENTAL GEOGRAPHY. Co-coordinator (with R. Jaakson), enrolment about 10.

1993-94 GGR 1400H CURRENT RESEARCH APPROACHES IN ENVIRONMENTAL GEOGRAPHY. Course coordinator.

2000 MSC 4000 SEMINARS IN ENVIRONMENT AND HEALTH. Team taught with F. Silverman and D. Cole. Seminar course designed to expose students to current topics and researchers in the multidisciplinary field.

1990-91 ESE 1008S ENVIRONMENTAL MANAGEMENT II: REMEDIAL ACTION PLANS IN THE GREAT LAKES. Course coordinator and lecturer, co-designed course (with G. Krantzberg).

1989 ESE 1014F AQUATIC CHEMISTRY. Developed and coordinated course, lectured and evaluated students.

1989 ESE 1006S MAN-ENVIRONMENT THEORY II. Co-coordinator. Lectured and provided project supervision.

Short Courses:

2000-2002 "Fundamentals of Risk Assessment", Short course offered by Professional Development

Centre, Faculty of Applied Science and Engineering. Co-taught with M. Monabbati and J. Archbold.

Guest Lectures in University Courses:

- 2012 Guest lecture in Faculty of Medicine, Determinants of Community Health (DOCH) course, Year 1, Semester 2. 1 hour lecture with 2 ours prep. " health promotion, including individual and community-level health promotion strategies, as well as health protection, including a focus on environmental and occupational health." Developed lecture in 2011-2012, delivered lecture in May 2, 2012-2013.
- 2013 Guest lecture, ENV 100, Oct 11, 2012, 2 hours
- 2013 Guest lecture, ENV 221, late October & early November. 2, 1 hour lectures = 2 hours total
- 2008-2013 JEH 445 (Assisted with design of course curriculum)
- 2004-2012 ES 9030 Environmental Applied Science and Management Program, Ryerson University
- 1987-2013 PCL 473/JNP 1014Y Interdisciplinary Toxicology.
- 1999 MSC4000 Seminars on Environment and Health.
- 1990,92,94,97,00,01 JNP 1016S Graduate Seminar in Toxicology.
- 1992-1993 GGR 1200H Physical Geography Core Course.
- 1992 ESE 1014S Aquatic Chemistry.
- 1990 POL 102 Introduction to Issues in Canadian Politics.
- 1990 CHE 201F Physico-Chemical Principles I.

12. c. THESES SUPERVISION

Department of Earth Sciences, M.Sc., Theses:

- 2012-present Daniela Serodio. Physical-chemical properties and persistence of organic flame retardants.

Department of Geography, Ph.D. Theses:

- 2011-present Golnoush Abbasi. Material flow analysis of PBDEs as a result of changes in policies from 1970-2020.
- 2007-2014 Jennifer Sawyer. Evaluating the transfer and accumulation of polyunsaturated fatty acids in freshwater food webs: a modeling approach Winner of 2010 International Assoc Great Lakes Res Graduate Student Award, .2011 Winner of J.E.R. Ross Scholarship from Dept of Geography UofT. Maternity leave spring 2012-current.
- 2000-2005 Sarah Gewurtz. An evaluation of factors controlling the dynamics of persistent organic pollutants in aquatic food webs: a modeling approach. Winner of Canadian Water Quality Association Graduate Fellowship. NSERC Scholar.
- 1996-1998 Neely Law. Transferred Ph.D. to University of North Carolina.

Department of Geography, M.Sc., Theses:

- 2006-2008 Xianming Zhang. Measurement and modelling of indoor concentrations of PCBs and PBDEs.
- 2005-2007 Lisa Melymuk. The multi-media movement of trace organic contaminants in an urban and urbanizing watershed. NSERC Scholar.
- 2005-2007 Liana del Gobbo. Risks and benefits: Contaminant and omega 3 fatty acid concentrations in fish and seafood consumed by the South-East Asian community.
- 2003-2005 Rosa Wu. Films on impervious surfaces: accumulation properties, contaminant concentrations and partitioning characteristics. Co-supervised with T. Harner, Environment Canada.
- 2002-2004 Tanya Labencki. Film-water exchange from impervious surfaces.
- 2001-2005 John Clarke. Applying the Multimedia Urban Model to measured PCBs, PAH and PBDEs

- in urban areas. Part-time student.
- 2001-2004 Heather Jones-Otazo. Development of MUM-FamRisk to estimate potential health effects of contaminant exposure in urban areas. Winner of 2003 Gordon Cressy Student Leadership Award, Labatt Fellowship, John Brown Award and Goerge Burwash Langford Prize, Univ of Toronto. NSERC Scholar.
- 2000-2003 Josephine Archbold. The Multimedia Urban Model: development and application of a screening-level ecological risk assessment model. Winner of 2002 Gordon Cressy Student Leadership Award, Sperrin Chant Masonic Award in Toxicology.
- 2000-2003 Craig Butt. Chemical and physical characterization of organic films on an impervious surface. Winner of 2002 Gordon Cressy Student Leadership Award, Labatt Fellowship.
- 1999-2002 Fiona Wong. Investigating persistent organic pollutants in soils along an urban-rural gradient. 1999-2002.
- 2001 Erin Hodge. Aryl hydrocarbon receptor mediated toxicity of the complex mixture of organic film from urban impervious surfaces. Co-supervised with P. Harper, Dept. of Pharmacology.
- 2000 Sheryl Law. Factors affecting the occurrence, isomer ratio and enantioselective degradation of hexachlorocyclohexane in arctic and temperate aquatic systems. 1998-00.
- 1999 Shannon Vickers. Metal accumulation and sediment-water exchange in an urban wet detention pond. Co-supervised with K. Bolton. 1997-99.
- 1999 Yau-Fei Chan. The effect of arsenic speciation on sorption and desorption to and from natural sediment. Co-supervised with K. Bolton. 1997-99. NSERC Scholar
- 1999 Sarah Gingrich. Chemical characterization of an organic film on impervious surfaces.
- 1996 Neely Law. Developing a simple model of chemical distribution in an urban watershed. 1994-96.
- 1993 Helen Wen Ling. Application of the QWASI fugacity/aquivalence model to assessing the fate of contaminants in the water and sediments of Hamilton Harbour. D. Mackay, co-supervisor. 1991-93.

Department of Geography, M.Sc., Research Papers:

- 1999 Marcy Burchfield. Characterizing scale dependent changes in spatial pattern of an urban land cover classification and the effects on a chemical fate and transport model. Co-supervised with F. Csillag. 1998-99.
- 1996 Glynn Gomes. The fate of organic contaminants in wet water detention ponds. 1995-96.
- 1996 Sherry Eaton. Application of the QWASI fugacity model to selected PAHs in Mohawk Lake, Brantford: An assessment of contaminant dynamics and system recovery. 1993-96, part time; 1994-96*.
- 1996 Judy Fedorowick. A multi-media inventory of pollutant loadings to the Don River watershed. 1992-96, part time; 1994-96*.
- 1996 Virginia Heffernan. Estimating *in situ* degradation rates for petroleum products in the Lower Don Lands, Toronto, Ontario. 1993-96. Leave of absence 6/94-1/95; 1/95-1/96, part time.
- 1995 Peter Jackson. Weekday-weekend variations of tropospheric ozone in the Metropolitan Toronto Region. 1993-95. 5/94-1/95, part time.
- 1994 James Helfield. Evaluating the use of wetlands in the Lower Don Lands. 1993-94.
- 1994 Margaret Faye. The role of primary production in the removal of arsenic from the waters of Moira Lake. 1992-94.

Department of Geography, M.A., Research Papers:

- 1993 Fredrick Bernard. Regulatory framework pertaining to toxics in Canada -- Southern Ontario in-service PCB case study. 1989-93, part time; 1992-93*.

Department of Geography, M.Sc.Pl.:

- 1997 Mark James. Analysis of the PCB destruction program at the contaminated site of General Electric in City of Toronto.
- 1993 Yvette Ali. A strategy for integrated pollution prevention and planning for Ontario.
- 1993 Rita Mezei. Site remediation planning process in Ontario: the need for reform. J. Whitney, co-supervisor.

Department of Chemical Engineering and Applied Chemistry, Ph.D. Theses:

- 2010-2013 Sri Chaudhuri. Measuring and understanding the indoor fate of, and exposure to phthalate esters. Withdrew April 2013.
- 2007-2012 Susan Csiszar. Estimating urban scale semi-volatile organic compound emissions and fate using a coupled multimedia and atmospheric transport model. OGS
- 2007-2012 Lisa Melymuk. Semi-volatile organic contaminants in the urban atmosphere: spatial and seasonal distributions and implications for contaminant transport. Winner of Eco-Tech Founders Award, 2007-08, Winner Sperrin Chant Masonic Award 2008, NSERC Scholar, Winner of Edward Jarvis Tyrrell Fellowship of 2011.
- 2006-2011 Nilima Gandhi. Improvements in hazard and Life Cycle Impact Assessment method for metal in freshwaters: addressing issues of metal speciation, fate, exposure and ecotoxicity. 2 NSERC Centennial Scholarship. Winner John R. Brown Prize 2008, Winner of Chris Lee Award from the Society of Environmental Toxicology & Chemistry and the International Copper Institute, 2010, Winner of Ray Langford Prize, Centre for Environment 2011.
- 2002-2007 Elisabeth Galarneau. Particle-gas partitioning of PAH: analysis and modelling.
- 2002-2005 Satyendra Bhavsar. Development of a coupled metal transport-speciation model for surface aquatic systems and its extension to soil.
- 1999 Mehran Monabbati. Effect of salinity and organic matter content of sediments on the sediment-water exchange of arsenic. 1994-99.

Department of Chemical Engineering and Applied Chemistry, M.A.Sc. Theses:

- 2013-present Jimmy Truong. Organophosphosphate flame retardants and plasticizers in the Greater Toronto Area.
- 2012-present Anna Krol. Development and evaluation of the Indoor Multimedia Assessment Model.
- 2010-2013 Sumera Yacoob. Examining Model Predictions of Zinc and Copper Aqueous Speciation and Freshwater Ecotoxicity: Case Study of Ross Lake, Flin Flon, Manitoba, Canada.
- 2006-2007 Susan Csiszar. The fate of PCBs and PBDEs in urban areas: application of the Multimedia Urban Model. By-pass to PhD.
- 2004-2007 Julie Sommerfreund. Evaluation of contaminant fate in the Venice Lagoon using a multi-segment fugacity/aquivalence model and a probabilistic uncertainty analysis.
- 2004-2006 Roshanak Razavi. Contaminant fate in the Bay of Quinte: a modeling assessment.
- 2003-2004 Harshan Radhakrishnan. Optical imaging and investigation of the development of organic films. Co-supervised with S.Liss, Ryerson University. Changed supervisors.
- 2003-2005 Nadia Martinez Hernandez. Chemical characterization of organic films.
- 2001-2003 Nilima Gandhi. Modelling mercury in the Lahontan Reservoir and food web, Nevada.
- 2000-2002 David Schryer. Multimedia Urban Model: refinement and application. Withdrew.
- 1999-2002 Satyendrakumar Bhavsar. Coupling chemical speciation and fate models: estimating the fate of metals in Ross Lake, Manitoba. By-pass to Ph.D.
- 2000 David Priemer. The multimedia urban model: assessing the fate and transport of semivolatile organic compounds in urban areas. 1998-00. NSERC Scholar.
- 1999 Ayan Chakraborty. Modelling organic contaminants in lakes of the Upper Yukon River basin. Withdrew.
- 1999 Paul Helm. Degradation of α -Hexachlorocyclohexane and organochlorine contaminant

- fate in high arctic lakes. 1996-99. NSERC Scholar.
- 1997 Murali Ganapathy. Modelling mercury dynamics in the Lahontan Reservoir, Nevada. 1995-97.
- 1994 Hilary Freitas. Modelling organic and inorganic chemicals in Arctic lakes. 1992-94.

Department of Chemical Engineering and Applied Chemistry, M. Eng. Papers:

- 1995 Makoto Kawai. A preliminary model to estimate chemical behaviour in lakes of the Upper Yukon River Basin. 1993-95; 1994-95* .
- 1994 Lennox Gibbs. A seasonal model for arsenic dynamics in Moira Lake. 1993-94; 1994* .
- 1994 Rochmi Widjajanti. Developing environmentally sound technology for the palm oil industry. 1991-94; 1993-94* .

* Time under my supervision.

Dalla Lana School of Public Health, M.Sc. Theses or research projects:

- 2013 Caryn Thompson. Analysis of phthalate concentrations indoors (withdrew from project)
- 2012-present Fe de Leon. Flammability standard setting in Canada.
- 2003-2005 Shelby Yamamoto. The status and potential health risks of PAH in Kampala, Uganda. Co-supervisor with Donald Cole. Winner of Eric Krause Award.

Department of Physical and Environmental Sciences, Ph.D. Theses:

- 2012-present Joseph Okeme. Indoor passive air sampling of semi-volatile organic compounds.
- 2011-present Aman Sanai. The role of clothing in human exposure to semi-volatile organic compounds.

Additional Graduate Related Activities:

Ph.D. Supervisory Committees University of Toronto

- 2012-present Matt Binnington, PhD committee member, (Dept Physical & Environ Sci, UTSC).
- 2012 John Westgate, Final PhD defense committee member (Dept of Chemistry)
- 2011-2012 Serguei Stremilov, UTSC Physical and Environmental Sciences, Member of reading & comprehensive examination committee. (Dept Physical & Environ Sci, UTSC).
- 2010-present Alex Gudinov., Member of reading committee. (Dept Physical & Environ Sci, UTSC).
- 2010 Fiona Wong. Dept of Chemistry, University of Toronto. Member of Senate oral committee. (Dept of Chemistry)
- 2010-2012 Christina Quinn. Dept of Chemistry, University of Toronto. Member of Senate oral committee. (Dept of Chemistry)
- 2010-2011 Xianming Zhang, Dept of Chemistry, University of Toronto. Member of reading and PhD committees. (Dept of Chemistry)
- 2007-2014 Kelly Sabaliauskas, Dept of Chemical Engineering. Member of reading committee.
- 2008-2013 Maryam Ramin, Dept. of Physical and Environmental Science, UTSC. Member of reading committee.
- 2008 Fiona Wong, Dept. of Chemistry, Member of qualifying oral committee
- 2007 Gillian Daly, Dept. of Chemical Engineering. Member of final PhD examination committee.
- 2007 Sarah Hershorn. Dept. of Geology. Member of final PhD examination committee.
- 2006-2010 Julian Cleary, Dept. of Geography, Member of comprehensive examination committee.
- 2003-2007 Chris Eckley, Dept. of Geography. Member of reading committee and defense committees.
- 2000-2007 Adam Cornwell. Dept. of Geography. Member of reading committee and department defence committee.
- 2007 Chris Warren, Trent University. External Examiner on Ph.D. oral defense.
- 1999-2004 Levi Waldron. Faculty of Forestry. Member of reading and final examination committee.
- 1999-2002 Paul Helm. Dept. of Chemical Engineering. Member of reading committee.

- 1999–2009 Liisa Jantunen. Dept. of Chemical Engineering. Member of reading committee.
 1997 Tom Harner. Dept. of Chemical Engineering. Member of examination committee.
 1997-2001 Jonathan Schwartz. Dept. of Political Science. Member of reading committee.
 1997-1999 Chris Desousa, Dept. of Geography. Member of reading, comprehensive exam, departmental defense and final defense committees.
 1996-2000 James Smith, Dept. of Geography. Member of reading and comprehensive exam comm.
 1996 Steven Young, Dept. of Material Science and Metallurgy. Member of reading and examination committee, Internal examiner for Senate oral.
 1994-1998 Annameiki Farenhorst, Dept. of Geography. Member of reading and exam. committee.
 1995-2000 Cathy Cottrell. Dept. of Chemical Engineering. Member of reading, departmental defense and final defense committees.
 1995-1998 Edwin Tam. Dept. of Civil Engineering. Member of reading, comprehensive exam, departmental and final defense committees.
 1994 Frank Wania, Dept. of Chemical Engineering. Member of Dept. and Senate oral committees.
 1993 Kathleen Jagger. Dept. of Geography. Member of oral comprehensive examination committee.

Master's Committees, Dept. of Geography

- 2010 Nyssa Clubine, M.Sc.
 2008 Tony Zhang, M.Sc.
 2004 Yvonne Feng, M.Sc.
 2003 Angelika Bayer, M.Sc.
 2002 Carl Mitchell, M.Sc.
 2001 Maggie Young, M.Sc.
 Frank Donnelly, M.A.
 Kyle Hodder, M.Sc.
 Carrie Lillyman, M.Sc.
 1999 Andrew Cornwell, M.Sc.
 Vivian Campbell, M.Sc.
 1997 James Sterling, M.Sc.
 Anastasia Svirejava, M.Sc.
 Dan Fitzgerald, M.Sc.
 Eric Krause, M.A.
 Sue Asprey, M.Sc.Pl.
 1996 Heather Alexander, M.A.
 Keilly Griffiths. M.Sc.Pl.
 Neil Mallen. M.Sc.Pl.
 Andrew Rodie, M.Sc.
 1994 Sue Dickson. M.Sc.
 Claire Woolveridge. M.A.
 Larry Dufay. M.A.
 Val Aloe. M.Sc.Pl.
 1993 Sarah Cowell. M.Sc.
 Simon Benger. M.Sc.
 Sean Ledgerwood. M.A.
 1992 Huang Zhen. M.Sc.
 Kerry Lakatos-Hayward. M.Sc.Pl.

Master's Committees, Dept. of Chemical Engineering and Applied Chemistry

- 2010 Bernadette Assamoi. M.Sc.Eng. project defense

2007 Kelly Sabaliauskas, M.A.Sc. bypass oral.
 2002 Elizabeth Gilmore, M.A.Sc.
 2000 Yan Liang, M.Eng.
 1994 Penny Vlahos. M.A.Sc.
 1993 Shirley Thompson. M.Eng.
 1991 Robert Caron. M.A.Sc.

Master's Committees, other departments and universities

2006 Christopher Warren. Trent University. External examiner.
 2002 David Wasserstein. Institute of Medical Sciences. Internal examiner.
 2002 Gail Klein, Dept. of Pharmacology. External examiner.
 2002 Charlotte Corda, Dept. of Pharmacology. External examiner.
 1999 Matt McLeod. Trent University. External examiner.
 1992 Fereshteh Hashemi, Dept. of Botany. M.Sc.

External PhD Examiner

2013 Michael Owsianiak, Danish Technical University
 2013 Paul Messing, University of Manitoba
 2012 Karen Søggaard Christiansen, University of Copenhagen
 2011 Karen Lavin, University of Otago, New Zealand
 2010 Anneke Sleeswijk, Leiden University, The Netherlands
 2010 Emma Goosey, University of Birmingham
 2009-10 Nadia Abdelouahab, Université de Québec à Montréal. External reviewer.
 2009 Kristina Sundqvist, University of Umeå, Sweden
 2007 Cecile Bulle, Dept of Chemical Engineering, Ecole Polytechnique, Montreal, Quebec.
 External examiner for PhD

Additional Supervisory Activities:

Post-Doctoral Fellows

2014-present Congqiao Yang, PhD.
 2010-2013 Emma Goosey, Ph.D.
 2007-2009 Cristian Mugnai, PhD. (visiting from Italy)
 2006-2010 Matthew Robson, Ph.D.
 2005-2006 Marco Belmont, Ph.D.
 1999-2002 Qintao Liu, Ph.D.
 1999-2001 Bagher Bahavar, Ph.D.
 1999-2002 Mehran Monabbati, Ph.D.
 1998-1999 Nisheeth Bahadur, Ph.D.

Visiting Scholars

2011-2012 Anping Zhang, Assoc. Prof, Zhejiang University, Hangzhou, China. Spending most of his time at Environment Canada.
 2011-2012 Qi Hong, Assoc. Prof, Harbin Inst Technology, Nanjing, China
 2010 Deqi Xiong, Ph.D., Dalian Maritime University, China
 2006 Radka Alexy, Ph.D.

Visiting Students

2013 Sandra Brommer, University of Birmingham, U.K. PhD candidate. 3 month visit.
 2012 Maria Bialo, National School for Water and Environmental Engineering of Strasbourg (ENGEES)

Research Associates

2013	Jimmy Truong
2012	Daniela Serodio
2011	Clayton Catching
2010-2011	Stefanie Verkoyoen
2008-2009	Catherine Abreu
2007-2008	Liana del Gobbo, M.Sc.
2003-2005	Nilima Gandhi, M.Sc.
2004	Julie Sommerfreund, B.Sc.
2003-2004	Buuan Lam, B.Sc.
2001-04, 06	Dianne Lapierre
2001-2004	Erin Hodge, M.Sc.
2001-2006	Jennifer Truong, B.Sc.
2000-2001	Trinh Tieu, B.A.Sc.
2000-2001	Marcy Burchfield, M.Sc.
1999-2000	Sarah Gingrich, M.Sc.
1998-1999	Edwin Tam, Ph.D.
1995-97	Cynthia Page, M.A.Sc.
1994	Lennox Gibbs, M.Eng.
1994	Hilary Freitas, M.A.Sc.
1993-1994	Helen Ling, M.Sc.

NSERC Undergraduate Research Award Recipients

2001	Kim Tsoi, Department of Chemical Engineering and Applied Chemistry.
2000	Jennifer Truong, Department of Geography.
1994	Ilan Kelman, Department of Chemical Engineering and Applied Chemistry.
1993	Rebecca Laposa, Department of Geography.

Undergraduate Summer Assistants

2013	Angela Huang
2012	Kevan Saba
2008 & 2009	Amanda Giang
2008	Kristina Dean
2007-2008	Catherine Abreu
2006	Kate Liss, Jennifer Cheung
2005	Kate Liss
2004	Veronica Lo, Rina Goldberg
2003	Bushra Drir, Talya Manoim
2002	Dianne Lapierre, Azadeh Zarashkian, Ylva Olsson
2001	Dianne Lapierre, Jennifer Truong
2000	Trinh Tieu, Dianne Lapierre.
1999	Asif Jalil, Julia Tsai.
1998	Sheryl Law*.
1997	Julie Phillips*
1996	Wilfred Tan, Judy Josefowicz (part-time)
1995	Judy Josefowicz (part-time)
1994	Martha Scroggie (part-time)
1993	David Tu, Martha Scroggie, Melissa Fotiadis
1992	Andrew Rodie, Hilary Freitas, Rebecca Laposa, Michelle Perera

* Environmental Youth Corps

Ontario Work-Study Plan Students

2014	Clara Thaysen
2013	Grant de Jeong
2013	Patrick Feghali
2012	Esmail Mansouri
2011-12	Vanessa Ymele
2006-07	Calvin Au
2005-06	Amy Leung
1999-00	Amelia Du
1995-1996	Laura Alionte
1992-1993	Andrew Rodie

12. d. OTHER TEACHING AND LECTURES

Annual	Guest lecture at Ryerson University, Environmental program.
2012	Mathematical modeling approaches to understanding environmental fate and behaviour of flame retardants. IVL Swedish Environmental Research Institute, Stockholm. Part of the INFLAME research project of the European Union. April 23,24, 2012.
2012	Interdisciplinary research. Held at University of Birmingham. Part of the INFLAME research project of the European Union. January 18-19, 2012.
2007	“Brominated flame retardants: from release to exposure”, UTSC, Dept of Physical & Environmental Sciences and Centre for Environment, Master of Environmental Science.
2007	“Connecting the dots between contaminant emissions and exposure”, University of Toronto, Moving Canada towards Sustainability. A forum to discuss global environmental issues.
2007	“Urban Contributions of Contaminant Load to Lake Ontario”. Lake Ontario Lake-wide Management Plan (LaMP) annual meeting, Niagara, N.Y. Organized by Environment Canada and U.S. EPA.
2007	“Loadings and fate of PCBs in Hamilton Harbour from a mass balance perspective”. Hamilton Harbour Remedial Action Plan (RAP) meeting.
2007	“What if the chemicals are toxic or persistent?” Urban Metabolism workshop held at University of Toronto. Organized by Prof. Chris Kennedy, Dept of Civil Engineering. Sponsored by Toronto & Region Conservation Authority.
2007	“Computer models in Great Lakes Decision-making”. A panel discussion held at 49 th Annual Conf. Internat. Assoc. Great Lakes Res. Windsor, Ont.
2006	“Brominated flame retardants: from release to exposure”, Ryerson University, Environmental Applied Science & Management Program.
2006	“What’s the burning issue with brominated flame retardants?” Physical Geography Research Day. Fall 2006.
2006	Polybrominated Diphenyl Ethers: Exposure pathways and human exposure. SENES Consultants.
2006	Brominated flame retardants – from source to exposure. Environmental Physician’s Group of Ontario Medical Association, seminar series “Clinical Reviews”.
2004	“Contaminants around us: the Toronto experience”, Centre for Urban Health Initiatives. University of Toronto.
2004	“Polybrominated diphenyl ethers: connecting sources and exposure”, Environmental Chemistry Seminar Series, Dept. of Chemistry, University of Toronto.
2004	“Chemical contaminants in the environment: from release to effects”, Gartner Lee Ltd.
2003	“Cities: contaminant fate and effects”, Toronto & Region Conservation Authority.
2002	“Water Quality”, “Women in Science”. Later Life Learning, Innis College.
2000	“Toxins in the Environment – Sources, Movement and Control Measures”. Public lecture

- in Green Waves Eco Talks organized by the Festive Earth Society.
- 1999 “Persistent Organic Pollutants: Fate in an Urban Environment and Potential Health Effects”. Presentation to Toronto Public Health Department, Health Promotion and Environmental Protection, City of Toronto.
- 1999 Arsenic cycling in Moira Lake. Presentation in workshop organized by “How Healthy is the Moira?” committee.
- 1996 Science Outreach. Lecture for girls 9 to 14 on research and career opportunities.
- 1992 Saturday Morning Seminar Series for Secondary School Students. Lecture on Great Lakes water quality.
- 1988 Tutorial Assistant, University of Toronto, Dept. of Chemical Engineering
- 1980-1981 Tutorial Assistant, McGill University, Dept. of Biology
- 1976-1979 Tutorial Assistant, University of Alberta, Dept. of Zoology

E. ADMINISTRATIVE POSITIONS

13. a. SERVICE ON COMMITTEES AND ORGANIZATIONS

Initiatives:

- 1998-2004 Initiation, organization and Vice-chair of “Women in Arts and Science Committee”, advisory to Dean of Arts and Science.
- 1997 Organized and chaired “Research Day” of Institute for Environmental Studies.
- 1997 Organized “The Great Debate” with Ruth Grier and Michael Bliss.
- 1996, 2000, 10 Organized or co-organized “Physical Geography Research Day” series to be held twice yearly as a forum for faculty and graduate students.
- 1994-1996 Involved with initiative to develop analytical facilities at University of Toronto. Member of ad hoc committee for ANALEST (Analytical Laboratory for Environmental Teaching).
- 1994 Developed M.Sc. Thesis option for Dept. of Geography and IES Collaborative Program.
- 1993 Initiated change of undergraduate program from “Physical Geography” to “Physical and Environmental Geography”

Major:

- 2011-2012 Dean’s working group on Environment and Resources, also curriculum committee for Environmental Science program
- 2011-2014 Provostial Assessor, Faculty of Nursing, search committees, promotions committee
- 2010-2012 Member, University Tribunal Committee
- 2010-2012 Vice-Chair, Planning and Budget Committee of Academic Board
- 2009-2012 Member, Honourary Degree Committee of Academic Board
- 2009-2010 Member, Academic Policy and Planning Committee of Academic Board
- 2007-present Coordinator, Physical Geography Building
- 2007-2009 Chair, Council of the Faculty of Arts and Sciences
- 2007-2010 School of Graduate Studies, Tenure Assessor
- 2007 Dean’s ad hoc committee on Earth & Planetary Sciences
- 2007 Dean’s representative, Dept. of Geology, search committee, Radiogenic Isotope Geochemistry
- 2004-05 Member, Search committee, Chair of Department of Geology
- 2004-05 Member, Search committee, Dept. of Geography, physical geography search
- 2004-05 Member, Search committee, Department of Physical Sciences, UTSC
- 2004-2008 Vice-Chair, Planning and Budget Committee of Academic Board, University of Toronto
- 2004-05 Governance Committee, Department of Geography
- 2003-04 Academic Planning Committee, Department of Geography.

2003-04	Search Committee, Department of Physics (Condensed Matter, CRC).
2003-2008	Member, Planning & Budget Committee of Academic Board, University of Toronto.
2003	Ad hoc Committee on Governance, advisory to Dean of Arts & Science.
2002	Search Committee, Physical Geography, St. George campus.
2001-2012	Member of Academic Board of Governing Council, University of Toronto.
2001	Search Committee, Technician, Physical Geography.
2001	Search Committee, Soil Science position, Scarborough College.
2000, 01	Search Committee, Physical Geography position, St. George campus.
2000	Graduate Admissions Committee, Member.
2000	Search Committee, Senior Hydrology position, Geography, St. George campus.
1999	Search Committee, Soil Science position, Scarborough College.
1999	Search Committee, Environment and Resource Management position in Geography, St. George campus.
1998	Search Committee, Hydrology position in Geography, St. George campus.
1998-99	5 Year Review Committee for Institute for Environmental Studies.
1998	Search Committee, Hydrology position at Erindale College.
1997	Chair of the Weigand Lecture committee. Organized and hosted seminars for two invited speakers.
1996	Physical Geography Research Day. Organized and chaired first of on-going series.
1994	Discover Science. Organized volunteers for demonstration in Physical Geography.
1994	Search Committee, Hydrology position at Erindale College.
1994	Science Options. Organized Dept. of Geography Information Booth. Rewrote information sheet on "Programs in Physical Geography"
1994	Member of Environmental Protection Subcommittee on Grounds/Water Use/Biodiversity.
1993-1996	Women in Science Committee, Faculty of Arts and Science Related activities: <ul style="list-style-type: none"> • Women in Science Faculty Advisor, Dept. of Geography; • Panelist, "Challenges and Solutions: Balancing an academic career and family responsibilities", Workshop for Women Faculty and Librarians, April 15, 1997. • "Women in Science" luncheons. Co-organized and moderated discussions. Co-sponsored by Dept. of Geography and Faculty of Arts and Science. 1996, 1994; • Forum on Women in Science, "Graduate School and Beyond". Moderated panel discussion. April, 1993.
1992-1993	Division of the Environment, Science Subcommittee.
1992	WHMIS and laboratory safety seminar. Co-organizer of seminar for Dept. of Geography.
1991-1993	Innis College Environmental Programme Committee.
Minor:	
2010-2011	Provostial Assessor, Search Committee, Faculty of Physical Education and Health
2009	Member, Search Committee, Graduate Chair of Dept. of Geography
2006	Centre for the Environment: Member of advisory committee of Collaborative Program on Environment & Health.
2003-2008	Life Sciences Awards Committee, University of Toronto
2004-05	Search Committee, Paleoclimatographer Dept. of Geology (half of search)
2004-2005	Member, Ontario Graduate Student Scholarship Panel.
2004-05	Promotion Committee, tenure committee, Department of Geography
2003-04	Senior Committee, Department of Geography.
2003	Research Advisory Committee, Institute for Environmental Studies
2001	Member of Advisory Committee for Environmental Management Certificate Program, Professional Development Centre.
2000, 2003	Innis College Curriculum Review

- 1999-present Collaborative Graduate Program in Environment and Health. Member of Advisory Committee.
- 1997-2004 Arctic Working Group. Member.
- 1996-2000 Environmental Engineering Faculty Council. Member.
- 1995-2001 Collaborative Graduate Program in Toxicology. Member of Program Committee.
- 1994-1997 Graduate Committee, Dept. of Geography.
- 1994 Ranking NSERC and OGS applications.
- 1994 Mathematics Sciences Review Committee.
- 1994 Ranking NSERC Undergraduate Student Research Awards from "non-NSERC" departments.
- 1992-1993 Undergraduate Committee, Dept. of Geography.

F. OTHER

Co-organizer of the following Conferences, Workshops and Conference Sessions:

- 2013 Co-chair, session at Dioxin 2013 Conference, Daegu, Korea
- 2012 Co-organizer, Discussion of a Chemical Planetary Boundary, Chalmers University, Gotenburg, Sweden, April 18-20, 2012
- 2008-2010 Co-chair of the annual conference of the International Association of Great Lakes Research, held at the University of Toronto, May 2010.
- 2009 Canadian Association for Water Quality, Central Region. 44th Annual conference. Co-chair of special symposium on Bisphenol A.
- 2008 Life Cycle Impact Assessment: The Clearwater Meeting on Developing Characterization Factors for Aquatic Ecotoxicity of Metals.
- 2007 Diversity in POPs, Co-organizer of Special Symposium at Society of Environmental Toxicology & Chemistry annual meeting, Milwaukee.
- 2003 SETAC, Laurentian Chapter Annual Meeting, Toronto.
- 1999 Lake Ontario Research and Management Workshop. Held at University of Toronto. Co-chaired by D. Mackay, Trent University, and J. DePinto, SUNY Buffalo.
- 1996 Life Cycle Assessment of Site Remediation Options - A Review of the Generic Approach and Case Study. Funded by Ministry of Environment and Energy. Held at Dept. of Geography, Toronto.
- 1992 Lake Superior Mass Balance Workshop. Funded by the International Joint Commission and Atmospheric Environment Service of Environment Canada, Toronto.
- 1991 Great Lakes Research Day. Sponsored by the Institute for Environmental Studies, Toronto.
- 1991 Great Lakes Mass Balance Workshop. Funded by the International Joint Commission, Niagara-on-the-Lake.
- 1990 Workshop to develop a regional model of mercury accumulation in sport fish. Held at the Institute for Environmental Studies, Toronto.

Workshop Participant:

- 2013 Blue Mountain Retreat. Assembled 21 experts and industry representatives to advance the agenda of toxic chemical control. June 2013.
- 2011 Advancing exposure science to improve chemical safety. Co-sponsored by American Chemistry Council and Health Canada, Quebec City, June 2011. Rapporteur for poster session.
- 2009 & 2010 SVOCs in Indoor Air, Indoor Air Institute.
- 2009 ScorePP: Workshop on Urban pollution sources and water treatment, Universite de Quebec

- 2009 Canadian Environmental Modelling Centre, Partners' Meeting, "Advances in modelling the aquatic fate and toxicity of metals", Trent University.
- 2009 Indoor contaminants. Workshop sponsored by US EPA, Raleigh, NC.
- 2009 Exposure science in the 21st century. National Research Council, 8th Workshop of the Standing Committee on Risk Analysis Issues and Reviews. Speaker "Predictive Model Frameworks: Physical Models". Washington, DC.
- 2008 Health and indoor environments, sponsored by National Research Council.
- 2008 Health-Environment Linkages, sponsored by Statistics Canada.
- 2007 National Policy Consultation on Children's Health and Environment. Workshop #5, Toxic Substances in Consumer Products. Respondent in discussion.
- 2007 Lake Ontario Lake-wide Management Plan. Annual meeting. Environment Canada and U.S. EPA.
- 2007 Hamilton Harbour Remedial Action Plan. Summary of Results 2007.
- 2007 Roundtable Discussion, Ontario Ministry of Environment, Air Pollution & Climate Change. Opportunity to discuss with Minister Laurel Broten.
- 2007 City of Toronto Workshop on "Community Right to Know", developing a toxic release inventory.
- 2007 "Health and Environmental Tracking and Surveillance in Canada". Health Canada workshop.
- 2007 "Air Pollution and Children's Health" Co-sponsored by Pollution Probe, Children's Health Coalition, Health Canada. Participant.
- 2003 "Hazard Identification Approach for Metals and Inorganic Metal Substances", Pellston Workshop sponsored by SETAC.
- 2003 "Metal Unit World" workshop. Organized by Center for the Study of Metals in the Environment, University of Delaware.
- 2002 Retreat on science in the Meteorologic Service of Canada, Environment Canada. Organized by the Senior Scientists Committee of MSC, Environment Canada.
- 2001 Framework for Modelling Ecological Change in the Detroit River - Lake Erie Corridor. Panelist in a workshop sponsored by the International Joint Commission - Council of Great Lakes Research Managers'.
- 2000 "Northern Contaminants Workshop". Sponsored by Dept. of Indian Affairs and Northern Development.
- 1999 "Lake Ontario Mass Balance Workshop". Sponsored by University of Toronto, Trent University, SUNY Buffalo, Toronto.
- 1999 "Environmental Resource Group Meeting for the PSL2 Assessment of releases from copper and zinc smelters and refineries". Sponsored by Environment Canada, Ottawa.
- 1999 "How Healthy is the Moira?", Sponsored by Trent University and "How Healthy is the Moira" Committee, Peterborough, Ontario.
- 1999 Canadian Network of Toxicology Centres (CNTC), Annual Research Symposium, Ottawa.
- 1998 "Wolf Creek Research Workshop". Sponsored by Environment Canada, Whitehorse.
- 1997 "Environmental Resource Group Meeting for the PSL2 Assessment of releases from copper and zinc smelters and refineries". Sponsored by Environment Canada, Ottawa.
- 1997 "Arctic Archipelago Project Planning Meeting". Sponsored by Dept. of Indian Affairs and Northern Development, Iqaluit, Nunavik.
- 1997 "Nunavik and Northern Labrador Contaminants Action Plan Meeting". Sponsored by Dept. of Indian Affairs and Northern Development, Kuujuaq, Nunavik.
- 1997 "Northern Contaminants Research Results Workshop". Sponsored by Dept. of Indian Affairs and Northern Development, Victoria 1997, Calgary 1996, Winnipeg 1994, Burlington 1993.
- 1994 Yukon Contaminants Workshop. Organized by Yukon Contaminants Committee.

- Whitehorse, Yukon.
- 1993 “Evaluating the Benefits of Water Quality Improvements”. Sponsored by the Ontario Ministry of Environment and Energy.
- 1990 & 1991 “Bay of Quinte Remedial Action Plan Workshop”. Two workshops sponsored by the Ontario Ministry of Environment.

Referee for Reports:

- 2003 “Lake Ontario Mass Balance”. Member of Scientific Review Panel, U.S. EPA.
- 1998 “Lake Michigan Mass Balance Program”. Member of Scientific Review Panel, U.S.EPA.
- 1998 “Hudson River PCB Mass Balance Study”. Member of Peer Review Panel, U.S. EPA.
- 1994 “Lower Don Lands Site Characterization and Remedial Options Study”. Review for the Waterfront Regeneration Trust.
- 1993 “Niagara River (Ontario) Stage I RAP Report”. Review for the Great Lakes Regional Office, International Joint Commission. Review included oral presentation at public information meeting in Niagara Falls, Ontario.
- 1991 “Arsenic and its Compounds, Priority Substances List Assessment Report”. Review for Government of Canada, Health and Welfare Canada and Environment Canada under the Canadian Environmental Protection Act (CEPA).

Referee for Journals and Monographs:

Environmental Science and Technology

Environmental Pollution

Atmospheric Environment

Environmental Management

Science of the Total Environment

Journal of Great Lakes Research

Water Environment Federation

Mercury as a Global Pollutant: Towards Integration and Synthesis.

Referee for Grant Proposals:

- 2013 NSERC Discover Grants
- 2012 Israeli Environmental Health Fund
- 2010 NSERC, Swiss Federation of Science
- 2007 NSERC.CRD
- 2006 Large Pelagics Research Centre.
- 2003 NSERC Discovery Grants Program, Canada Foundation for Innovation, Canadian Foundation for Climate and Atmospheric Sciences
- 2001, 2002 NSERC Collaborative Research and Development Grants Program
- 2000 Hudson River Foundation
- 1998 NSERC Strategic Grant.
- 1997 Minnesota Sea Grant College Program
- 1997 Hudson River Foundation
- 1996 National Science Foundation.
- 1993 Great Lakes Research Fund.

Miscellaneous:

Numerous others that I’ve stopped recording.

- 2011 “Tracking toxins in the city: where are chemicals coming from and what does it mean?” Presentation to UTSS.
- 2008 “What’s in the air we breathe?” Presentation at Women’s Health conference.
- 2007 “How to stop climate change.” Presentation at forum organized by MP Olivia Chow,

- Trinity-Spadina riding.
- 2006 Later Life Learning. “All you want to know about contaminants!”
- 2001 Presentation to the Walkerton Inquiry, Public Hearing 5: Regulatory and Technical Issues for Specific Sources of Contaminants; Water Quality, “Urban development and water quality protection”. Toronto, Ontario.
- 1997, 2000 Judge for Chandler-Misener Award, International Association for Great Lakes Research.
- 1997 Co-chair, “Modeling chemicals in the Great Lakes: What have we learned? Where do we go from here?” International Association for Great Lakes Research 1997 Conference, Buffalo, N.Y.

Selected Media interviews*:

- 2014 March 20, 2014. David Fraser, CBC. Discussion about flame retardants. 30 minutes.
- 2013 CTV Newsworld, July 10, 2013. Live to air TV comment on environmental impact of train disaster in Lac Magantic.
- Al Jazeera English, August 14, 2013. Video interview for posting on pay TV channel and website. About stockpile of refinery coking residue in Detroit blowing over to Windsor and broader issue of society’s waste.
- Weather Network. Microplastics. Kasia Bodurka. Phone interview Sept 17, shoot Oct 3. 2013.
- Toronto Star, Raveena Aulakh. The environmental cost of cheap clothing. Phone interview Oct 8, 2013.
- CBC Marketplace, Friday Oct 11, 2013. Comment on the finding in tea leaves levels of some pesticides above Health Canada guidelines. About 1.5 hours spent on research and the phone call.
- Press release from Environmental Defense. “Pre-polluted, A report on toxic substances in the umbilical cord blood of Canadian newborns”, June 26, 2013.
- SRC, Radio Canada. Flame retardants. Jan 24, 2012, 30 min interview.
- 2012 Global TV. Telephone interview re: health risks to fire fighters. I asked not to be quoted directly since this isn’t my area of expertise but I did provide background information. May 8, 2012.
- CBC Market Place, May 11, 2012
- Press release from Canadian Environmental Law Association regarding flammability standards requiring use of flame retardants. May 11, 2012.
- Global News. For on-line news. Interview regarding news of anticipation of extremely hot summer, May 16, 2012
- Global Toronto.com Interview with James Armstrong. The annual “smog” interview. June 11, 2012.
- CBC French. Comment on Peter Kent’s announcement of \$16 million to fight algae blooms in Great Lakes (a re-announcement of money already being spent!) Oct 9, 2012
- CBC National News, discussion about a potential story, Thurs November 29, 2012
- Toronto Star, article on flame retardants, Thurs November 29, 2012, for Monday’s paper
- CFAX radio in Victoria, ½ live to air interview re: flame retardants, Thurs November 29, 2012
- Interview for magazine, Canadian Chemical News, from Chemical Institute of Canada. Tyler Irving. Monday December 3, 2012. Re: flame retardants.
- CBC TV Marketplace. November 30, 2012. Advice and guidance on program, on camera interviews in lab and on location, experimental work on location and in our lab.
- May 11, 2012. Press release from Canadian Environmental Law Association regarding flammability standards requiring use of flame retardants
- May 8, 2012. Global TV. Telephone interview re: health risks to fire fighters.
- May 11, 2012 CBC Market Place
- 2011 Post Canada Magazine. June 23, 2011

- November 22, 2011. CBC News. Removing BPA from canned soup.
 Flame retardants: are the benefits worth the risk”. Participated in film clip to be used as a trailer to get funding for film with that title. Producer – James Redford), March 28, 2012
 November 2011. “A consumer's guide to buying the right mattress: personal health; environmental concerns; comfort”. Provided information to free-lance author of this story that was published in
 A few Q&A with CBC researchers
 March 2012. Interview with Stephen Scharper regarding deep cuts to Environment Canada, which he profiled in his column in Toronto Star
- 2010
 CBC’s Market Place (feature interview & TV shoot)
<http://www.cbc.ca/marketplace/2011/lousylabls/miriamdiamond.html>
- 2009
 Interview, Zoe Cormier, for New Internationalist
 CBC Radio, Here and Now. Interview on Toronto’s garbage strike (July 8)
 CBC Radio, The Current. Interview on “Slow Death by Rubber Duck” (June 18)
 Toronto Sun, beaches water quality (July 24)
 CBC TV special on the future (July 24), 20 minute hour interview
 CBC.ca on-line news article on “back to school” shopping. Phthalates in kids school supplies (August 26), 1/4 hour interview
 Toronto International Film Festival, article connecting “Green Porno” at TIFF with scientific perspective, 1.5 days
 Toronto Sun, phone interview. Sept 18, 15 minutes. Comment on nearshore Lake Ontario water quality
 Green Living magazine, interview (March 2009 appeared in April 2009) (interview)
- 2008
 Toronto Star, Feature article, October 23, 2008.
 Global TV, water pollution. Extended interview broadcast on 19X6 (interview on camera, ~1 hour)
 University of Toronto magazine, short & extended interviews on toxic chemicals
- 2007
 BC Metro Morning. June 7. Live interview, Environ Sci of the Year.
 Toronto Star, June 7. Lead in drinking water.
 Toronto Star, June 7. Smog and health effects (annual interview on the subject that fails to go away).
 Toronto Star, July 9. Air pollution trends.
 Toronto Star, July 11. Release of Stats Can report on Canadian’s going “shades” of green.
 Globe & Mail, July 12. Biomagnification of persistent organic pollutants.
 CBC, The Nature of Things, July 16-19. Health effects of climate change and air pollution in cities. Aired November 2007.
 Hamilton Spectator, July 30. Fire at pesticide plant resulting in effluents entering Spencer Creek.
 CTV, Night news. July 31. Ultra fine particles from laser printers. TV shoot.
 Global TV. Consultation on series on pollution. TV interview re: Toronto’s major polluters, aired Wed March 7, 2007.
 Radio interview, The Green Majority, CIUT. March 2.
 CBC Radio, Edmonton and Calgary. April 17.
 Canadian Geographic Magazine, 2 weeks, January.

* List starts in 2007

Exhibit C

Statement of David A. Eastmond

Sept. 15, 2014

To whom it may concern:

I, David A. Eastmond, am writing this statement in support of the Petition to the CPSC to ban or significantly restrict the availability of certain household products containing additive non-polymeric organohalogen flame retardants.

1. I am Professor and Chair of the Department of Cell Biology and Neuroscience, and a Research Toxicologist at the University of California, Riverside. I received B.S. and M.S. degrees from Brigham Young University, in Provo, Utah, and a Ph.D. from the University of California, Berkeley. My research focuses on the mechanisms involved in the toxicity and carcinogenicity of environmental and agricultural chemicals, with a goal to more accurately identify the potential adverse health effects associated with chemical exposures. I was a Jefferson Science Fellow at the US Department of State, and have served as President of the Environmental Mutagen Society and as Chair of the Board of Scientific Counselors for the National Toxicology Program, NIEHS. I have also participated on numerous review panels related to chemical mutagenesis, carcinogenesis and risk assessment, including panels for the US EPA, the US Food and Drug Administration, the International Programme for Chemical Safety, the International Agency for Research on Cancer, the Organisation for Economic Cooperation and Development, Health Canada, and the International Working Group for Genotoxicity Testing. In 2011, I was elected a Fellow of the Collegium Ramazzini, an organization of international scholars working towards solutions to occupational and environmental health problems occurring internationally. I am currently a member of the Carcinogen Identification Committee for the California Environmental Protection Agency and of the Chemical Assessment Advisory Committee of the US EPA. I have attached my CV and list of publications.

2. Organohalogens are often used as flame retardants in consumer products, without adequate toxicological information to assess whether or not they may be harmful to human or environmental health. To address this lack of knowledge on health effects, two of my graduate students, Virunya Bhat and Kristi Capsel, performed, under my supervision, a hazard screen of approximately 90 brominated and chlorinated flame retardants, ~85 of which are non-polymeric compounds. The list of studied chemicals includes a large number of organohalogen flame retardants (OFRs) in use or available for potential use in consumer products. The objective of the hazard screen was to determine which of these OFRs should be considered toxic, and therefore used with caution, or not used at all. The results of this study have been presented at several scientific meetings, and we are in the process of preparing a peer-reviewed journal article describing our results.

3. Using the Chemical Abstract Services (CAS) registry numbers as primary identifiers, we performed an extensive search for toxicity information on these 85 non-polymeric OFRs. Whenever possible, we searched for and used, if found, the results of existing hazard screens or

toxicity reviews, such as those from the U.S. EPA Design for the Environment program, the Office of Environmental Health Hazard Assessment of the California Environmental Protection Agency, the World Health Organization/International Programme on Chemical Safety, the Agency for Toxic Substances and Disease Registry, the International Agency for Research on Cancer, Health Canada/Canadian Environmental Protection Agency and/or Clean Production Action. Additionally, we searched for peer-reviewed toxicity data in public databases such as Pubmed and Toxnet. Because often we could not identify peer-reviewed data in these databases, we also used other information sources, which included non-peer reviewed information or unpublished data, such as the U.S. EPA Toxic Substance Control Act Test Submissions, the Registry of Toxic Effects of Chemical Substances, the European Chemicals Agency database, and the U.S. EPA High Production Volume data submissions. We gave preference to *in vivo* data via any exposure route, rather than *in vitro* data, due to the lack of guidelines or current consensus on appropriate method(s) to determine human relevance or to extrapolate the results of *in vitro* assays when characterizing *in vivo* hazard potential. In the cases in which we could not identify any empirical data, we used Structure-Activity Relationship (SAR) models.

4. We used three related hazard screening tools: the U.S. EPA's Design for the Environment (DfE) program, the Clean Production Action's GreenScreen™, and the Washington State Department of Ecology's Quick Chemical Assessment Tool (QCAT®). All three provide a framework for identifying problematic characteristics of chemicals and then grading the chemicals according to the level of concern. Because most OFRs lacked sufficient information to use the DfE tool or run a GreenScreen™, our hazard screening was based mainly on the QCAT® methodology (Stone, 2010, 2012), with some modifications to account for the overall lack of publicly available toxicity information for the majority of chemicals.

5. The QCAT® prioritizes 9 out of the 18 hazard categories included in the more comprehensive GreenScreen™ and US EPA DfE approaches: acute mammalian toxicity, five human health hazards (carcinogenicity, reproductive toxicity, developmental toxicity, mutagenicity/genotoxicity and endocrine disruption) and three environmental hazards (acute aquatic toxicity, persistence, and bioaccumulation). These hazard endpoints are considered to pose significant threats to sensitive populations such as children, and provide a good indication of the risks associated with exposure to chemicals (Stone, 2010). The QCAT® grading process is similar to that established for the GreenScreen™. The main difference is that assigning a QCAT® score requires less information than for a GreenScreen™, meaning that the QCAT® can be performed even on chemicals for which not enough data are available to conduct a GreenScreen™, but it is not as thorough an evaluation of potential hazards posed by chemical alternatives as the GreenScreen™. However, if a chemical is found to be a poor alternative using the QCAT methodology, it will also be a poor candidate using the GreenScreen™ methodology. There remains a chance that a chemical not rejected by QCAT® could still prove to be unsatisfactory if a more complete review is done using methods like the GreenScreen™.

6. To perform our hazard assessment, we assigned concern levels for each hazard category, such as Low, Moderate, or High, based on the available information. Examples are provided below.

- a. Acute Mammalian Toxicity: We assigned the hazard scores based preferentially on the most potent empirical oral, inhalation, and/or dermal LD₅₀ (the dose that is lethal to 50% of a population of test animals) values. When empirical LD₅₀ data were not identified, SAR predictions (rat oral LD₅₀) were used to assign the score.
- b. Carcinogenicity: Cancer bioassays were found for 8 of the studied OFRs, resulting in all of these OFRs being listed as carcinogens by authoritative bodies (i.e. “High” concern). Since most of the screened OFRs did not have empirical carcinogenicity data, the ISS and Oncologic QSAR models (OECD Toolbox, 2012) were used to identify a structural alert for carcinogenicity. If a structural alert was identified, we assigned a hazard score of “Moderate”.
- c. Reproductive toxicity: Two chemicals listed by an authoritative source as reproductive toxicants were rated as “High” concern. For a limited number of OFRs for which a two-generation reproduction study was identified, we assigned concern levels based on NOAEL values identified from these studies. Less than one-third of the OFRs screened had data to assess reproductive toxicity. We did not conduct SAR modeling of reproductive toxicity, due to the lack of guidelines for the use of SAR modeling tools for this hazard category.
- d. Developmental toxicity: The same two chemicals listed by an authoritative source as reproductive toxicants were also listed as developmental toxicants, and thus rated as “High” concern. When developmental toxicity studies were identified, we assigned concern levels based on NOAEL values from these studies. For most of the OFR, we used VEGA Caesar (2012) and/or U.S. EPA (2011) Toxicity Estimation Software Tool (T.E.S.T.) software to predict developmental toxicity potential due to the lack of empirical data. If predicted positive, we assigned a hazard score of “Moderate”.
- e. Mutagenicity/Genetic Toxicity: One OFR, TCEP (tris(2-carboxyethyl) phosphine, CAS#115-96-8), was listed by an authoritative source as a Global Harmonization System (GHS) category 1B germ cell mutagen (i.e. “High” concern). For the other OFRs, the scores were based, when possible, on empirical data, most commonly *Salmonella* reverse mutation assays. A few chemicals were negative in *Salmonella* assays but positive in other assays of genetic toxicity. In this case, we applied a hazard score of “Moderate”. When mutagenicity data were not identified, we used the ISS Quantitative Structure-Activity Relationship (QSAR) model (OECD Toolbox, 2012) to identify molecular functional groups or substructures considered to be structural alerts for *in vivo* or *in vitro* mutagenicity.
- f. Endocrine disruption: A few OFRs were listed as known or suspected endocrine disruptors by authoritative sources. Most of the other OFRs lacked empirical data specifically assessing endocrine disruption. Due to the current lack of SAR models to

predict endocrine disruption, no further modeling was done. This hazard category was the most prevalent one for data gaps.

- g. Acute aquatic toxicity: Those chemicals classified as toxic to aquatic organisms by an authoritative source were designated as “High” concern. For the others, the score was based on empirical LC₅₀ (the lethal concentration to 50% of the organisms tested) or EC₅₀ (the concentration that affects 50% of the organisms) values when identified. When empirical data were not identified, we used the U.S. EPA (2011) ECOSAR software to predict acute aquatic toxicity.
- h. Persistence: OFRs that have been classified as POP (Persistent Organic Pollutants) or PBT (Persistent, Bioaccumulative and Toxic) were designated as “High” concern. Most screened OFRs did not have empirical data available for these parameters. For these, the hazard score for persistence was based on the most conservative EPISuite model estimates for half-life in soil, water and sediment.
- i. Bioaccumulation: For the OFRs that were not listed or classified as a POP or PBT, the hazard score for bioaccumulation was based on octanol-water partition coefficients (K_{ow}) and bioaccumulation or bioconcentration factors, which were predicted using U.S. EPA (2011) EPISuite software when empirical data could not be identified.

7. Data gaps posed the greatest challenge in this study, and as indicated above, we often had to rely on QSAR modeling. It should be noted that QSAR models are often based on SMILES structures, which are sometimes not unique for every chemical, and the models are likely not calibrated specifically for OFRs. Therefore, we interpreted the modeling results with caution and did not rely solely upon them to denote chemicals of “High” concern. I would like to emphasize that the QCAT® methodology we used is generally health-protective. While it may not find all substances of concern, when it does, that result is defined according to independently established criteria and would be sufficient to warrant concern prompting further investigation or a search for a suitable alternative with a lower degree of concern.

8. On the basis of these data and model results, we assigned each chemical both an initial and a final grade based on QCAT® criteria, where:

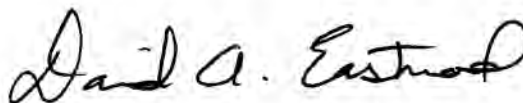
- “A” means few concerns / preferable,
- “B” means the chemical raises slight concerns / improvement possible,
- “C” means the chemical raises moderate concern / use but search for safer alternatives,
- “D” means the chemical is of high concern / avoid
- “F” means the chemical is toxic/do not use.

Chemicals received an automatic F if they were assigned a “High” score for any of the 5 priority human health endpoints. The initial grade considers only the concern levels based on empirical data and model results. The final grade assigned by the QCAT® model includes penalties for excessive data gaps.

9. The results of our on-going hazard screen are presented in draft form in the attached summary table. Italicized hazard scores denote that QSAR model results and/or low confidence empirical data served as the basis of the score. As the table shows, the initial grades for all of the evaluated organohalogen flame retardants were C or worse: 9 OFRs received C grades, 26 received D grades, and the remaining 48 received F grades. In the final grading step, 5 OFRs received D grades, and the remaining 78 received F grades. Five polymers and 3 OFRs with inadequate chemical information to allow for scoring were excluded from these tallies. These low grades were due to empirical data suggesting high hazard, SAR model predictions, and/or excessive data gaps. Carcinogenicity was the most prominent potential health hazard identified based on empirical data. Endocrine disruption exhibited the most prevalent data gaps.

10. In conclusion, all of the non-polymeric OFRs that we have screened using the QCAT® and related methodologies were found to be either of high concern or toxic based on the criteria described above. The results of our screening show that critical toxicological data are lacking for many OFRs, and that those for which data are available have the potential to pose significant hazards for human or environmental health.

Sincerely,



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Chemical Name	Abbrev. (Bergman 2012)	CAS #	Initial Grade	Final Predicted Grade (SAR included)	Acute toxicity	Carcinogenicity	Reproduction	Development	Mutagenicity/Genotoxicity	Endocrine Disruption	Acute Aquatic	Persistence	Bioaccumulation
1H-Indene, 4,5,6,7-tetrabromo-2,3-dihydro-1,1,3-trimethyl-3-(2,3,4,5-	OBTMPI	1084889-51-9, 893843-07-7,	F	F	H	M	dg	M	L	dg	L	vH	L
Benzene, 1,1'-oxybis[2,3,4,5,6-pentabromo- or Decabromodiphenyl ether	DecaBDE	1163-19-5	F	F	L	M	H	H	L	dg	L	vH	H
Phenol, 2,4,6-tribromo-	TBP	118-79-6	F	F	H	M	H	M	L	M	vH	vH	M
Phenol, 2,4,6-tribromo-3-	TBPD-TBP	168434-45-5	C	F	M	L	dg	dg	L	dg	L	vH	L
Benzene, 1,2,4,5-tetrabromo-3,6-dimethyl-	TBX	23488-38-2	D	F	L	M	dg	dg	L	dg	M	vH	vH
1,3,5-Triazine, 2,4,6-tris(2,4,6-	TBP-TAZ	25713-60-4	F	F	L	L	L	L	L	dg	vH	vH	H
Benzene, dibromoethenyl-	DBS	31780-26-4	D	F	M	M	dg	M	L	dg	M	vH	L
1,4,-Bis(2,4,6-tribromophenoxy)-2,3-dibromobutene	OBPB	31977-87-4	D	F	M	L	dg	M	L	dg	L	vH	L
Pentabromodiphenyl ether	Penta BDE	32534-81-9	F	F	L	M	M	H	L	H	vH	vH	vH
Octabromodiphenyl ether	Octa BDE	32536-52-0	F	F	L	M	H	H	L	M	vH	vH	M
N-N-Ethylene-bis(tetrabromophthalimide	EBTEBPI	32588-76-4	D	F	L	M	L	L	L	dg	L	vH	H
Benzene, 1,3,5-tribromo-2-(2-propen-1-	TBP-AE	3278-89-5	D	F	L	L	dg	M	L	dg	L	vH	H
Phenol, 4,4'-(1-methylethylidene)bis[2,6-dibromo-, 1,1'-diacetate	TBBPA-BOAc	33798-02-6	F	F	M	M	dg	M	M	dg	L	vH	vH
Bicyclo[2.2.1]hept-2-ene, 1,2,3,4,7,7-hexachloro-5-(2,3,4,5-tetrabromophenyl)-	HCTBPH	34571-16-9	C	D	M	M	dg	dg	L	dg	L	vH	L
Benzene, 1,3,5-tribromo-2-(2,3-	TBP-DBPE	35109-60-5	F	F	M	M	dg	M	M	dg	L	vH	vH
Benzene, 1,2,3,4,5-pentabromo-6-(2-propen-1-yloxy)-	PBP-AE	3555-11-1	F	F	M	L	dg	M	L	dg	L	vH	vH
1,2-Bis(2,4,6-tribromophenoxy)ethane	BTBPE	37853-59-1	F	F	L	M	dg	L	L	dg	H	vH	H
Benzene, 1,2,3,4,5-pentabromo-6-	PBBB	38521-51-6	F	F	L	M	dg	M	M	dg	vH	vH	vH
Benzene, 1,2,3,4-tetrabromo-5-chloro-6-	TBCT	39569-21-6	D	F	M	M	dg	M	L	dg	M	vH	vH
Phenol, 4,4'-sulfonylbis[2,6-dibromo-	TBBPS	39635-79-5	D	F	L	L	dg	M	L	dg	L	vH	H
Benzene, 1,1'-sulfonylbis[3,5-dibromo-4-(2,3-dibromopropoxy)- AKA	TBBPS-BDBPE	42757-55-1	C	F	M	M	dg	M	M	dg	L	vH	M
Benzene, 1,1'-[oxybis(methylene)]bis[2,3,4,5,6-	DBDBE	497107-13-8	C	F	M	L	dg	M	L	dg	L	vH	L

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Chemical Name	Abbrev. (Bergman 2012)	CAS #	Initial Grade	Final Predicted Grade (SAR included)	Acute toxicity	Carcinogenicity	Reproduction	Development	Mutagenicity/Genotoxicity	Endocrine Disruption	Acute Aquatic	Persistence	Bioaccumulation
1,3,5-Triazine-2,4,6(1H,3H,5H)-trione, 1,3,5-tris(2,3-dibromopropyl)-	TDBP-TAZTO	52434-90-9	F	F	M	M	dg	M	M	dg	L	vH	vH
1,3,5-Triazine-2,4,6(1H,3H,5H)-trione, 1-(2,3-dibromopropyl)-3,5-di-2-propen-1-yl-	DBP-TAZTO	57829-89-7	D	F	L	M	dg	M	L	dg	M	vH	H
Benzene, 1,2,3,4,5-pentabromo-6-	PBBC	58495-09-3	F	F	H	M	dg	M	M	dg	L	vH	vH
Benzene, 1,2,4,5-tetrabromo-3,6-bis(2,3,4,5,6-pentabromophenoxy)-	4'-PeBPOBDE208	58965-66-5	D	F	L	L	dg	M	M	dg	L	vH	L
2-Propenoic acid, (2,3,4,5,6-pentabromophenyl)methyl ester	PBB-Acr	59447-55-1	F	F	H	M	dg	M	M	M	L	vH	vH
Phenol,2,3,4,5,6-pentabromo-	PBP	608-71-9	F	F	H	M	dg	dg	L	H	vH	vH	M
Phenol, 2,4-dibromo-	DBP	615-58-7	F	F	vH	M		M	L	H	M	vH	L
Phenol, 4,4'-(1-methylethylidene)bis[2,6-dibromo-, polymer with 2,2'-(1-		68928-70-1	C	F	L	M	L	L	M	dg	L	vH	L
Benzene, 1,1'-sulfonylbis[3,5-dibromo-4-	TBBPS-BME	70156-79-5	F	F	M	L	dg	M	L	dg	L	vH	vH
Tetrabromophthalic anhydride or 4,5,6,7-tetrabromo-2-benzofuran-1,3-dione		72625-95-7	F	F	H	L	dg	dg	M	dg	L	vH	H
Decabromodiphenylethane	DBDPE	84852-53-9	F	F	L	M	dg	L	L	dg	L	vH	H
Benzene, 1,2,3,4,5-pentabromo-6-ethyl-	PBEB	85-22-3	F	F	L	M	dg	M	L	M	L	vH	vH
1,2,3,9-Tetrabromo-1,2,3,4-tetrahydro-1,4-methanonaphthalene	TTMN	855992-98-2			dg		dg	dg	dg	dg			
1,2,3,9-Tetrabromo-1,2,3,4-tetrahydro-1,4-methanonaphthalene	TTMN	855993-01-0	D	F	M	L	dg	M	L	dg	L	vH	M
Benzene, 1,2,3,4,5,6-hexabromo-	HBB	87-82-1	F	F	M	M	dg	L	L	dg	vH	vH	H
Benzene, 1,2,3,4,5-pentabromo-6-methyl-	PBT	87-83-2	F	F	H	M	dg	L	L	M	L	vH	vH
Brominated epoxy resin end-capped with tribromophenol		135229-48-0	C	F	L	L	L	L	L	dg	L	vH	L
Poly(dibromostyrene): Benzene, ethenyl-, ar-bromo derivs., homopolymers	FIREMASTER CP44-HF & PBS-64HW	148993-99-1			dg		dg	dg	dg	dg		dg	dg
Poly(pentabromobenzyl acrylate) PBB-MA Brominated polyacrylate or 2-Propenoic		59447-57-3	C	F	L	M	L	L	M	dg	L	vH	L

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Chemical Name	Abbrev. (Bergman 2012)	CAS #	Initial Grade	Final Predicted Grade (SAR included)	Acute toxicity	Carcinogenicity	Reproduction	Development	Mutagenicity/Genotoxicity	Endocrine Disruption	Acute Aquatic	Persistence	Bioaccumulation
Benzene, ethenyl-, homopolymer, brominated or Brominated polystyrene	na	88497-56-7	C	F	L	L	L	L	L	dg	L	vH	L
1-Propanol, 2,3-dibromo-, 1,1',1''-	TDBPP	126-72-7	F	F	M	H	H	H	H	dg	vH	M	L
1-Propanol, 3-bromo-2,2-bis(bromomethyl)-, 1,1',1''-phosphate	TTBNPP	19186-97-1	D	F	L	M	H	H	M	dg	L	H	M
Tetrabromophthalic anhydride	TEBP-Anh	632-79-1	D	F	M	L	dg	dg	L	dg	M	vH	H
Bis(pentabromobenzyl)	BPBTB	82001-21-6	D	F	M	M	dg	M	M	dg	L	vH	L
Bis(pentabromobenzyl) terephthalate	BPBTerP	90075-91-5	D	F	H	L	dg	M	M	dg	L	vH	L
Benzoic acid, 2,3,4,5-tetrabromo-, 2-ethylhexyl ester	EH-TBB	183658-27-7	D	D	L	M	M	M	L	dg	L	vH	L
1,2-Benzenedicarboxylic acid, 3,4,5,6-tetrabromo-, 1-[2-(2-hydroxyethoxy)ethyl] 2-	HEEHP-TEBP	20566-35-2	D	F	L	M	dg	M	L	dg	M	H	L
1,2-Benzenedicarboxylic acid, 3,4,5,6-tetrabromo-, 1,2-bis(2-ethylhexyl) ester	BEH-TEBP	26040-51-7	F	F	L	M	dg	L	M	dg	vH	vH	L
1,3,5-Triazine-2,4,6(1H,3H,5H)-trione, 1,3-bis(2,3-dibromopropyl)-5-(2-propen-1-yl)-	BDBP-TAZ	75795-16-3	F	F	M	M	dg	M	M	dg	L	vH	vH
1,2-Benzenedicarboxylic acid, 3,4,5,6-tetrabromo-, mixed esters with diethylene		77098-07-8	C	F	M	M	dg	M	M	dg	L	vH	L
Ethanol, 2-chloro-, phosphate (3:1)	TCEP	115-96-8	F	F	M	H	H	H	vH	dg	H	vH	L
Tris(1-chloro-2-propyl)phosphate	TCIPP	13674-84-5	C	D	M	M	L	L	L	dg	M	vH	L
2-Propanol, 1,3-dichloro-, phosphate (3:1)	TDCIPP	13674-87-8 (see isomer 78-43-3)	F	F	L	H	M	M	M	dg	M	vH	L
Tetrakis(2-chloroethyl)dichloroisopentylidiphosphate	BCMP-BBCP	38051-10-4	C	F	L	M	M	M	L	dg	M	vH	L
Tris(2,3-dichloro-1-propyl)phosphate		66108-37-0	D	F	M	L	dg	M	M	dg	M	vH	L
2,3-dichloro-, 1,1,1-phosphate propanol	TDCPP	78-43-3 (see isomer 13674-87-8)	F	F	H	M	dg	M	H	dg	M	vH	L
Cyclodecane, hexabromo-	HBCYD	25495-98-1	F	F	L	M	dg	M	M	dg	L	vH	vH
1,2,5,9,10-Hexabromocyclodecane	unspecified HBCD	25637-99-4	F	F	L	M	H	H	L	H	H	vH	vH
1,2,5,9,10-Hexabromocyclodecane	HBCDD	3194-55-6	F	F	L	M	H	L	L	M	vH	vH	vH
Cyclooctane, 1,2,5,6-tetrabromo-	TBCO	3194-57-8	F	F	L	M	dg	dg	L	dg	vH	vH	H
Cyclohexane, 1,2-dibromo-4-(1,2-	DBE-DBCH	3322-93-8	F	F	L	M	dg	M	H	H	L	vH	L

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Chemical Name	Abbrev. (Bergman 2012)	CAS #	Initial Grade	Final Predicted Grade (SAR included)	Acute toxicity	Carcinogenicity	Reproduction	Development	Mutagenicity/Genotoxicity	Endocrine Disruption	Acute Aquatic	Persistence	Bioaccumulation
Chlorendic anhydride aka 4,7-Methanoisobenzofuran-1,3-dione, 4,5,6,7,8,8-hexachloro-3a,4,7,7a-	HCBCH-DCA _{anh}	115-27-5	C	D	L	H	M	L	L	dg	M	vH	L
Chlorendic acid	HCBCH-DCA	115-28-6	F	F	M	H	M	M	M	dg	M	vH	vL
1,4:7,10-Dimethanodibenzo[a,e]cyclooctene, 1,2,3,4,7,8,9,10,13,13,14,14-dodecachloro-	DDC-CO	13560-89-9	D	F	L	M	L	L	L	dg	L	vH	H
1,3,4-Metheno-1H-cyclobuta[cd]pentalene, 1,1a,2,2,3,3a,4,5,5,5a,5b,6-dodecachlorooctahydro-	MIREX	2385-85-5	F	F	vH	H	H	H	L	H	M	vH	vH
1,4:6,9-Dimethanodibenzofuran, 1,2,3,4,6,7,8,9,10,10,11,11-dodecachloro-1,4,4a,5a,6,9,9a,9b-octahydro-	DDC-DBF	31107-44-5	F	F	H	M	dg	dg	M	H	vH	vH	vH
hexachlorocyclopentadienyl-	DBHCTD	51936-55-1	F	F	L	M	dg	M	L	dg	L	vH	H
1-Propanol, 3-bromo-2,2-bis(bromomethyl)-	TBNPA	1522-92-5	F	F	L	M	dg	dg	H	dg	M	vH	L
1,3-Propanediol, 2,2-bis(bromomethyl) OR 2,2-Bis(bromomethyl)-1,3-propanediol	DBNPG	3296-90-0	F	F	M	H	M	M	H	dg	M	H	L
1-Propanol, 2,2-dimethyl-, tribromo derive. (Tribromoneopentylalcohol)		36483-57-5	D	F	L	M	dg	dg	M	dg	vH	vH	L
Flamestab Nor 116 or 1,3-Propanediamine, N,N'-1,2-ethanediylbis-, Alkanes, C10-13, chloro	SCCP	191680-81-6			L	dg	dg	dg	dg	dg	dg	dg	dg
Medium chain chlorinated paraffins (more DATA in ECHA)	MCCP	85535-84-8; 71011-85535-85-9	F	F	L	H	dg	M	L	M	vH	vH	vH
1,3-Isobenzofurandione, 4,5,6,7-tetrachloro- (TETRACHLOROPHTHALIC)	TCP-Anh	117-08-8	C	D	L	M	L	L	L	dg	L	vH	M
1,4:5,8:9,10-Trimethanoanthracene, 1,2,3,4,5,6,7,8,12,12,13,13-dodecachloro-1,4,4a,5,8,8a,9,9a,10,10a-decahydro-	DDC-Ant	13560-92-4	D	F	M	M	dg	dg	L	dg	L	vH	L
Benzene, 1,1'-(1-methylethylidene)bis[3,5-dibromo-4-(2,3-dibromopropoxy)-	TBBPA-BDBPE	21850-44-2	F	F	L	M	M	M	M	dg	L	vH	H
Benzene, 1,1'-(1-methylethylidene)bis[3,5-dibromo-4-(2-propen-1-yloxy)-	TBBPA-BAE	25327-89-3	D	F	L	L	dg	M	L	dg	H	vH	vH

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Chemical Name	Abbrev. (Bergman 2012)	CAS #	Initial Grade	Final Predicted Grade (SAR included)	Acute toxicity	Carcinogenicity	Reproduction	Development	Mutagenicity/Genotoxicity	Endocrine Disruption	Acute Aquatic	Persistence	Bioaccumulation
Oxirane, 2,2'-[(1-methylethylidene)bis[(2,6-dibromo-4,1-phenylene)oxymethylene]]bis-	TBBPA-BGE	3072-84-2	D	F	H	M	dg	M	M	dg	L	vH	M
Phenol, 4,4'-[(1-methylethylidene)bis[2,6-dibromo-, dipropanoate (9CI)	TBBPA-BP	37419-42-4	D	F	M	M	dg	M	M	dg	L	vH	H
Benzene, 1,1'-[(1-methylethylidene)bis[3,5-dibromo-4-methoxy- AKA TETRABROMOBISPHENOL A BME	TBBPA-BME	37853-61-5	D	F	L	M	dg	H	L	dg	M	vH	H
Ethanol, 2,2'-[(1-methylethylidene)bis[(2,6-dibromo-4,1-phenylene)oxy]]bis-	TBBPA-BHEE	4162-45-2	F	F	H	L	dg	M	M	dg	vH	vH	vH
2-Propenoic acid, 1,1'-[(1-methylethylidene)bis(2,6-dibromo-4,1-	TBBPA-BA	55205-38-4	D	F	M	L	dg	dg	M	dg	L	vH	H
2-Propenoic acid, 1,1'-[(1-methylethylidene)bis[(2,6-dibromo-4,1-	TBBPA-BHEEBA	66710-97-2	D	F	M	L	dg	M	M	dg	L	vH	H
Phenol, 4,4'-(-methylethylidene)bis[2,6-	TBBPA	79-94-7	F	F	L	M		H	L	H	vH	vH	vH
1,2,5,9,10-Hexabromocyclodecane	γ-HBCD	134237-52-8	F	F	L	M	H	M	L	H	H	vH	vH
1,2,5,9,10-Hexabromocyclodecane	α-HBCD	34237-50-6	F	F	L	M	H	M	L	H	H	vH	vH
1,2,5,9,10-Hexabromocyclodecane	β-HBCD	34237-51-7	F	F	L	M	H	M	L	H	H	vH	vH
2,2',4,4'-Tetrabromodiphenyl ether	BDE-47	5436-43-1	F	F	M	M		H	M	H	M	vH	vH

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Brigham Young University, Provo, Utah, B.S., Zoology, 1980.

PROFESSIONAL EXPERIENCE:

Professor, Environmental Toxicology Graduate Program and Department of Cell Biology & Neuroscience, University of California, Riverside, California; Assistant professor 1990-1996, Associate professor 1996-2000, Professor 2000-present, Graduate Program Chair, 1999-2004, 2005-08, Interim Director, UC Washington Center and UC Sacramento programs at UCR, 2007-08; Department Chair, 2008-present.

Assistant Research Toxicologist, Department of Biomedical and Environmental Health Sciences, University of California, Berkeley, California, 1989.

Alexander Hollaender Distinguished Postdoctoral Fellow in Genetic and Molecular Toxicology, Biomedical Sciences Division, Lawrence Livermore National Laboratory, University of California, Livermore, California, 1987-1989.

Research assistant in biochemical toxicology, University of California, Berkeley, California, 1983-1987.

Intern with the Environmental Effects Branch, Office of Toxic Substances, Environmental Protection Agency, Washington, D.C., 1983.

Research assistant in environmental toxicology, Brigham Young University, Provo, Utah. 1979-1983.

Field supervisor for a seed alfalfa integrated pest management project directed by Utah State University, Delta, Utah, summer 1979.

Field technician conducting environmental impact-related studies directed by BYU for the Department of Energy, Raft River, Idaho, summer 1978.

TEACHING
EXPERIENCE:

Instructor for a graduate-level Principles of Toxicology course (ENTX 201) at UC Riverside

Instructor for a graduate-level and an undergraduate level Risk Assessment courses (ENTX 154 & 220) at UC Riverside.

Lead instructor for a graduate-level seminar course (ENTX 270) at UC Riverside

Lead instructor and co-instructor for a graduate-level Mechanisms of Toxicity course (ENTX 202) at UC Riverside

Co-instructor for an undergraduate-level Cancer Biology course (ENTX 150) at UC Riverside

Instructor for freshman-advising seminars (NASC 91 and 93) at UC Riverside

Instructor for an Environmental Toxicology course (Env. Sci. X100) taught through the UC Riverside Extension.

Teaching assistant in the General Biology, Introductory Entomology, Human Physiology, and Comparative Toxicology classes at Brigham Young University.

OTHER PROFESSIONAL
EXPERIENCE:

Member, Chemical Assessment Advisory Committee, Science Advisory Board, U.S. Environmental Protection Agency, Nov. 4, 2013 – Sept. 30, 2016

Member, Carcinogen Identification Committee, Science Advisory Board, Office of Environmental Health and Hazard Assessment, State of California, 1999 - 2003, 2005 to present.

Associate Director, NIEHS Training Program in Environmental Toxicology at University of California, Riverside, July 1, 2010 – present.

Member, Genotoxicity Test Guidelines Working Group, Organisation for Economic Cooperation and Development Sept. 2010 – present.

Member, Genetic Toxicology Technical Committee Steering Team, Health and Environmental Sciences Institute, International Life Sciences Institute, Jan. 2013 – present.

Member, Working Group on Quantitative Approaches and Non-Linear Dose-Response Relationships in Genotoxicity Assessment, International Working Group on Genotoxicity Testing, Jan. 2013 – present.

Chair, Board of Scientific Counselors, National Toxicology Program, NIEHS, Member, Jan. 2009 – Dec. 2012, Chair, Feb. 2011 – Dec. 2012.

Participant, Research Participation Program, National Center for Environmental Assessment, Environmental Protection Agency, 2008 – 2011.

Co-chair, Expert Panel on Genotoxicity Testing of Pharmaceuticals, Center for Drug Evaluation and Research, Food and Drug Administration, Jan. 2010.

Member, Risk and Technology Review Panel, Science Advisory Board, Environmental Protection Agency, July 2009 - Jan. 2010.

Council Member, National Council on Radiation Protection and Measurements, 2004 to 2010; consociate member, 2010 - present.

Editorial board member for the journals *Toxicological Sciences* (2007 – present), *Mutation Research*, *Genetic Toxicology and Environmental Mutagenesis* (1994 - present), and *Chemico-Biological Interactions* (1998 - 2001).

Member, Working group, International Agency for Research on Cancer, Working group meeting on pharmaceuticals, Oct. 2008.

Chair, WHO/IPCS international expert meetings to conduct an update of the "IPCS harmonization of methods for the prediction and quantification of human carcinogenic/mutagenic hazard", April 2007 and June 2008.

Working group member, International Agency for Research on Cancer, Working group meeting on ethylene oxide, 1,3-butadiene, vinyl chloride, vinyl bromide, and vinyl fluoride, June 2007.

Advisor to the US Environmental Protection Agency and conducted detailed reviews of the following topics: Chemical and radiation-induced leukemogenesis in humans and rodents and the value of rodent models for assessing risks of lymphohematopoietic cancers, 1995-96; The use of genetically modified animals in the cancer risk assessment process, 2001; Genotoxicity of carbon tetrachloride and its implications for mode-of-action and dose response decisions, 2006; Conducted a review of the literature on "Childhood leukemia: origins and biomarkers" 2005-2006; Conduced a review of the genotoxicity and mode-of-action sections of the draft toxicological review of 1,2,3-trichloropropane (NCEA-S-1669), 2007; Lymphohematopoietic Cancers Induced by Chemicals and Other Agents: Overview and Implications for Risk Assessment, 2012.

Invited expert for the USEPA "Peer Consultation Workshop on Research Needs Related to the IRIS Draft Toxicological Review of Naphthalene", April 2005

Invited specialist, International Agency for Research on Cancer, Working Group meeting on Formaldehyde, 2-butoxyethanol, and propylene glycol mono-t-butyl ether, June 2004.

Program chair, 34th Annual meeting of the Environmental Mutagen Society, Miami Beach, Florida, May 10-14, 2003.

Member, ILSI Risk Science Institute Steering Committee for Screening Tests for Toxic Chemicals, 2002-05.

Reviewer of Public Health Goal Documents, Risk Assessment Documents or Proposed Guidelines for the US Environmental Protection Agency (EPA), 1999, 2004 and the California EPA, Office of Environmental Health Hazard Assessment, 1998, 2001, 2002, 2004, 2005, 2006, 2008.

Invited participant to the ILSI/Health Canada peer consultation panel on "Genotoxicity for Categorisation of "Inherent Toxicity" to Humans under CEPA '99", 2002.

Council member, Environmental Mutagen Society, April 1997-2000.

Panel member, US Environmental Protection Agency's Expert Panel Peer Review of Benzene Risk Assessment Update, June-July 1997.

Research associate, Statewide Air Pollution Research Center, Riverside, California.

Invited participant in the World Health Organization's International Programme on Chemical Safety Task Group to finalize the Environmental Health Criteria for Hydroquinone. Carshalton Surrey, United Kingdom May 1993.

Reviewer of manuscripts for *American Journal of Human Genetics*; *Archives of Biochemistry and Biophysics*; *Archives of Environmental Contamination and Toxicology*; *Biochemie*; *British Journal of Cancer*; *Bulletin of Environmental Contamination and Toxicology*; *Cancer Epidemiology, Biomarkers and Prevention*; *Cancer Letters: Cancer Research*; *Chemico-Biological Interactions*; *Critical Reviews in Toxicology*; *Cytometry*; *Environmental and Molecular Mutagenesis*; *Environmental Health Perspectives*; *Environmental Pollution*; *Environmental Science & Technology*; *Environmental Toxicology & Pharmacology*; *Genes, Chromosomes and Cancer*; *Genetics and Molecular Biology*; *Human Genetics*; *International Journal of Environmental Research and Public Health*; *International Journal of Environmental Research and Public Health*; *International Journal of Radiation Biology*; *Journal of Agriculture and Food Chemistry*; *Journal of Toxicology and Environmental Health*; *Leukemia*; *Mutagenesis*; *Mutation Research*; *Oncology Research*; *Pediatrics*; *Proceedings of the National Academy of Sciences*; *Toxicological Sciences*; *Radiation Research*; *Toxicology Letters*; *Toxicology and Applied Pharmacology*; *Vaccine*. 1987-present.

Member of the Society of Toxicology's ad hoc Tox 90s Educational Issues Task Force 1991-1993.

Reviewer of Grant Proposals, Pre-proposals/Fellowship Applications, or Cooperative Research Agreements for the U.S. Environmental Protection Agency (1989), the Air Force Office of Scientific Research (1990), Center for Indoor Air Research (1995), NIEHS Small Business Grants (1995, 96,

97, 03), Flanders (Belgium) Fund for Scientific Research (1998), UC MEXUS (2003), Health Effects Institute (1994, 2005), University of California Biotechnology Research and Education Program (2005 and 2006), University of California Toxic Substances Research and Teaching Program (1992, 2007 and 2008).

Invited Participant in a peer review session to recommend acceptable levels of polycyclic aromatic hydrocarbons in the Great Lakes for the International Joint Commission, 1982.

Selected Participant in a tropical biology research project on the function of buttressing in tropical trees, Barro Colorado Island, Panama, 1982.

Participant in a marine biology field experience, focusing primarily on intertidal ecology, Friday Harbor, Washington, 1980.

AWARDS AND RECOGNITIONS:

Article by Bhat, Hester, Nesnow and Eastmond was selected as "One of the Best Papers Advancing the Science of Risk Assessment" by the Risk Assessment Specialty Section of the Society of Toxicology at its 2014 annual meeting, March 2014.

Recipient of the Perry J. Gehring Best Graduate Student Abstract Mentor Award by the Risk Assessment Specialty Section of the Society of Toxicology at its 2013 annual meeting, March 2013.

Elected Fellow of the Collegium Ramazzini, Nov. 2011

Jefferson Science Fellow, US Department of State (administered by the National Academy of Sciences), Washington DC, 2004-2005.

President, Environmental Mutagen Society, May 2003-Oct. 2004.

Outstanding Environmental Toxicology Faculty/Mentor award presented by the students of the Environmental Toxicology Graduate Program, University of California, Riverside, 2001, 2007 and 2011.

Alexander Hollaender Distinguished Postdoctoral Fellow, U.S. Dept. of Energy, 1987-1989.

Outstanding Postdoctoral Research Presentation, Genetic and Environmental Toxicology Association of Northern California, 1988.

Selected New Investigator, Society of Toxicology, 1987.

Recipient of the Margaret Beattie Award for Excellence in the Laboratory Sciences, School of Public Health, U.C. Berkeley, 1987.

Honorable Mention, Society of Toxicology Mechanisms Award, 1987.

Outstanding Graduate Student Research Presentation, Genetic and Environmental Toxicology Association of Northern California, 1986.

Thesis selected as the Outstanding Thesis of the College of Biological and Agricultural Sciences at BYU, 1983.

Various Fellowships and Traineeships, U.C. Berkeley, 1983-1987.

Sigma Xi Research Society, 1982.

Phi Kappa Phi Honor Society, 1980.

Alvin S. Barrett Scholarship, Brigham Young Univ., 1974-75, 1977-80.

SOCIETY

MEMBERSHIPS:

Environmental Mutagenesis and Genomics Society

Society of Toxicology (National and Southern California Chapters)

Collegium Ramazzini

American Association for the Advancement of Science

BIBLIOGRAPHY

David A. Eastmond, Ph.D.

PUBLICATIONS

1. Vassilaros, D.L., Eastmond, D.A., West, W.R., Booth, G.M., and Lee, M.L. (1982). Determination and Bioaccumulation of Polycyclic Aromatic Sulfur Heterocycles in Aquatic Biota. In: Polynuclear Aromatic Hydrocarbons: Physical and Biological Chemistry, M. Cooke, A.J. Dennis, and G.L. Fisher (Eds.), Battelle Press, Columbus, pp. 845-857.
2. Porter, S., and Eastmond, D.A. (1982). *Euryopsis coki* (Therididae), A Spider that Preys on *Pogonomyrmex* Ants. *J. Arachnology* 10, 275-277.
3. Eastmond, D.A., Meuhle, C.M., Price, R.L., Hutchens, C.A., Booth, G.M., and Lee, M.L. (1983). Acute Toxicity, Bioconcentration, and Elimination of a Coal Liquid in Freshwater Organisms. In: Polynuclear Aromatic Hydrocarbons: Formation, Metabolism, and Measurement, M. Cooke and A.J. Dennis, (Eds.), Battelle Press, Columbus, pp. 451-469.
4. Eastmond, D.A. (1983). Toxicity, Accumulation, and Elimination of Polycyclic Aromatic Sulfur Heterocycles in *Daphnia magna*. Master's Thesis, Brigham Young University.
5. Fluck, D.S., Rappaport, S.M., Eastmond, D.A., and Smith, M.T. (1984). Conversion of 1-Naphthol to Naphthoquinone Metabolites by Rat Liver Microsomes: Demonstration by HPLC with Reductive Electrochemical Detection. *Arch. Biochem. Biophys.* 235, 351-358.
6. Eastmond, D.A., Booth, G.M., and Lee, M.L. (1984). Toxicity, Accumulation, and Elimination of Polycyclic Aromatic Sulfur Heterocycles in *Daphnia magna*. *Arch. Environ. Contam. Toxicol.* 13, 105-111.
7. Smith, M.T., Fluck, D.S., Eastmond, D.A., and Rappaport, S.M. (1985). Detection of Quinone Metabolites by HPLC with Reductive Electrochemical Detection. *Life Chemistry Reports* 3, 250-258.
8. Lipnick, R.L., Bickings, C.K., Johnson, D.E., and Eastmond, D.A. (1985). Comparison of QSAR Predictions with Fish Toxicity Screening Data for 110 Phenols. In: Aquatic Toxicology and Hazard Assessment, Eighth Symposium, ASTM STP 891, R.C. Bahner and D. J. Hensen, (Eds.), American Society for Testing and Materials, Philadelphia, pp. 153-176.
9. Eastmond, D.A., Smith, M.T., Ruzo, L.O., and Ross, D. (1986). Metabolic Activation of Phenol by Human Myeloperoxidase and Horseradish Peroxidase. *Molecular Pharmacology* 30, 674-679.
10. Eastmond, D.A., French, R.C., Ross, D., and Smith, M.T. (1987). Metabolic Activation of Diethylstilbestrol by Human Leukocytes. *Cancer Letters* 35, 79-86.
11. Eastmond, D.A. (1987). Free Radical Mechanisms in Benzene Toxicity. Doctoral Dissertation, University of California, Berkeley.

12. Eastmond, D.A., French, R.C., Ross, D., and Smith, M.T. (1987). Metabolic Activation of Phenol and 1-Naphthol by Human Leukocytes and a Xanthine Oxidase System. *Chemico-Biological Interactions*, 63, 47-62.
13. Smith, M.T., Eastmond, D.A., and Di Monte, D. (1987). The Activation and Detoxication of Quinones by DT-Diaphorase. *Chemica Scripta*, 27A, 105-107.
14. Eastmond, D.A., Smith, M.T., and Irons, R. (1987). An Interaction of Benzene Metabolites Reproduces the Myelotoxicity Observed with Benzene Exposure. *Toxicol. Appl. Pharmacol.*, 91, 85-95.
15. Warren, S.D., Black, H.L., Eastmond, D.A., and Whaley, W.H. (1988). Structural Function of Buttresses of *Tachigalia versicolor*. *Ecology* 69, 532-536.
16. Eastmond, D.A. and Tucker, J.D. (1989). Identification of Aneuploidy-inducing Agents Using Cytokinesis-blocked Human Lymphocytes and an Antikinetochore Antibody. *Environmental and Molecular Mutagenesis* 13, 34-43.
17. Smith, M.T., Yager, J.W., Steinmetz, K.L., and Eastmond, D.A. (1989). Peroxidase-dependent Metabolism of Benzene's Phenolic Metabolites and its Potential Role in Benzene Toxicity and Carcinogenicity. *Environmental Health Perspectives*, 82, 23-29.
18. Eastmond, D.A. and Pinkel, D. (1989). Aneuploidy Detection by Analysis of Interphase Nuclei Using Fluorescence *In Situ* Hybridization with Chromosome-Specific Probes. In: *Mechanisms of Chromosome Distribution and Aneuploidy*, M.A. Resnick and B.K. Vig (Eds.), Alan R. Liss, New York, pp. 277-284.
19. Eastmond, D.A., Tucker, J.D., and Pinkel, D. (1989). The Use of an Antikinetochore Antibody and DNA Probes to Measure Aneuploidy in Interphase Human Lymphocytes. In: *Multilevel Health Effects Research: From Molecules to Man*, J.F. Park and R.A. Pelroy (Eds.), Battelle Press, Richland, WA, pp. 157-165.
20. Eastmond, D.A. and Tucker, J.D. (1989). Kinetochore Localization in Micronucleated Cytokinesis-Blocked Chinese Hamster Ovary Cells: A New and Rapid Assay for Identifying Aneuploidy-Inducing Agents. *Mutation Res.* 224, 517-525.
21. Yager, J.W., Eastmond, D.A., Robertson, M.L., Paradisin, W.M., and Smith, M.T. (1990). Characterization of Micronuclei Induced in Human Lymphocytes by Benzene Metabolites. *Cancer Res.* 50, 393-399.
22. Tucker, J.D. and Eastmond, D.A. (1990). Use of an Antikinetochore Antibody to Discriminate Between Micronuclei Induced by Aneuploidogens and Clastogens. In: *Mutation and the Environment, Part B: Metabolism, Testing Methods, and Chromosomes*, ML Mendelsohn and RJ Albertini, Wiley-Liss, Inc. pp. 275-284.
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25. Eastmond, D.A. and Pinkel, D. (1990). Detection of Aneuploidy and Aneuploidy-inducing Agents in Human Lymphocytes using Fluorescence *In Situ* Hybridization with Chromosome-specific DNA Probes. *Mutation Res.* 234, 303-318.
26. Kolachana, P., Subrahmanyam, V.V., Eastmond, D.A., and Smith, M.T. (1991). Metabolism of Phenylhydroquinone by Prostaglandin (H) Synthase: Possible Implications in *o*-Phenylphenol-induced Bladder and Kidney Carcinogenesis. *Carcinogenesis* 12, 145-149.
27. Robertson, M.L., Eastmond, D.A., and Smith, M.T. (1991). Two Benzene Metabolites, Catechol and Hydroquinone, Produce a Synergistic Genotoxic Response in Cultured Human Lymphocytes. *Mutation Research* 249, 201-209.
28. Subrahmanyam, V.V., Ross, D., Eastmond, D.A., and Smith, M.T. (1991). Potential Role of Free Radicals in Benzene-induced Myelotoxicity and Leukemia. *Free Radical Biology & Medicine* 11, 495-515.
29. Eastmond, D.A. (1993). Induction of Micronuclei and Aneuploidy by the Quinone-forming Agents Benzene and *o*-Phenylphenol. *Toxicology Lett.* 67, 105-118.
30. Eastmond, D.A., Rupa, D.S., Chen, H.W. and Hasegawa, L. (1993). Multicolor Fluorescence *In Situ* Hybridization with Centromeric DNA Probes as a New Approach to Distinguish Chromosome Breakage from Aneuploidy in Interphase Cells and Micronuclei, In: *Chromosome Segregation and Aneuploidy*, BK Vig (Ed.), Springer-Verlag, Berlin, pp. 377-390.
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42. Chen, H. and Eastmond, D.A. (1995) Topoisomerase Inhibition By Phenolic Metabolites: A Potential Mechanism For Benzene's Clastogenic Effects. *Carcinogenesis* 16: 2301-2307.
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54. Kwok, E.S.C. and Eastmond, D.A. (1997) Effects of pH on non-enzymatic oxidation of phenylhydroquinone: Potential role in the urinary bladder carcinogenesis induced by *ortho*-phenylphenol in Fischer 344 Rats, Chem. Res. Toxicol. 10:742-749.
55. Dobo, K.L., Eastmond, D.A. and Grosovsky, A.G. (1997) The influence of cellular apoptotic capacity on N-nitrosodimethylamine-induced loss of heterozygosity mutations in human cells. Carcinogenesis 18:1701-1707.
56. Frantz, C.E., Smith, H., Eades, D.M., Grosovsky, A.J. and Eastmond, D.A. (1997) Bimolane: *in vitro* inhibitor of human topoisomerase II, Cancer Letters 120:135-140.
57. Rupa, D.S. and Eastmond, D.A. (1997) "Chromosomal alterations affecting the 1cen-1q12 region of buccal mucosal cells of betel quid chewers detected using multicolor fluorescence *in situ* hybridization", Carcinogenesis 18:2347-2351.
58. Schuler, M., Metzler, M. Parks, R. and Eastmond, D.A. (1998) Dose-response studies of the induction of hyperdiploidy and polyploidy by diethylstilbestrol and 17 β - estradiol in cultured human lymphocytes using multicolor fluorescence *in situ* hybridization. Environmental and Molecular Mutagenesis 31:263-273.
59. Dobo, K.L., Eastmond, D.A., Grosovsky, A.J. (1998) Sequence specific mutations induced by N-nitrosodimethylamine at two marker loci in metabolically competent human lymphoblastoid cells, Carcinogenesis 19:755-764.
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62. Schuler, M.J., Rupa, D.S. and Eastmond, D.A. (1999) Applications of Fluorescence *In Situ* Hybridization in Genetic Toxicology. In: *An Introduction to Fluorescent In Situ Hybridization*, (M. Andreeff and D. Pinkel, eds.), Wiley-Liss, Inc. New York., pp. 371-390.
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69. Grosovsky, A. J., J. C. Sasaki, J. Arey, D. A. Eastmond, K. K. Parks, and R. Atkinson. 1999. Evaluation of the Potential Health Effects of the Atmospheric Reaction Products of Polycyclic Aromatic Hydrocarbons. Health Effects Institute Research Report Number 84, Cambridge, MA , pp. 1-27.
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Exhibit D

Statement of David Epel



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HOPKINS MARINE STATION
PACIFIC GROVE, CA 93950

DAVID EPEL
JANE AND MARSHALL STEEL, JR.
PROFESSOR OF MARINE SCIENCES

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DEPEL@STANFORD.EDU

November 17, 2014

I, David Epel, am writing this statement in support of the Petition to the CPSC to regulate four categories of household products containing non-polymeric additive organohalogen flame retardants.

1. I, David Epel, am a Jane and Marshall Steel Jr. Professor Emeritus of Biological and Marine Sciences at the Hopkins Marine Station of Stanford University. I have a Ph.D. from the University of California, Berkeley. I have been a Guggenheim Fellow, and am a Fellow of the American Association for the Advancement of Science, a Fellow of the California Academy of Sciences, and a Life Fellow of Clare Hall of the University of Cambridge in the UK. I was awarded the Ed Ricketts Memorial Award for Lifetime Achievement in the Marine Sciences. Please see my CV and list of publications accompanying this statement.

2. One of my areas of research deals with the cellular and molecular mechanisms that allow embryos to resist the effects of environmental stresses such as ultraviolet radiation, pathogens and natural and man-made toxins. My expert opinion below is based on my work on the primary line of defense against toxic substances provided by a large family of efflux transporters known as ABC (ATP-binding cassette) transporters.

3. These ABC transporters are proteins in the plasma membrane of cells that act as “bouncers” to keep toxic substances out of cells, and also as “garbage collectors”, removing chemicals that evaded the original bouncer action. All organisms, from bacteria to plants to humans, employ this defense system. If the transporters can recognize a chemical, they can then prevent its entry into the cell. A well-studied example of this mechanism is resistance to cancer chemotherapy, which can develop during the course of cancer treatment. When cells are exposed to anti-cancer drugs, they often respond by elevating the number of ABC transporters. This keeps the anti-cancer drugs out of the cell and makes the cells resistant to chemotherapy.

4. Some chemicals seem to evade this bouncer defense, for example teratogen thalidomide, neurochemical methyl mercury, and organohalogen compounds such as DDT, PCBs and chlordane. These chemicals are not recognized by the ABC transporters. The cell also has little capacity to metabolize or convert these chemicals to less toxic forms. As a result, these chemicals accumulate in the cell, where they remain for the lifetime of the cell – a legacy of prior exposure.

5. A large group of organohalogen flame-retardants are similar to DDT, PCBs and chlordane in that they have very low water solubility and have carbon-halogen bonds. These chemicals:

- (1) Are not transported out of the cell by the ABC transporters.
- (2) Are fat soluble, so they can permeate the cell membrane and enter the cell.

(3) Are not metabolized by the cell or converted to forms that can be eliminated. Consequently, the organohalogen flame-retardants with low water solubility persist in many organisms including in humans, fish, and marine mammals.

6. A colleague has recently studied the interactions between some PBDE congeners (which are also organohalogen flame retardants with very low water solubility) and the ABC transporters. He found that the studied PBDEs inhibited the ABC transporters, which could explain the inability to transport these chemicals out of the cell. This inhibition would also impair the cell's defenses, altering its ability to keep other toxic compounds out. My colleague is continuing to study other organohalogen flame retardants, but these preliminary results are of concern, as they suggest that organohalogen flame-retardants can not only cause biological harm on their own, but also potentially exacerbate the harmful effects of other chemicals.

7. All organohalogen flame-retardants form a structurally similar chemical class, characterized by one or more halogens (chlorine or bromine) bound to carbon. Those that have very low water solubility can bioaccumulate and have the potential to produce the adverse biological effects described above, as my research on their interactions with the ABC transporters has shown. The more water-soluble organohalogen flame retardants do not tend to bioaccumulate. However, as a result of their carbon-halogen bonds, they are also not natural to mammalian biochemistry and may not be recognized by the ABC transporters. Animal and epidemiological studies have linked exposure to the more water-soluble organohalogen flame retardants (most of which are organophosphates) to adverse health effects. Thus, sufficient evidence from scientific studies shows a substantial potential of harm from the entire class of organohalogen flame-retardants (i.e. both water-soluble and water-insoluble).

8. To conclude, my research, as well as the research of many other colleagues, has shown that properties shared by all organohalogen flame-retardants as a class can lead to adverse effects for human health. This class of chemicals easily enters the cells, may decrease the cells' ability to keep out other toxic compounds, and can cause adverse health effects. Because of these findings, my professional opinion is that consumer products containing non-polymeric organohalogen flame-retardants in additive form (which results in exposure) should be banned, as explained in the accompanying petition.

Yours sincerely,

David Epel, PhD

A handwritten signature in black ink, appearing to read 'Epel', written in a cursive style.

Jane and Marshall Steel Jr. Professor Emeritus of Biological and Marine Sciences
Hopkins Marine Station, Stanford University

CURRICULUM VITAE

David Epel

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Department of Biological Sciences of Stanford University
Pacific Grove, California 93950
TEL: 831-655-6226; FAX: 831-375-0793
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Date of Birth: March 26, 1937; Detroit, Michigan
Marital Status: Married 1960 to Lois S. Ambush; 3 children

Education: A.B., Wayne University, 1958
Ph.D., University of California, Berkeley, 1963

PRESENT POSITION

The Jane and Marshall Steel Jr. Professor Emeritus of Marine Sciences (2009-present)
The Jane and Marshall Steel Jr. Professor of Marine Sciences (1999-2009) and Professor of Biological Sciences (1977-present); Interim Director, 1984-1988; Associate Director (1988-2007).

PREVIOUS POSITIONS

Post-doctoral fellow, Johnson Research Foundation, Department of Biophysics and Biophysical Chemistry, University of Pennsylvania Medical School, 1963-1965
Assistant Professor of Biology, Hopkins Marine Station, Department of Biological Sciences, Stanford University, 1965-1970
Associate Professor of Biology, 1970-1974; then Professor, 1974-1977 - Department of Scripps Institution of Oceanography, University of California, San Diego

NATIONAL AND INTERNATIONAL TEACHING POSITIONS:

Faculty Member, Fertilization & Gamete Physiology Training Program, Marine Biological Laboratory, Woods Hole, MA; summer, 1974
Co-Director, Embryology Course, Marine Biological Laboratory, Woods Hole, MA; summers, 1975-1977; adjunct faculty, summer 1992.
Faculty, International Cell Research Organization/UNESCO Course on Developmental Biology, Palermo Italy, 1987.
Visiting Professor, Toho University, Japan 1989.
Faculty, NSF Antarctic Biology Course, McMurdo Sound, Antarctica, January 1996.
Faculty, International Cell Research Organization/UNESCO course on Early Embryonic Development, International Marine Research Centre, Sardinia Italy, October 1997.
Faculty, European Molecular Biology Organization Course on "Reproduction and Early Development: Marine Molecular Biology Aspects", Bergen Norway, October 1998.
Visiting Professor of Developmental Biology, Plymouth Environmental Research Center and the University of Plymouth, United Kingdom, 1998-2004.

HONORS

Guggenheim Fellow, 1976-1977

Overseas Fellow of Churchill College, Cambridge University, 1976-1977;

Fellow, AAAS (Elected 1978).

Fellow, California Academy of Sciences, (Elected 2000).

Distinguished Fellow in Science and Technology, California State University, Monterey Bay (Awarded, 2004).

Allan A. Cox Medal for Fostering Excellence in Undergraduate Research at Stanford University, 1995

Ed Ricketts Memorial Lecture Award for Lifetime Achievement in Marine Sciences, 2006

Life Fellow, Clare Hall, University of Cambridge, 2007

PROFESSIONAL SERVICE AND ACTIVITIES:

PROFESSIONAL SOCIETIES:

Member

A.A.A.S.

American Society for Cell Biology

International Cell Research Organization (UNESCO)

Marine Biological Laboratory, Corporation Member

Society for Comparative and Integrative Biology

Society for Developmental Biology

National Association of Biology Teachers

National Marine Educators Association

EDITORIAL ACTIVITIES--

Associate Editor:, Developmental Biology, 1974-1983; Gamete Research, 1977- 1986; Biological Bulletin, 1991-1997

Editorial Board, Cell Differentiation, 1982-1990; Experimental Cell Research, 1984-1989. Zygote, 1993-present; Animal Biology, 1993-present; Biological Bulletin, 1997-2004; Acta Histochemica, 1999-present. Aquatic Biology, 2008-present

Advisory Board, Development, Growth and Differentiation, 1995-present;; Zoological Science (Tokyo), 2002-present.

SERVICE TO PROFESSIONAL ORGANIZATIONS AND GOVERNMENT AGENCIES

Member-at-large, Section G (Biological Sciences) American Association for Advancement of Science (AAAS), 1979-1984;

Chairperson, Section G (Biological Sciences) AAAS, 1997-1998;

Council Member, AAAS, 1998-99.

Member of Council, American Society for Cell Biology (ASCB), 1979-1981. Chairman of Education Policy Committee, (ASCB), 1979-1981; Member, Public Policy Committee 1983-1984, .

Organizing Committee, Xth Congress of the International Society for Developmental Biology, 1984-1985;

Organizing Committee, NATO Advanced Research Workshop on Mechanism of Fertilization; Plants to Humans, 1989;
Organizing Committee, 1st, 2nd and 3rd International Conference on the Cell and Molecular Biology of Egg Coats, 1993, 1997 and 2004.
Chairman, Decennial Review Committee (Representative, National Academy of Sciences), Marine Biological Laboratory, 1984; Member, Decennial Review Committee, 1994.
Member, Visiting Committee, Naval Biological Laboratory, ONR, 1983-1985; Member, ONR Technical Advisory Group - Biological Sciences, 1988
Member, Organizing & Advisory Committee and Director Search Committee, Monterey Bay Aquarium Research Institute, 1986;
Board of Directors, Monterey Bay Aquarium Research Institute, 1987-1989;
Member, NIH Animal Resources Review Committee, 1989-1991
Member, NSF Developmental Biology Panel, 1988-1993
Member, University of California Coastal Toxic Research Advisory Board, 1992-2002
Chairperson, National Cooperative Program on Non-Human *in vitro* Fertilization and Pre-implantation Development (NIH), 1991-1998
Chairperson, Section on Developmental & Cell Biology, American Society of Zoologists, 1991-93. Chairperson, Endowment Committee, 1994-95. Member, Program Committee, 2000-2002.
Organizing Committee, 7th and 9th International Congress of Society for Invertebrate Reproduction, 1995 and 2001.
Organizing Committee, 8th-11th International Conference on Pollution Responses in Marine Organisms, 1997, 1999, 2001, 2003 and 2005.
Member, Monterey County Marine Research Task Force, 2000-present
Scientific Advisory Board, The Environment Agency, United Kingdom, 2003-2004
Founding member and organizer, Ocean Round Table, 2005-2009

RECENT CONGRESS & SYMPOSIA ADDRESSES

American Chemical Society Symposium on "Pharmaceuticals and Personal Care Products in the Environment" (San Francisco)
19th Annual Meeting of the Brazilian Society of Biochemistry and Molecular Biology. Plenary Lecture (Caxambu, Brazil).
International symposium "Molecular Mechanisms of Cell-Cell Interaction" (San Diego, CA).
13th and 14th Meeting on the Developmental Biology of the Sea Urchin (Woods Hole, MA)
XIth International Congress of Histochemistry and Cytochemistry (York, UK).
11th International Conference on Pollution Responses in Marine Organisms (Plymouth UK)
9th International Congress of Society of Invertebrate Reproduction, Plenary Speaker, (Grahamstown, South Africa)
Gordon Conference on Fertilization and Activation of Development (Holderness, NH).
Society for Integrative and Comparative Biology Symposium "Ecological Developmental Biology: Developmental Biology Meets The Real World."
American Society for Cell Biology, Organizer and Speaker, Symposium on "Emerging Environmental Contaminants: A Role for Cell Biology?" (San Francisco)

International Workshop on Sustainable Aquaculture: Animal Welfare, Human Health and Interactions with the Environment (Siena Italy)

4th International Symposium on Molecular and Cell Biology of Egg and Embryo Coats, Ise-Shima Japan

Plenary Speaker, 10th International Congress on Invertebrate Reproduction and Development Newcastle UK.

Aquatic Models of Human Disease, Athens GA

XIIth Pollution Responses in Marine Organisms, Alessandria Italy

RECENT KEYNOTE OR PLENARY ADDRESSES:

Reproductive Strategies, National Institute Basic Biology, Okazaki Japan

Symposium in memory of Alberto Monroy...20 years later, Palermo Italy

European Society of Comparative Biochemistry and Physiology, Antwerp Belgium

Cell Signaling in Gamete Activation, Tokyo, Japan

10th Annual Green Chemistry and Engineering Conference, American Chemical Society, Washington DC

National Association of Biology Teachers, Albuquerque NM

ICCA-LRI workshop on Integrating new advances in exposure science and toxicity testing: next steps

DEPARTMENTAL AND UNIVERSITY COMMITTEES

Hopkins representative, Monterey Bay Sanctuary Research Advisory Panel

Stanford Environmental Initiative Pedagogy Committee

STANFORD ALUMNI ASSOCIATION AND CONTINUING EDUCATION ACTIVITIES

• **Alumni Association:**

Alumni College on “Biology of the Sea” , July 1999 and 2000.

Director and ‘Dean’ of this College for the 2nd year. The course enrolled 30+ alumni in a 4-day series of lectures and labs, which included lecturers from the Marine Station, Department of Engineering and Earth Sciences (on ocean currents), Law School (on environmental policy) and also a lecture on Ed Ricketts and John Steinbeck.

• **Alumni Travel/Study Program (Faculty Lecturer)**

Baja California Whale Watching, 1989

Belize Snorkeling Adventure, 1999

Galapagos Family Adventure, 2001

Alaska Family Adventure, 2002

- **Continuing Education:**

“The Ocean as a Laboratory” Every year since 1998.

STANFORD FUND RAISING ACTIVITIES—Campaign for Undergraduate Education

Participant in the Think Again Series, New York City and Orange County

Speaker at Alumni Re-union College, Fall 2002

COMMUNITY SERVICE

Trustee, Monterey Bay Aquarium, 1985-1988

Board Member, Hatton Canyon Foundation, 1989-present

Board Member, Sierra Club (Ventana Chapter), 1990-1996, 2001-present

Science Mentor, Seaside High School, since 1990

Guest Faculty, Outward Bound Program (UCSC), Stanford Young Medical Scientist

Program, Stanford Young Environmental Scientist Program [These programs promote interest of minority students in environmental science or medicine], 1996-present.

Board Member, Friends of Moss Landing Marine Laboratory, 1994-present.

Recent Research Grants:

- 1). National Science Foundation
“Efflux Transporters in Sea Urchin Development”
\$ 390,000
February 1, 2005-January 31, 2008; no-cost extension through 2008..
- 2).National Science Foundation-Instructional Materials Development
“Inquiry-based high school biology using sea urchin fertilization and development”.
\$574,935; no cost extension through 2008
- 3). Wallenberg Foundation and Stanford University
“Hands-On Possibilities and Experiences in Biology Education (Bio-HOPE)
\$50,000 planning grant in collaboration with Goteborg University 2006
- 4). Wallenberg Foundation and Stanford University
“Hands-On Possibilities and Experiences in Biology Education (Bio-HOPE)
\$250,000 grant in collaboration with Goteborg and Linkoping University 2006-2008
- 5). Wallenberg Foundation and Stanford University
“Inquiry and Insight: Investigating environmental problems”
\$113,00 planning grant in collaboration with the Sven Loven Centre for Marine Studies,
Kristineberg, Sweden 2009
- 6). Wallenberg Foundation and Stanford University
“Inquiry and Insight: Investigating environmental problems”
\$650,000 full grant in collaboration with the Sven Loven Centre for Marine Studies,
Kristineberg, Sweden 2009-2013

PUBLICATIONS

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WEB SITES AND ARTICLES ON SCIENCE EDUCATION

Sea Urchin Embryology. Web site of 275 pages devoted to educational materials for high school and college teachers. Primarily directed toward laboratory exercises.
<http://www.stanford.edu/group/Urchin/index.html>

Virtualurchin.stanford.edu. New web site, funded by the NSF, that provides virtual labs for high school and college students

ESI.stanford.edu. New web site, funded by the Wallenberg Foundation, that explores an unexpected consequence of global warming on salmon migration.

I2i.stanford.edu Current web site that focuses on international dialogue between sisters schools in different countries on shared environmental problems.

Exhibit E

Statement of Rolf Halden

September 26, 2014

I, Rolf Halden, am writing this statement in support of the Petition to the CPSC to regulate four categories of household products containing non-polymeric additive organohalogen flame retardants.

1. I, Rolf Halden, am Director of the Center for Environmental Security at the Biodesign Institute and Professor in the Ira A. Fulton School for Sustainable Engineering and the Built Environment, Arizona State University. I am also a Senior Sustainability Scientist in the Global Institute of Sustainability at Arizona State University and hold an adjunct faculty appointment at the John Hopkins Bloomberg School of Public Health. I am an environmental scientist and engineer by training, and my research focuses on the movement of chemicals through the environment and their potential health impacts. I received my M.S. (1994) and Ph.D. (1997) in Civil (Environmental) Engineering from the University of Minnesota-Minneapolis. I have authored over 110 peer-reviewed articles, 11 book chapters, 15 patent applications and 160 conference papers. I have also presented over 110 invited lectures and keynote addresses at national and international scientific symposia. I have attached a copy of my *curriculum vitae* and a list of my publications for your reference.

2. I strongly believe that there is a need to regulate hazardous chemicals, such as organohalogen flame retardants, as classes or compound families. Many organohalogen flame retardants have been shown to be persistent, bioaccumulative and/or toxic, and have been detected in the environment, wildlife, and human populations across the globe. Due to these concerns, two major commercial flame retardant formulations, penta- and octa-brominated diphenyl ethers (BDE), were banned by the European Union (EU) in 2004 and voluntarily phased-out in the U.S. in 2005. The fully brominated deca-BDE was banned in electrical and electronic applications within the EU in 2008, while negotiations between the EPA and deca-BDE producers in the U.S. led to an agreement to cease all uses of this product in the U.S. by the end of 2013. Many of the replacement chemicals now finding their way into commerce as substitutes for PBDEs are structurally similar to the original, now banned/phased-out compounds; as a result, they show similar persistence and bioaccumulative characteristics in the environment.^{i,ii}

3. In general, the replacement of hydrogen with halogen atoms positively correlates with problematic characteristics such as hydrophobicity (which facilitates bioaccumulation), environmental persistence and toxicity.ⁱⁱⁱ It is therefore a not surprising, but underappreciated fact, that 74% of harmful organic compounds regulated by the U.S. EPA (U.S. Environmental Protection Agency) under the Safe Drinking Water Act contain at least one halogen atom^{iv}.

4. A recent study by our group featured the use of municipal sewage sludge (a solid byproduct of wastewater treatment) for identifying and prioritizing persistent and bioaccumulative chemicals. We identified eight top priority chemicals with high abundance and bioaccumulative potential, including five organohalogens, three of which were brominated flame retardants.^v The brominated flame retardants were the third most abundant group of chemicals detected in nationally representative U.S. sewage sludges, suggesting their widespread use and ongoing exposures of human populations and wildlife. The study also revealed that, out of 55 potentially bioaccumulative chemicals detectable in sewage sludge, 93% were halogenated.

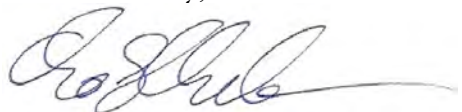
Center for
Environmental Security

Rolf Halden, PhD, PE
Professor and Director, Center for Environmental Security
Biodesign Institute/Security and Defense Systems Initiative

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5. The mass manufacture of toxic chemicals that lack effective routes of degradation creates unnecessary problems for current and future generations. The substitution of known harmful organohalogen flame retardants with chemicals sharing structural and functional similarity is not an effective solution to this problem⁶. Substitutes are often chemicals that have minor modifications to the carbon backbone (i.e., the length or shape of the carbon chain) or halogen substitution pattern (i.e., the arrangement of halogens in the molecule) of known hazardous chemicals. These minor changes do not result in major changes in the risk profile of the substitutes relative to the compounds targeted for replacement.
6. In particular, because of their bioavailability and potential for bioaccumulation, organohalogen flame retardants of low molecular weight that are not covalently bonded to the consumer product will very likely pose significant environmental and human health risks, irrespective of any minor modifications to their structure.
7. The solution to this problem ultimately depends on curtailing the use and production of chemicals sharing structural and functional similarity to known hazardous compounds, rather than making minor modifications to the carbon backbone or halogen substitution pattern, and then hoping for a different, better outcome. Pragmatic steps for reducing environmental pollution and adverse human health impacts include⁶: (i) avoiding the use of flame retardants in consumer products that do not pose a significant fire risk in the first place, (ii) avoiding the use of flame retardants that resemble their hazardous predecessors in molecular size and structure, and (iii) developing next-generation flame retardants that are covalently bound to the consumer products to minimize release, and have large molecular sizes (e.g., large polymers) to limit uptake by biota.
8. My professional opinion is that organohalogen flame retardants should be regulated as a class, especially the ones used in additive form (i.e., not covalently bound) in consumer products. Instead of regulating individual formulations such as penta- or octa-BDE and replacing them with similar formulations, a more proactive and adequate strategy is required for chemical safety management. Learning from past failures is necessary for an effective regulatory framework, and organohalogen flame retardants should be the starting point for the redesign of safer and greener consumer products. I therefore support the accompanying petition and urge the CPSC to regulate consumer products containing non-polymeric additive organohalogen flame retardants.

Yours sincerely,



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- ⁱ Covaci A, Harrad S, Abdallah MA, Ali N, Law RJ, Herzke D et al. 2011. Novel brominated flame retardants: A review of their analysis, environmental fate and behaviour. *Environ Int* 37(2):532-556.
- ⁱⁱ Wu J, Guan Y, Zhang Y, Luo X, Zhi H, Chen S et al. 2011. Several current-use, non-PBDE brominated flame retardants are highly bioaccumulative: Evidence from field determined bioaccumulation factors. *Environ Int* 37(1):210-215.
- ⁱⁱⁱ Halden RU 2014. On the Need and Speed of Regulating Triclosan and Triclocarban in the United States. *Environ Sci Technol* 48:3603–3611. DOI: 10.1021/es500495p. (Cover & Feature Article, April 1, 2014).
- ^{iv} Halden RU. Invited Talk: Sustainable Chemistry & Human Health in the 21st Century. U.S. EPA Emerging Chemicals Workgroup. Presented on April 6, 2011.
- ^v Venkatesan AK, Halden RU. 2014. Wastewater Treatment Plants as Chemical Observatories to Forecast Ecological and Human Health Risks of Manmade Chemicals. *Sci Rep* 4:3731. DOI: 10.1038/srep03731. www.nature.com/srep/2014/140116/srep03731/full/srep03731.html
- ⁶ Venkatesan AK and Halden RU. New Strategies for Monitoring and Regulating Chemical Mixtures and Contaminants Sharing Pathways of Toxicity (Internal White Paper, Arizona State University).



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September 28, 2014

CURRICULUM VITAE
Rolf U. Halden, Ph.D., P.E.
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ASU CENTER & INSTITUTE Biodesign Institute, Tempe, AZ
Founding Director, Center for Environmental Security

AFFILIATIONS Tenured Professor, School of Sustainable Engineering and the Built Environment, Arizona State University
School of Biological and Health Systems Engineering (Affiliate), ASU
Senior Sustainability Scientist, ASU Global Institute of Sustainability, ASU
Center for Biodiversity Outcomes, (Affiliate), ASU
Honors Faculty, Barrett Honors College, Arizona State University
Chair of Admission, Biological Design Graduate Program, ASU
Founding Director, Center for Environmental Security Mass Spectrometry
Adjunct Faculty, Johns Hopkins University, Bloomberg School of Public Health, Baltimore, MD
Co-Founder & Chief Technical Officer, In Situ Well Technologies, LLC, ASU/AzTE Startup Company

EDUCATION B.S., 1986 (Pre-diploma), Technical University of Braunschweig, Field: Biology
M.S., 1992 (Diploma), Technical University of Braunschweig, Major: Biology; Minors: Microbiology, Biotechnology & Sanitary Engineering
M.S., 1994, (Environmental Engineering) Department of Civil Engineering, University of Minnesota, Minneapolis, MN
Ph.D., 1997, (Environmental Engineering) Department of Civil Engineering, University of Minnesota, Minneapolis, MN

POSTDOCTORAL 1997-1998, University of California, Lawrence Livermore National Laboratory, Environmental Protection Department, Livermore, CA

PROFESSIONAL REGISTRATION & CERTIFICATION Management Certificate, University of the Pacific, 2000
Supervisor Certificate, 40-Hour SARA/OSHA 8CCR5192(e)(4)
Professional Environmental Engineer, Minnesota, 1997 – Present (#25155);
Arizona 2010 – Professional Environmental Engineer Lic. (#51849)
Engineer-in-Training, Minnesota, 1996 - 1997

PROFESSIONAL EXPERIENCE Founding Director, Center for Environmental Security (CES), The ASU Biodesign Institute, 6/2012 – Present.
Founding Director, Center for Environmental Security Mass Spectrometry Facility, 7/2013 – Present.
Chair of Admissions for the University-wide Biological Design Program at Arizona State University, 12/2012 – Present.
Leader, Biosecurity Thrust Area, Security and Defense Systems Initiative,

ASU, 6/2012 – Present.
 Barrett Honors Faculty, 2012 – Present.
 Co-Founder and Chief Technical Officer, In Situ Well Technologies (ISW), LLC Startup Company, ASU/AzTE, 2011 – Present.
 Tenured Full Professor, School of Sustainable Engineering and the Built Environment, Arizona State University. 2011 – Present.
 Senior Sustainability Scientist, Global Institute of Sustainability, ASU. 2010 – Present.
 Co-founder of the MapStory Health Initiative, 2014 - Present
 Interim Co-Director, Center for Health Information & Research (CHiR) 2011 – 2012.
 Associate Director, Swette Center for Environmental Biotechnology, ASU Biodesign Institute. 2011 – 2012.
 Assistant Director, Center for Environmental Biotechnology, ASU Biodesign Institute. 2009 – 2011.
 Adjunct Associate Professor. 2008 – Present. Department of Environmental Health Sciences, Johns Hopkins Bloomberg School of Public Health, Johns Hopkins University
 Special Government Employee, Food and Drug Administration, '05 – Present
 Tenured Associate Professor. 12/2007 – 7/2011. School of Sustainable Engineering and the Built Environment, Arizona State University
 Associate Professor. 2007. Department of Environmental Health Sciences, Johns Hopkins Bloomberg School of Public Health
 Joint Appointment in the Department of Geography and Environmental Engineering, Johns Hopkins University
 Assistant Professor. 2001 – 2007. Department of Environmental Health Sciences, Johns Hopkins Bloomberg School of Public Health, Johns Hopkins University
 Project Engineer & Environmental Scientist. 1998 – 2001. Environmental Protection Department, Lawrence Livermore National Laboratory, Livermore, CA. Principal Responsibilities: Design and Management of Subsurface Remediation Activities with a Cumulative Budget of \$6M. Supervisor: Dr. John Ziagos.
 Research & Teaching Fellow/Assistant. January 1993 – April 1997. Department of Civil Engineering, University of Minnesota, Twin Cities, MN. Supervisor: Dr. Daryl Dwyer
 Research Associate. January 1992 – July 1992. Helmholtz Centre for Infection Research, (formerly German National Institute for Biotechnology (GBF), Braunschweig, Germany. Principal Responsibilities: Microbial Ecology. Supervisor: Dr. Daryl F. Dwyer
 Research Assistant. January 1991 – December 1991. Helmholtz Centre for Infection Research, (formerly German National Institute for Biotechnology (GBF), Braunschweig, Germany. Principal Responsibilities: Bioreactors. Supervisor: Dr. Joachim Klein

PROFESSIONAL ACTIVITIES

Society Memberships

American Public Health Association (APHA)
 American Society for Mass Spectrometry (ASMS)
 American Chemical Society (ACS) – ACS Expert for Media Relations, 2014 - Present
 American Society for Microbiology (ASM)
 American Society of Civil Engineers (ASCE)
 Association of Environmental Engineering and Science Professors (AEESP)
 Environmental and Water Resources Institute (EWRI)
 Society of Environmental Toxicology and Chemistry (SETAC)

Participation on Advisory Panels and Committees

- ACS Expert for Media Relations, American Chemical Society (ACS)**, 2014 - Present
Member, NIEHS Fish Advisory Information Network, National Institute of Environmental Health Sciences, June 2014 - Present.
- Center for Transformative Action, Invited Member of the Independent Review Board**, August 2014 - Present.
- Invited Presenter and Panel Member: Discussion Forum Micro-plastics in the Marine Environment & Potential Human Health Risks**, National Academies, Washington, DC, 3/3/2014.
- Community Advisory Board Member**, West van Buren Area WQARF Site, Phoenix, AZ, 2013 - Present.
- Invited Presenter at Congressional Briefing** on the Safety of the Antimicrobial Triclosan, Washington, DC, 2/17/2011.
- Food And Drug Administration, Center For Drug Evaluation And Research (CDER) Nonprescription Drugs Advisory Committee**. Special Government Employee (10/2005 – 10/2015)
- Science Advisor**, Johns Hopkins University Center for a Livable Future, 2009 – Present
Invited Panelist, **National Association of Clean Water Agencies** Pretreatment and Pollution Prevention Workshop, St. Louis, MO, 5/19/2011.
- Invited Panelist, Workshop on Environmental Estrogens and Endocrine Disrupting Compounds, sponsored by the **Johnson Foundation**, Wingspread, WI, May 2010.
- Invited Panelist, Special Symposium on Next Generation Superfund Contaminants sponsored by the **National Institute of Environmental Health Sciences (NIEHS)**, Tucson, AZ, August 2009.
- Invited Panelist, **American Academy for Microbiology**, "Global Antibiotic Resistance: New Approaches to an Old Problem," Fondation Merieux, Annecy, France, October 2008.
- National Research Council of the National Academies**. NRSB-O-05-04-A. Conduct a Technical Assessment of Ongoing and Planned Environmental Remediation and Monitoring Programs at the Los Alamos National Laboratory (LANL) and Provide Recommendations to Improve Their Technical and Cost Effectiveness and Reduce Worker, Public, and Environmental Risks.
Invited NRC Committee Member, Dual Appointment in the Areas of Groundwater Monitoring and Chemistry. 15-Month Term Starting March, 2006.
- Invited Panelist, **BIO 2006**, World's Largest Annual International Convention on Biotechnology. Chicago, IL. Environmental Biotechnology Session. 04/9-12/2006
- Mid-Atlantic States Section of the Air & Waste Management Association (MASS-A&WMA), Special Symposium on Emerging Environmental Issues and Policies. **Invited Speaker/Panelist**. New Brunswick, NJ, April 6, 2006.
- EPA Office of Inspector General, Office of Program Evaluation, Evaluation of Drinking Water Laboratory Procedures. Invited Expert Consultant. 1/19/2006.
- Food And Drug Administration, Center For Drug Evaluation And Research (CDER) Nonprescription Drugs Advisory Committee**. "Benefits and Hazards of Antiseptic Products Marketed for Consumer Use." **Invited Panelist/Voting Committee Member**. 10/20/2005.
- National Congress on Assessing and Mitigating Environmental Impacts of Emerging Contaminants – Renewable Natural Resources Foundation. Co-Sponsored by the United States Geological Survey and the Food and Drug Administration. **Invited Delegate**. 12/1-2/2005
- Harvard School of Public Health Risk Assessment Workshop: "Pharmaceuticals and Personal Care Products in the Environment: Emerging Threat or Unwarranted Concern?" **Invited Panelist**. 11/10/2005
- International Conference on Safe Water, Exploring Global Demands and Impacts of Natural Disasters, SAFEWATER 2005. San Diego, CA. Groundwater Remediation Session. **Invited Session Chair**. 10/21/2005

DOE/EPA SERDP and ESTCP Expert Panel Workshop on Research and Development Needs for the Environmental Remediation Application of Molecular Biological Tools. **Invited Speaker and Voting Panel Member.** Specialty: Proteomics. 08/9-10/2005

Governor Ehrlich's Maryland Department of the Environment – Maryland State Water Quality Advisory Committee (SWQAC) Public Interest Member. **Selected by JHSPH Dean Al Sommer to be the Johns Hopkins Representative for this Committee.** 1/1/2003 – 12/31/2005

Governor Ehrlich's Maryland Water Security and Wastewater Systems Advisory Council Alternate Member. 01/2004 – 12/2004

Maryland Water Monitoring Council: "Ecological Restoration Assessment & Monitoring" Linthicum, MD. **Invited Panelist.** 11/18/2004

Water Environment Research Foundation (WERF) Project Advisory Committee. "Fate of Pharmaceuticals and Personal Care Products through Wastewater Treatment Processes." **Invited Committee Member.** 2004-2006

Water Environment Research Foundation (WERF) Project Advisory Committee. "Contributions of Household Chemicals to Sewage and their Relevance to Municipal Wastewater Systems and the Environment." **Invited Committee Member.** 2004-06

DOE Natural and Accelerated Bioremediation Research Program (NABIR) Workshop. Warrenton, VA. **Invited Panelist.** 3/18-20/2002

DOE New Perspectives Council, Lawrence Livermore National Laboratory. **Appointed Chairman** of a 14-Member Task Force Assembled to Provide Recommendations for Managing Environmental Cleanup and Research at two CA Superfund Sites, Livermore CA, 2000.

EDITORIAL ACTIVITIES

Book Editor

Contaminants of Emerging Concern: Ecotoxicological and Human Health Considerations, 2010. American Chemical Society (ACS) Book Series. 606 pp. Oxford University Press, New York, NY. ISBN13: 9780841224964; eISBN: 9780841224971; DOI: 10.1021/bk-2010-1048

Peer Review Activities

1. American Chemical Society (ACS) Books
2. American Chemical Society (ACS) Merits Awards, Env. Chem. Division
3. Analytical Chemistry
4. Archives of Environmental Contamination and Toxicology
5. Archives of Microbiology
6. California Environmental Protection Agency
7. Chemosphere
8. Consumer Reports
9. EcoHealth
10. Ecotoxicology and Environmental Safety
11. Environmental Chemistry
12. Environmental Health Perspectives
13. Environmental Pollution
14. Environmental Research
15. Environmental Science & Technology
16. Environmental Science and Pollution Research
17. Environmental Toxicology & Chemistry
18. Environmental Technology
19. Environment International
20. Expert Review of Proteomics
21. Integrated Environmental Assessment and Management (IEAM)
22. International Journal of Industrial Chemistry

23. Journal of Chromatography A
24. Journal of Chromatographic Science
25. Journal of Environmental Science and Health, Part B
26. Journal of Hazardous Materials
27. Journal of Proteome Research
28. Leaking Underground Storage Tank Line
29. Marine Environmental Research
30. Molecular & Cellular Proteomics
31. Renewable Natural Resources Foundation
32. Science
33. Science of the Total Environment
34. Soil & Sediment Contamination: an International Journal
35. Toxicology
36. United States Environmental Protection Agency
37. Water Research
38. Water Science & Technology

PROPOSAL REVIEW ACTIVITIES

- | | |
|------|---|
| 2014 | Department of Defense, Air Force Ad Hoc Proposal Review |
| 2011 | EPA Small Business Innovative Research (SBIR) Panel – Drinking Water |
| 2011 | NIH Study Section Community Level Health Promotion (CLHP) Ad Hoc Member |
| 2011 | Hudson River Foundation for Science and Environmental Research |
| 2010 | Water Resources Research Institutes Program, United States Geological Survey |
| 2009 | NIH Study Section ZRG1 HDM-B 11B, Healthcare Delivery and Methodologies-Occupational Health, Small Business Innovative Research (SBIR) Program |
| 2009 | NIH Study Section ZRG1 HOP E 11, Health of the Population, Small Business Innovative Research (SBIR) Program |
| 2009 | Water Resources Research Institutes Program, United States Geological Survey |
| 2008 | NIH Study Section ZRG1 HOP E 10, Health of the Population, Small Business Innovative Research (SBIR) Program |
| 2007 | NIH Study Section ZRG1 HOP E 10, Health of the Population, Small Business Innovative Research (SBIR) Program |
| 2007 | Natural Sciences and Engineering Research Council of Canada, NSERC's Discovery Grant Program |
| 2007 | Caribbean Coral Reef Institute (CCRI) in Cooperation with the University of Puerto Rico – Mayagüez and the National Atmospheric and Oceanic Administration (NOAA) |
| 2006 | National Academies, U.S. Agency for International Development (USAID), Middle East Regional Cooperation Program (MERC) |
| 2006 | U.S. Environmental Protection Agency (EPA), Office of Research, Small Business Innovative Research (SBIR) Program |
| 2006 | International Science and Technology Center (ISTC); Science Center Programs of the U.S. Department of State |
| 2005 | Natural Sciences and Engineering Research Council of Canada (NSERC), Collaborative Health Research Project (CHRP) Grant Program |
| 2005 | Cooperative Grants Program of the U.S. Civilian Research and Development Foundation (CRDF), Co-founded and Sponsored by the National Science Foundation (NSF) |
| 2004 | National Science Foundation (NSF), Microbial Observatories (MO) and Microbial Interactions and Processes (MIP); RFA: NSF-04-586 |
| 2004 | Water Environment Research Foundation (WERF), Pharmaceuticals and Personal Care Products in the Environment |
| 2003 | National Science Foundation (NSF), Microbial Observatories (MO) and Microbial Interactions and Processes (MIP); RFA: NSF-03-571 |

2002 International Science and Technology Center (ISTC); Science Center Programs of the U.S. Department of State

ACADEMIC SERVICE

Nationwide

National Institute of Environmental Health Sciences (NIEHS) Superfund Research Program, R01 Working Group, National Leader. 2012 – Present

Congressional Briefing, Invited Talk at U.S. Congress: Environmental Health Risks of Triclosan. Capitol Hill Congressional Briefing Room, Washington, DC, February 17, 2011

University Wide

ASU Biological Design Graduate Program, Executive Committee Member. 2013 – Present

ASU Biological Design Graduate Program, Chair of Admission. 2013 – Present

Chief Operating Officer of ASU/AzTE Startup Company, ISW, LLC (2012 – Present)

ASU IPIRC Intellectual Property Institutional Review Committee, Member. 2011 – Present

ASU Biodesign/AzTE Intellectual Property Advisory Committee, Member. 2011 – Present

School Wide

ASU Faculty Search Committee (Member; Process Engineering Position) 2013 – 2014

ASU Faculty Search Committee (Member; Water Resources Position) 2013 – 2014

ASU Faculty Search Committee (Chair; CHiR Director) 2011 – 2012

ASU Faculty Search Committee (Chair; Air Toxics) 2011 – 2012

ASU Curriculum Committee, 2009 – 2011

ASU Fulton Undergraduate Research Initiative (FURI) Committee, 2009 – 2013

ASU Grand Challenges Faculty Search Committee, 2009 – 2011

ASU Faculty Search Committee, 2008 – 2009

Johns Hopkins University Faculty Senator, Dept. of Environ. Health Sciences. Elected 09/2003 – 08/2004

Johns Hopkins University Committee on Information Technology (CIT) Member, JHSPH, 9/04 – 12/07

Faculty Representative at the Technology Transfer Retreat, JHSPH, July 23, 2004

JHSPH Faculty Title Task Force. Invited Representative of the Junior Faculty, 2003

Co-organizer of the JHSPH Junior Faculty Meetings, 2003

Division and Department

ASU Biodesign Personnel Committee, 2014 – Present

ASU Intellectual Property Institutional Review Committee, 2011 – 2012

ASU Biodesign Research & Collaboration Advancement Committee, 2011 – Present

ASU Specialty Area Coordinator for Environmental and Water Resource Engineering. 2008 – 2009

JHU Enrichment and Seminars Committee, EHS, Member, 08/2003 – 07/2004

JHU Ad-hoc Committee for Development of a Mission Statement for the Dept. of EHS, 2003

JHU Center for Water and Health Faculty Search Committee, Member, 2002 – 2005

JHU Academic Affairs Committee, Dept. of Environ. Health Sci., Member, 9/2004 – 8/2005

JHU Organizer of the “Exposure Assessment Session” at the EHS Annual Research Day, Mt. Washington Conference Center, Baltimore, MD, Nov. 14, 2003

Communication and Outreach

Conducted 150+ TV/Radio/Newspaper Interviews; Contributions were featured in, e.g., New York Times, Wall Street Journal, Time Magazine, Science News, and the Los Angeles Times

AWARDS & HONORS

- 2014 Invited Expert for Media Relations, Expert Program, American Chemical Society (ACS)
- 2012 Appointed National Leader of R01 Working Group of the NIEHS Superfund Program
- 2011 Leroy E. Burney Lecturer, Johns Hopkins School of Public Health
- 2011 List of 20 Public Health Experts Worth Knowing
- 2010 Senior Sustainability Scientist, Global Institute of Sustainability, ASU. 2010 – Present
- 2010 Award for Research Excellence, Arizona BioIndustry Association's BIOFEST 2010, Nominee and Finalist
- 2010 Biodesign Impact Accelerator Program, Selected Startup Company, ASU
- 2010 Faculty Honoree, School of Sustainable Engineering and the Built Environment, ASU
- 2007 Faculty Research Initiative Award, Johns Hopkins University
- 2005 Faculty Research Initiative Award, Johns Hopkins University
- 2002 Faculty Innovation Award, Johns Hopkins University
- 2000 Two Recognition Awards, Lawrence Livermore National Laboratory
- 1998 American Permanent Residency National Interest Waiver, LLNL
- 1997 American Society for Microbiology, Travel Grant
- 1996 Dissertation Fellowship, Outstanding Ph.D. Student, University of Minnesota

PUBLICATIONS

Peer-reviewed, Archival Journal Articles (* Indicates Corresponding Author)

1. Done, H., and **R. U. Halden**.* 2014. Reconnaissance of 47 Antibiotics and Microbial Risks in Major Seafood and Aquaculture Products Consumed in the United States. *J. Hazardous Materials* (In Press).
2. **Halden, R. U.*** 2014. Epistemology of Contaminants of Emerging Concern and Literature Meta-analysis. *J. Hazardous Materials* (In Press).
3. Geer, L. A., B. F. Pycke, D. M. Sherer, O. Abulafi, and **R. U. Halden**. 2014. Use of Amniotic Fluid for Determining Pregnancies at Risk of Preterm Birth and for Studying Diseases of Potential Environmental Etiology. *Environmental Research* (In Press).
4. Pycke, B. F. G.; L. A. Geer; M. Dalloul; O. Abulafia; A. M. Jenck; **R. U. Halden**; Human Fetal Exposure to Triclosan and Triclocarban in an Urban Population from Brooklyn, New York. *Environmental Science & Technology*. 48(15):8831–8838. DOI: 10.1021/es501100w.
5. Pycke, B. F. G., I. Roll, B. Brownawell, C. Kinney, E. Furlong, D. Kolpin, and **R. U. Halden**.* 2014. Transformation Products and Human Metabolites of Triclocarban and Triclosan in Sewage Sludge across the United States. *Environmental Science & Technology*. 48(14):7881-7890. DOI: 10.1021/es5006362.
6. Bruton, T., A., B. F. G. Pycke, and **R. U. Halden**.* 2014. Effect of Nanoscale Zero-Valent Iron Treatment on Biological Reductive Dechlorination: A Review of Current Understanding and Research Needs. (In Press in *Critical Reviews in Environmental Science & Technology*).
7. Venkatesan A. and **R. U. Halden**.* 2014. Loss and In Situ Production of Perfluoroalkyl Chemicals in Outdoor Biosolids-soil Mesocosms. *Environmental Research* 132:321–327; 10.1016/j.envres.2014.04.024
8. Venkatesan, A, B. F. G. Pycke, and **R. U. Halden**.* 2014. Detection and Occurrence of N Nitrosamines in Archived Biosolids from the Targeted National Sewage Sludge Survey of the

U.S. Environmental Protection Agency. *Environmental Science & Technology* 48(9):5085-5092. doi: 10.1021/es5001352. Epub 2014 Apr 15.

9. Wells, E. M.,* A. Navas-Ancien, B. J. Apelberg, J. B. Herbstman, J. M. Jarrett, Y. H. Lin, C. P. Verdon, C. Ward, K. L. Caldwell, J. R. Hibbeln, **R. U. Halden**, F. R. Witter, and L. R. Goldman. 2014. Association of Selenium and Copper with Lipids in Umbilical Cord Blood. *Journal of Developmental Origins of Health and Disease*. 5(4), 281-287. DOI:10.1017/S2040174414000233.
10. Hesari, N., C. M. Francis, and **R. U. Halden**.* 2014. Evaluation of Glycol Ether as an Alternative to Perchloroethylene in Dry Cleaning. *Toxics* 2:115-133; doi:10.3390/toxics2020115
11. **Halden, R. U.*** 2014. On the Need and Speed of Regulating Triclosan and Triclocarban in the United States. *Environmental Science & Technology* 48:3603–3611. DOI: 10.1021/es500495p. ES&T Cover & Feature. Epub March 3, 2014.
12. Venkatesan, A., H. Done, and **R. U. Halden**.* 2014. United States National Sewage Sludge Repository at Arizona State University – A New Resource and Research Tool for Environmental Scientists, Engineers, and Epidemiologists. *Environmental Science and Pollution Research* (In Press).
13. Venkatesan A. and **R. U. Halden**.* 2014. Brominated flame retardants in U.S. biosolids from the EPA national sewage sludge survey and chemical persistence in outdoor soil mesocosms. *Water Research* 55, 133-142. <http://dx.doi.org/10.1016/j.watres.2014.02.021>
14. Venkatesan A. and **R. U. Halden**.* 2014. Wastewater Treatment Plants as Chemical Observatories to Forecast Ecological and Human Health Risks of Manmade Chemicals. *Scientific Reports*, 4: 3731 | DOI: 10.1038/srep03731. www.nature.com/srep/2014/140116/srep03731/full/srep03731.html
15. Marsalla, J., B-O. Kim. and **R. U. Halden**.* 2013. Analysis of Crop Rotations in the U.S. Breadbasket Using Legumes as an Alternative to Industrially-Produced Fertilizer. *J. Agric. Sci. Appl.* 3(2):169-174. <http://www.j-asa.org/Download.aspx?ID=5141>. PMID TBD.
16. Deo, R. P. and **R. U. Halden**.* 2013. Pharmaceuticals in the Built and Natural Water Environment of the United States. *Water* 5(3):1346-1365. DOI:10.3390/w5031346. PMID TBD.
17. Doudrick, K., N. Corson, G. Oberdorster, A. C. Elder, P. Herckes, **R. U. Halden**, and P. Westerhoff. 2013. Extraction and Quantification of Carbon Nanotubes in Biological Matrices with Application to Rat Lung Tissue. *ACS Nano* (In Press; Article ASAP). DOI: 10.1021/nn403302s
18. Dong, H.-P., Williams, E., Wang, D.-Z., Xie, Z.-X.,³ Hsia, R.-C., Jenck, A., **Halden, R.U.**, Chen, F., Place, A. R. 2013. Responses of *Nannochloropsis oceanica* IMET1 to Long-term Nitrogen Starvation and Recovery. *Plant Physiol.* 162(2):1110-1126. DOI: 10.1104/pp.113.214320
19. Scotch, M, B. Baarson, R. Beard, R. Lauder, A. Varman, and **R. U. Halden**. 2013. Examining the Differences in Format and Characteristics of Zoonotic Virus Surveillance Data on State Agency Websites. *Journal of Medical Internet Research* 15(4):e90. doi:10.2196/jmir.2487.
20. Venkatesan A. and **R. U. Halden**.* 2013. National Inventory of Perfluoroalkyl Substances in Archived U.S. Biosolids from the 2001 EPA National Sewage Sludge Survey. *J. Hazardous Materials* 4:413-418. DOI:10.1016/j.jhazmat.2013.03.016. NIHMS 464002.

21. Ziv-El, M., T. Kalinowski, R. Krajmalnik-Brown and **R. U. Halden**.* 2013. Simultaneous Determination of Chlorinated Ethenes and Ethene in Groundwater using Automated Headspace Solid Phase Microextraction. *Journal of Chromatographic Science* doi 10.1093/chromsci/bms258.
22. North, E. J. and **R. U. Halden**.* 2013. Plastics and Environmental Health: The Road Ahead. Invited paper at *Reviews on Environmental Health* 28(1):1-8. DOI 10.1515/reveh-2012-0030.
23. Venkatesan A. and **R. U. Halden**.* 2013. National Inventory of Alkylphenol Ethoxylate Compounds in U.S. Biosolids and Chemical Fate in Outdoor Soil Mesocosms. *Environmental Pollution* 174:189-193.
24. Love, D. C., **R. U. Halden**, M. F. Davis, and K. E. Nachman. 2012. Response to Comment on Feather Meal: A Previously Unrecognized Route for Reentry into the Food Supply of Multiple Pharmaceuticals and Personal Care Products (PPCPs). *Environ. Sci. Technol.*, 46(24): 13557-13558. DOI: 10.1021/es304181c.
25. Love, D. C., **R. U. Halden**, M. F. Davis, and K. E. Nachman. 2012. Response to Comment on Feather Meal: A Previously Unrecognized Route for Reentry into the Food Supply of Multiple Pharmaceuticals and Personal Care Products (PPCPs). *Environ. Sci. Technol.*, 46(24):13026-13027. DOI: 10.1021/es304180x.
26. Chari, B. P. and **R. U. Halden**.* 2012. Predicting the Concentration Range of Unmonitored Chemicals in Wastewater-dominated Streams and in Run-off from Biosolids-amended soils. *Science of the Total Environment* 440:314-320. doi: 10.1016/j.scitotenv.2012.05.042. PMID 22682556.
27. Kalinowski, T. * and **R. U. Halden**. 2012. Can Stress Enhance Phytoremediation of Polychlorinated Biphenyls? *Environmental Engineering Science* 29(12):1047-1052; DOI: 10.1089/ees.2012.0089.
28. Hartmann. E. M., and **R. U. Halden**.* 2012. Analytical Methods for the Detection of Viruses in Food by Example of CCL-3 Bioagents. *Analytical and Bioanalytical Chemistry* 404(9):2527-2537. PMID 22526652.
29. Pycke, B. F. G., T.-C. Chao, P. Herckes, P. Westerhoff and **R. U. Halden**.* 2012. Beyond nC₆₀: Strategies for Identification of Transformation Products of Fullerene Oxidation in Aquatic and Biological Samples. *Analytical and Bioanalytical Chemistry*, 404(9) (2012):2583-2595. DOI 10.1007/s00216-012-6090-8. PMID 22644149.
30. Chari, B. P. and **R. U. Halden**.* 2012. Validation of Mega Composite Sampling and Nationwide Mass Inventories for 26 Previously Unmonitored Contaminants in Archived Biosolids from the U.S National Biosolids Repository. *Water Research* 36:4814-4824. PMID 22789759.
31. Delgado, A., P. Parameswaran, D. Fajardo-Williams, **R. U. Halden**, and R. Krajmalnik-Brown.* 2012. Role of Bicarbonate as a pH Buffer and Electron Sink in Microbial Dechlorination of Chloroethenes. *Microbial Cell Factories* 1(128):10pp.
32. Ziv-El, M., S. C. Popat, K. Cai, **R. U. Halden**, R. Krajmalnik-Brown, and B. E. Rittmann*. 2012. Managing Methanogens and Homoacetogens to Promote Reductive Dechlorination of Trichloroethene with Direct Delivery of H₂ in a Membrane Biofilm Reactor. *Biotechnol. Bioeng.* 109(9):2200-2210. PMID 22392141.

33. Ziv-El, M., S. C. Popat, P. Parameswaran, D. W. Kang, A. Polasko, **R. U. Halden**, B. E. Rittmann, and R. Krajmalnik-Brown.* 2012. Using Electron Balances and Molecular Techniques to Assess Trichoroethene-induced Shifts to a Dechlorinating Microbial Community. *Biotechnol. Bioeng.* 109(9):2230-2239. PMID 22447387.
34. Venkatesan, A. K., B. F. Pycke, L. B. Barber, K. E. Lee, and **R. U. Halden**.* 2012. Occurrence of Triclosan, Triclocarban, and Its Lesser Chlorinated Congeners in Minnesota Freshwater Sediments Collected Near Wastewater Treatment Plants. *Journal of Hazardous Materials* 229-230:29-35. PMID 22742731.
35. Ziv-El, M., A. G. Delgado, Y. Yao, K. Muto, D.-W. Kang, **R. U. Halden**, R. Krajmalnik-Brown.* 2012. Development and Characterization of DehaloR², a Novel Anaerobic Microbial Consortium Performing Rapid Dechlorination of TCE to Ethene. *Applied Microbiology and Biotechnology* 95(1):273-274. PMID 21667274.
36. Hartmann, E. M., J. P. Badalamenti, R. Krajmalnik-Brown, and **R. U. Halden**.* 2012. Quantitative PCR for Tracking Megaplasmid-borne Biodegradation Potential of a Model *Sphingomonad*. *Appl. Environ. Microbiol.* 78(12):2293-4496. PMID 22492441.
37. Love, D. C., **R. U. Halden**, M. F. Davis, and K. E. Nachman. Response to Comment on Feather Meal: A Previously Unrecognized Route for Reentry into the Food Supply of Multiple Pharmaceuticals and Personal Care Products (PPCPs). *Environ. Sci. Technol.*, 46(10):5631-5631. DOI: 10.1021/es301528a.
38. Hansmeier, N., T.-C. Chao, L. R. Goldman, F. R. Witter, and **R. U. Halden**.*. 2012. Prioritization of Biomarker Targets in Human Umbilical Cord Blood: Identification of Proteins in Infant Blood Serving as Validated Biomarkers in Adults. *Environmental Health Perspectives* 120(5):764-769. <http://dx.doi.org/10.1289/ehp.1104190>. PMID 22538116.
39. Love, R. C., **R. U. Halden**, M. F. Davis and K. E. Nachman. 2012. Feather Meal: a Previously Unrecognized Route for Reentry into the Food Supply of Multiple Pharmaceuticals and Personal Care Products (PPCPs). *Environ. Sci. Technol.* 46(7):3795-3802. PMID 22435972.
40. Wells, E. M.,* L.R. Goldman, J. M. Jarrett, B. J. Apelberg, J. B. Herbstman, K. L. Caldwell, **R. U. Halden**, and F. R. Witter. 2012. Selenium and Maternal Blood Pressure During Childbirth. *Journal of Exposure Science and Environmental Epidemiology.* 22(2):191-197. PMID 22108761.
41. Gray, E. P, T. A. Bruton, C. P. Higgins, **R. U. Halden**, P. Westerhoff, and J. F. Ranville. 2012. Analysis of Gold Nanoparticle Mixtures: a Comparison of Hydrodynamic Chromatography (HDC) and Asymmetrical Flow Field-Flow Fractionation (AF4) Coupled to ICP-MS. *J. Analyt. Atomic Spectrometry* 27(9):1532-1539. DOI: 10.1039/c2ja30069a
42. Colquhoun, D., E. M. Hartmann, and **R. U. Halden**.* 2012. Proteomic Profiling of the Dioxin-Degrading Bacterium *Sphingomonas wittichii* RW1. *J. Biomed. Biotech.* Article ID 408690, 9 pages. (In Press). doi:10.1155/2012/408690. PMID 23091346.
43. Ziv-El, M., A. G. Delgado, Y. Yao, K. Muto, D.-W. Kang, **R. U. Halden**, R. Krajmalnik-Brown.* 2011. Development and Characterization of DehaloR², a Novel Anaerobic Microbial Consortium Performing Rapid Dechlorination of TCE to Ethene. *Applied Microbiology and Biotechnology* 92(5):1063-1071. PMID 21667274.

44. Novak, P. J., Arnold, W. A., Blazer, V.S., **Halden, R. U.**, Klaper, R. D., Kolpin, D. W., Kriebel, D., Love, N. G., Martinovic-Weigelt, D., Patisaul, H. B., Snyder, S. A., vom Saal, F. S., Weisbrod, A. V., and D. L. Swackhamer. 2011. On the Need for a National (US) Research Program to Elucidate the Potential Risks to Human Health and the Environment Posed by Contaminants of Emerging Concern. *Environmental Science & Technology* 45(9):3829-3830. DOI: 10.1021/es200744f. PMID 21438522.
45. Novak, P. J. with Contributing Authors: Arnold, W. A., Blazer, V.S., **Halden, R. U.**, Klaper, R. D., Kolpin, D. W., Kriebel, D., Love, N. G., Martinovic-Weigelt, D., Patisaul, H. B., Snyder, S. A., vom Saal, F. S., Weisbrod, A. V., and D. L. Swackhamer. 2011. Unite to Assess Contaminant Risk. *Nature* 471(7340):578-578. (See <http://www.nature.com.ezproxy1.lib.asu.edu/nature/journal/v471/n7340/extref/471578a-s1.pdf> for full list of authors).
46. Chao, T.-C., G. Song, N. Hansmeier, P. Westerhoff, P. Herckes, **R. U. Halden**.* 2011. Characterization and LC-MS/MS based quantification of hydroxylated fullerenes. *Analytical Chemistry* 83(5):1777-1783. PMID 21294534.
47. Wells, E. M.,* B. J. J. M. Jarrett, Y. H. Li, K. L. Caldwell, J. R. Hibbeln, B. J. Apelberg, J. Herbstman, **R. U. Halden**, F. R. Witter and L. R. Goldman. 2011. Body Burdens and Descriptors of Mercury, Lead, Selenium and Copper Among Newborns at an Urban Hospital. *Environ. Res.* 11(3):411-417. doi:10.1016/j.envres.2010.12.009. PMID 21277575.
48. Wells, E. M.,* Navas-Acien, A., Herbstman, J. B., Apelberg, B. J., Silbergeld, E.K., Caldwell, K. L., Jones, R. L., **Halden, R. U.**, Witter, F. R., and L. R. Goldman. 2011. Low level lead exposure and elevated blood pressure during pregnancy. *Environ. Health Perspect.* 119(5):664-669. doi:10.1289/ehp.1002666. PMID 21292600.
49. Neta, G.,* L. R. Goldman, D. Barr, A. Sjödin, N. Fedarko, B. J. Apelberg, F. R. Witter, **R. U. Halden**. 2011. Fetal exposure to chlordane and permethrin mixtures in relation to inflammatory cytokines and birth outcomes. *Environmental Science & Technology* 45(4):1680-1687. PMID 21235202.
50. Benn, T. M.*, B. F. Pycke, P. Herckes, P. Westerhoff, and **R. U. Halden**. 2011. Evaluation of Extraction Methods for the Quantification of Aqueous Fullerenes in Urine. *Anal. Bioanalyt. Chem.* 399(4):1631-1639. PMID 21153587.
51. W. P. Ela,* D. L. Sedlak, M. A. Barlaz, H. F. Henry, D. D. G. Muir, D. L. Swackhamer, E. J. Weber, R. G. Arnold, L. Ferguson, J. A. Field, E. T. Furlong, J. P. Giesy, **R. U. Halden**, T. Henry, R. A. Hites, K. C. Hornbuckle, P. H. Howard, R. G. Luthy, A. K. Meyer, A. E. Sáez, F. S. vom Saal, C. D. Vulpe, and M. R. Wiesner. 2011. Towards Identifying the Next Generation of Superfund and Hazardous Waste Site Contaminants. *Environ. Health Perspect.* 119(1):6-10. PMID 21205582.
52. Higgins, C. P.,* Z. J. Paesani, T. E. A. Chalew, **R. U. Halden**, L. Hundal. 2011. Persistence of Triclocarban and Triclosan in Soils after Land Application of Biosolids and Bioaccumulation in *Eisenia foetida*. *Environ. Toxicol. Chem.* 30(3):556-563. PMID 21128266.
53. Pycke, B. F., T. M. Benn, P. Herckes, P. Westerhoff, and **R. U. Halden***. 2011. Strategies for Quantifying C60 Fullerenes in Environmental and Biological Samples and Implications for

Toxicological Studies in Environmental Health and Ecotoxicology. *Trends in Analytical Chemistry* 30(1):44-57. PMID 21359100.

54. Miller, T. R., A. L. Delcher, S. L. Salzberg, E. Saunders, J. C. Detter, and **R. U. Halden**.* 2010. Genome Sequence of the Dioxin Mineralizing Bacterium *Sphingomonas wittichii* RW1. *J. Bacteriology* 192(22):6101-6102. PMID 20833805.
55. Deo, R. P. and **R. U. Halden**.* 2010. *In Silico* Screening for Unmonitored, Potentially Problematic High Production Volume (HPV) Chemicals Prone to Accumulate in Biosolids. *Journal of Environmental Monitoring* 12(10):1840-8145. DOI:10.1039/c001559h. PMID 20721409.
56. Miller, T. R., D. R. Colquhoun, and **R. U. Halden**.* 2010. Identification of Wastewater Bacteria Involved in the Degradation of Triclocarban and its Non-Chlorinated Congener. *J. Hazard. Mat.* 183(1-3):766-772. PMID 20727675.
57. Walters, E., K. McClellan and **R. U. Halden**.* 2010. Occurrence and loss over three years of 72 pharmaceuticals and personal care products from biosolids-soil mixtures in outdoor mesocosms. *Water Research* 44:6011-6020. PMID 20728197.
58. Neta, G., L. R. Goldman,* D. Barr, A. Sjödin, B. J. Apelberg, J. Herbstman, F. R. Witter and **R. U. Halden**. 2010. Distribution and determinants of pesticide mixtures in cord serum using principal component analysis. *Environ. Sci. Technol.* 44(14):5641–5648. PMID 20550184.
59. Guerrero-Preston, R., L. Goldman, L. Brebi-Mieville, C. Ili-Gangas, C. LeBron, M. Hernández-Arroyo, F. R. Witter, B. J. Apelberg, M. Roystacher, A. Jaffe, **R. U. Halden**, and D. Sidransky. 2010. Global DNA hypomethylation is associated with in utero exposure to cotinine and perfluorinated alkyl compounds. *Epigenetics* 5(6):539-546. PMID 20523118.
60. Chao, T.-C., Hansmeier, N. and **R. U. Halden**.* 2010. Towards proteome standards: The use of absolute quantitation in high-throughput biomarker discovery. *J. Proteomics.* 73(3):1641-1646. Online at doi:10.1016/j.jprot.2010.04.004. PMID 20399287.
61. Hartmann. E. M., D. R. Colquhoun and **R. U. Halden**.* 2010. Identification of Putative Biomarkers for Toluene-Degrading Burkholderia and Pseudomonads using Matrix-Assisted Laser Desorption/Ionization Time-of-Flight Mass Spectrometry and Peptide Mass Fingerprinting. *Bioscience, Biotechnology, Biochemistry* 74(7):1470-1472. PMID 20622441.
62. McClellan K. and **R. U. Halden**.* 2010. Pharmaceuticals and Personal Care Products in Archived U.S. Biosolids from the 2001 EPA National Sewage Sludge Survey. *Water Res.* 44(2):658-668. doi: 10.1016/j.watres.2009.12.032. PMID 20106500.
63. **Halden, R. U.*** 2010. Plastics and Health Risks. *Annual Reviews of Public Health.* 31:179-194. DOI:10.1146/annurev.publhealth.012809.103714. PMID 20070188.
64. Deo, R. P. and **R. U. Halden**.* 2010. Comment on "The removal of pharmaceuticals, personal care products, endocrine disruptors and illicit drugs during wastewater treatment and its impact on the quality of receiving waters. *Water Res.* 44:2685-2687
<http://dx.doi.org/10.1016/j.watres.2009.11.040>. PMID 20022620.

65. Deo, R. P. and **R. U. Halden**.* 2010. Effect of sample filtration on the quality of monitoring data reported for organic compounds during wastewater treatment. *J. Environ. Monit.* 12:478-483. doi:10.1039/b919076g. PMID 20145890.
66. Deo, R. P. and **R. U. Halden**.* 2009. Empirical Model for Predicting Concentrations of Refractory Hydrophobic Organic Compounds in Digested Sludge from Municipal Wastewater Treatment Plants. *Environ. Chem.* 6:544-550. PMID 20161626.
67. Heidler J. and **R. U. Halden**.* 2009. Fate of Organohalogenes in U.S. Wastewater Treatment Plants and Estimated Chemical Releases to Soils Nationwide from Biosolids Recycling. *J. Environ. Monit.* 11:2207-2215. Accessible online at: DOI:10.1039/B914324F. PMID 20024018.
68. Zhao, Y., K. Wang, H.-W. Ackermann, **R. U. Halden**, N. Jiao, and F. Chen.* 2010. Searching for a “Hidden” Prophage in a Marine Bacterium. *Appl. Environ. Microbiol.* 76(2):589-595. PMID 19948862.
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PUBLICATIONS

International and National Conference Proceedings Papers, Abstracts and Presentations (Referred)

1. Pycke, B. F. J., **R. U. Halden**, M. Dalloul, O. Abulafia, A. Jenck, and L. A. Geer. Prenatal Exposure to Triclocarban and Triclosan In Relation to Birth Weight and Size in an Urban Immigrant Population from Brooklyn, NY. 24th Annual International Society of Exposure Science Conference. Cincinnati, Ohio. October 12-16, 2014.
2. Venkatesan, A. and **R. U. Halden**. Occurrence of carcinogenic N-nitrosamines in nationally representative samples of U.S. sewage sludges. 248th American Chemical Society National Meeting and Exposition, San Francisco, August 10-14, 2014.
3. Venkatesan, A. and **R. U. Halden**. Nationwide Occurrence, Release Inventories and Prioritization of Emerging Contaminants in U.S. Sewage Sludges: Results from the National Sewage Sludge Repository of Arizona State University. 248th American Chemical Society National Meeting and Exposition, San Francisco, August 10-14, 2014.

4. Jenck, A. M., D. Lake, and **R. U. Halden**. Development of a proteomic-based analytical method for the isolation and identification of *Coccidioides* spp. proteins detectable in human blood plasma. 248th American Chemical Society National Meeting and Exposition, San Francisco, August 10-14, 2014.
5. Supowit, S. D., I. B. Roll, V. D. Dang, K. J. Kroll, N. D. Denslow, and **R. U. Halden**. Active sorptive sampling for bioavailability: The in situ sampler for bioavailability assessment (IS2B). 248th American Chemical Society National Meeting and Exposition, San Francisco, August 10-14, 2014.
6. Pycke, B. F. G., L. A. Geer, M. Dalloul, O. Abulafia, and **R. U. Halden**. Human biomonitoring of prenatal exposure to triclosan and triclocarban in a multiethnic urban population from Brooklyn, New York. 248th American Chemical Society National Meeting and Exposition, San Francisco, August 10-14, 2014.
7. **R. U. Halden**. Waste epidemiology: Taking the chemical pulse of a nation at the sewer by example of the United States. 248th American Chemical Society National Meeting and Exposition, San Francisco, August 10-14, 2014.
8. Kidd, J., Pycke, B. F. G., and **R. U. Halden**. Thermal treatment for mobilization and co-metabolic degradation of weathered heavy hydrocarbons in the vadose zone. 248th American Chemical Society National Meeting and Exposition, San Francisco, August 10-14, 2014.
9. Done, H. Y., and **R. U. Halden**. Antibiotics and Aquaculture: Detected Residues and Microbial Resistance Risks. 248th American Chemical Society National Meeting and Exposition, San Francisco, August 10-14, 2014.
10. Done, H., B. F. G. Pycke, and **R. U. Halden**. Antibiotic Residue Screening in United States Seafood. SETAC Europe 24th Annual Meeting, Basel, Switzerland, May 11-15, 2014.
11. **Halden, R. U.** Taking the Chemical Pulse of a Nation by Example of the U.S.A. SETAC Europe 24th Annual Meeting, Basel, Switzerland, May 11-15, 2014.
12. Pycke, B. F. G., I. Roll, D. Kolpin, C. Kinney, B. Brownawell, E. Furlong, and **R. U. Halden**. Determination of Metabolites in U.S. Biosolids to Assess Removal of Parent Antimicrobials in the Built Environment. 9th Battelle International Conference on Remediation of Chlorinated and Recalcitrant Compounds, Monterey, CA, May 19-22, 2014.
13. Thomas, J., L. A. Geer, B. F.G. Pycke, M. Dalloul, O. Abulafia, and **R. U. Halden**. Maternal Exposure to EDCs from Consumer Products: Comparison of Levels in a Caribbean Immigrant Population in the U.S. to National and Global Levels. 5th Annual CUGH Conference. Washington, D.C. May 10-12, 2014.
14. Epshtein, O., D. Childers, and **R. U. Halden**. Cracking the Black Box of Treatment Wetlands. Arizona Water Association (AZ Water) 87th Annual Conference, Glendale, Arizona, May 7-9, 2014.
15. Jenck, A. and **R. U. Halden**. Development of a Proteomic-based Diagnostic Tool for Valley Fever Infection Through the Isolation and Identification of *Coccidioides* Proteins Detectable in Blood Plasma. 58th Annual Coccidioidomycosis Study Group Meeting in Phoenix, AZ April 5, 2014.
16. Thomas, J., B. F. G. Pycke, **R. U. Halden**, M. Dalloul, O. Abulafia, and L. A. Geer. Maternal Exposure to Endocrine Disrupting Compounds from Consumer Products: Comparison of Levels in a Caribbean Immigrant Population in Brooklyn, NY to National and Global Levels. Brooklyn, NY, April 2, 2014.
17. Venkatesan, A, and **R. U. Halden**. National Sewage Sludge Repository at Arizona State University: A Chemical Observatory to Identify and Prioritize Chemicals of Concern to Environmental and Human Health. WATERCON IWEA 2014 Joint Conference and Expo, Springfield, IL, March 17-20, 2014.
18. Supowit, S. D, V. D. Dang, I.B. Roll, K. J. Kroll, N. D. Denslow, and **R. U. Halden**. Sampling for Bioavailability Using Solid Phase Extraction - the In Situ Sampler for Bioavailability (IS2B). 2014 Arizona State University Civil and Environmental Engineering Graduate Student Poster Symposium, Tempe, AZ. March 6, 2014.

19. Charles, M. N. C., A. Delgado, D. Fajardo-Williams, B. F. G. Pycke, R. Krajmalnik-Brown, G. Elliott, K. Wolf and **R. U. Halden**. Investigating the use of the “*In Situ* Microcosm Array” (ISMA) technology for site-specific remediation of dissolved chlorinated solvents in groundwater. 2014 Arizona State University Civil and Environmental Engineering Graduate Student Poster Symposium, Tempe, AZ. March 6, 2014.
20. Venkatesan, A, and **R. U. Halden**. National Biosolids Repository: A New Research Tool to Identify, Prioritize and Predict Environmental and Human Health Implications of Man-made Chemicals. 2014 AZ Water Research Workshop, Phoenix, AZ. January 15, 2014. (Winner of 2nd Prize in Poster Competition).
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22. Geer, L. A., B. F. G. Pycke, and **R. U. Halden**. Analysis of Maternal Urine, Amniotic Fluid and Cord Blood for Exploring Fetal Exposure to Endocrine Disrupting Compounds and Potentially Associated Adverse Health Outcomes. SETAC North America 34th Annual Meeting, Nashville, TN, November 17-21, 2013.
23. Supowit, S., V. D. Dang, K. J. Kroll, N. D. Denslow and **R. U. Halden**. Active sampling for bioavailability using solid phase extraction as a surrogate for body burden - the *in situ* sampler for bioavailability assessment (IS2B). SETAC North America 34th Annual Meeting, Nashville, TN, November 17-21, 2013.
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27. Supowit, S., V. D. Dang, K. J. Kroll, N. D. Denslow and **R. U. Halden**. Assessing Contaminant Bioavailability Using the *In Situ* Sampler for Bioavailability (IS2B). Annual Meeting of the Superfund Research Program, Baton Rouge, LA, October 15 - 17, 2013.
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29. Venkatesan, A. and **R. U. Halden**. Mass Flows of Contaminants of Emerging Concern in U.S. Biosolids and Chemical Fate in Outdoor Soil Mesocosms. 15th International Conference of the Pacific Basin Consortium; Honolulu, Hawaii, September 24-27, 2013.
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31. K. McClellan, T. Kalinowski, **R. U. Halden**. “*In Situ* Microcosm Array – A New Tool for Remedial Design”. AquaConSoil, Barcelona, Spain, April 16-19 2013.
32. Kalinowski, T, I. Bennett and R. U. Halden. Facilitating Mutual Understanding Among Diverse Stakeholders Through Participatory Assessment Of An Emerging Technology. DuPont Summit on Science, Technology and Environmental Policy, Washington, DC, December 2012.
33. McClellan, K., T. Kalinowski, T. A. Bruton, I. B. Roll, **R. U. Halden**. Bringing The Lab To The Field - The *In Situ* Microcosm Array. DECHEMA International Environmental Remediation Symposium. Frankfurt am Main, Germany, November 26-27, 2012.

34. North, E. J. and **R. U. Halden**. Exploring Opportunities and Obstacles in Society's Transition to Environmentally Sustainable Plastics / Plastics and Environmental Health: The Road Ahead. SETAC North America 33rd Annual Meeting, Long Beach, CA, November 11 – 15, 2012.
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39. Geer, L. A., B. F. G. Pycke, M. Dalloul, O. Abulafia, and **R.U. Halden**. Maternal Exposure to Environmental Aromatic Compounds from Consumer Products. 22nd Annual Meeting of the International Society of Exposure Science, Seattle, WA, October 28-November 1, 2012.
40. Supowit, S.D., I. B. Roll, V. D. Dang, K. J. Kroll, N. D. Denslow, and **R.U. Halden**. Sampling for Bioavailability Using Solid Phase Extraction – the In Situ Sampler for Bioavailability (IS2B). 25th Annual Meeting of the Superfund Research Program, Raleigh, NC, October 21-24, 2012.
41. Lee, H., E. W. Wells, J. I. Feinberg, S. Brown, R. A. Irizarry, J. Herbstman, F. R. Witter, **R. U. Halden**, L. R. Goldman, A. P. Feinberg, and M. D. Fallin. Genome-wide Association Between DNA Methylation and Neonatal Heavy Metal Exposures During Pregnancy. Annual ECHO Conference, Baltimore, October 2012.
42. Kalinowski, T, K. McClellan, K., T. A. Bruton, I. B. Roll, and **R. U. Halden**. Assessing the Predictive Performance of the In Situ Microcosm Array. 25th Annual Meeting of the Superfund Research Program, Raleigh, NC, October 21-24, 2012.
43. Roll, I. B., S. D. Supowit, and **R. U. Halden**. Performance Data for a System for In Situ Sample Preparation, the In Situ Sampler (IS2). 25th Annual Meeting of the Superfund Research Program, Raleigh, NC, October 21-24, 2012.
44. Charles, M., K. McClellan, T. Kalinowski, B. F. G. Pycke, D. W. Kang, R. Krajmalnik-Brown, and **R. U. Halden**. Effects of Nutrient Delivery Mode on the Composition of Microbial Communities Relevant to Bioremediation Using the "In Situ Microcosm Array" (ISMA). 25th Annual Meeting of the Superfund Research Program, Raleigh, NC, October 21-24, 2012.
45. Kalinowski, T., K. McClellan, T. A Bruton, I. B. Roll, S. Supowit and **R. U. Halden**. Introducing the In Situ Microcosm Array: A New Tool for Evaluating In Situ Remediation technologies In Situ. Motorola 52nd St. Superfund Site Community Information Meeting, Sonoran Science Academy, Phoenix, AZ, October 2012.
46. Kalinowski, R. Rushforth, F. Rider, **R. U. Halden**, and A. Wiek. Motorola 52nd St. Community Workshop on Emerging Remediation Technology: In Situ Microcosm Array. Gateway Community College, Phoenix, AZ, August 2012.
47. Love, D. K., **R.U. Halden**, M. Davis and K. Nachmann. Are Animal Feed Ingredients Contributing to Antimicrobial Resistance? Feather Meal Contains Multiple Antimicrobials, and Enrofloxacin at Levels that Inhibit Susceptible E. coli 22nd Annual Meeting of the American Society for Microbiology (ASM) San Francisco, June 19-22, 2012.
48. Kalinowski, T., K. McClellan, T. A. Bruton, I. B. Roll, R. Krajmalnik-Brown and **R. U. Halden**. Bioremediation of TCE and Hexavalent Chromium: Comparing Bench-Scale Treatability Studies to the In Situ Microcosm Array. Battelle's 8th International Conference on Remediation of Chlorinated and Recalcitrant Compounds, Monterey, CA, May 2012.

49. Kalinowski, T., K. McClellan, T. A. Bruton, and **R.U. Halden**. In Situ Microcosm Array: A Novel Tool for Conducting Treatability Studies In Situ. 22nd Annual International Conference on Soil, Water, Energy, and Air and AEHS Foundation Annual Meeting, San Diego, California, March 19-22, 2012.
50. Kalinowski, T., K. McClellan, T. A. Bruton, I. B. Roll, R. U. Halden. "In Situ Microcosm Array (ISMA) Vs. Standard Laboratory Assessment Of Candidate Remediation Technologies – A Trichloroethylene And Hexavalent Chromium Case Study" ACS National Meeting, San Diego, CA, March 29-29, 2012.
51. Bruton, T. A., K. McClellan, T. Kalinowski, I. B. Roll, R. U. Halden. "Use of the *In Situ* Microcosm Array for Predicting the Effectiveness of Persulfate ISCO for the Treatment of Trichloroethene" ACS National Meeting, San Diego, CA, March 29-29, 2012
52. McClellan, K., T. Kalinowski, T. A. Bruton, I. B. Roll, R. U. Halden. "Bringing the Lab to the Field - The *In Situ* Microcosm Array" ACS National Meeting, San Diego, CA, March 29-29, 2012
53. McClellan, K., Kalinowski, T., K., T. A. Bruton, and **R.U. Halden**. Lowering the Barrier for Novel *In Situ* Remediation Approaches - the *In Situ* Microcosm Array. 22nd Annual International Conference on Soil, Water, Energy, and Air and AEHS Foundation Annual Meeting, San Diego, California, March 19-22, 2012.
54. Venkatesan, A. K., and **R. U. Halden**. Nationwide Occurrence in Biosolids of Alkylphenol Ethoxylate Compounds and Their Fate in Soil Amended With Biosolids. 2012 Summer Specialty Conference: Contaminants of Emerging Concern, Denver, CO, June 25 -27, 2012.
55. Venkatesan, A.K., B.F.G. Pycke, T-C Chao, and **R. U. Halden**. Occurrence of triclosan, triclocarban, and their transformation products in sediments up- and downstream of U.S. wastewater treatment plants. Industrial Wastewater Seminar 2011. Atlantic City, NJ, USA. May 10, 2011.
56. Gray, E.P., Bruton, T.A., Higgins, C.P., **Halden, R.U.**, Westerhoff, P., Ranville, J.F. Comparison of Two Nanoparticle Separation Techniques, Asymmetrical Field Flow Fractionation and Hydrodynamic Chromatography Using Gold Particles, 32nd Annual SETAC North America Meeting, Boston, MA, November 13-17, 2011.
57. **Halden, R. U.**, A. K. Venkatesan and N. Hansmeier. Mixtures of Manmade Hazardous Compounds in the Anthroposphere and in Humans. International Toxicology of Mixtures Conference, Arlington, VA, October 21-23, 2011.
58. McClellan, K., T. Kalinowski, T. A. Bruton, I. B. Roll, and **R.U. Halden**. In Situ Microcosm Array (ISMA) vs. Standard Laboratory Assessment of Candidate Remediation Technologies – A Perchlorate Case Study Annual Symposium of the NIEHS Superfund Program, October 23-26, 2011, Lexington, KY.
59. Kalinowski, T., K. McClellan, T. A. Bruton, I. B. Roll, R. Krajmalnik-Brown and **R.U. Halden**. Evaluating Bioremediation of TCE and Hexavalent Chromium: A Case Study of the *In Situ* Microcosm Array (ISMA). Annual Symposium of the NIEHS Superfund Program, October 23-26, 2011, Lexington, KY.
60. Kalinowski, T., K. McClellan, T. A. Bruton, I. B. Roll and **R.U. Halden**. *In Situ* Microcosm Array (ISMA): A Novel Device for Conducting Treatability Studies. Geological Society of America Annual Meeting, October 9-12, 2011, Minneapolis, MN.
61. McClellan, T. Kalinowski, K. T. A. Bruton, I. B. Roll and **R.U. Halden**. *In Situ* Microcosm Array (ISMA) vs. Standard Laboratory Assessment of Candidate Remediation Technologies – A Perchlorate Case Study. Geological Society of America Annual Meeting, October 9-12, 2011, Minneapolis, MN.
62. Bruton, T. A., K. McClellan, T. Kalinowski, I. B. Roll and **R.U. Halden**. Field Application of the In Situ Microcosm Array. Groundwater Resources Association of California (GRAC) conference, October 5, 2011, Sacramento, CA.

63. **Halden, R. U.** Biosolids: A Diagnostic Matrix Foretelling Exposures in the Anthroposphere. 3rd International Conference on Occurrence, Fate, Effects, and Analysis of Emerging Contaminants in the Environment, Copenhagen, Denmark, August 23-26, 2011.
64. Hartmann, E. M., M. L. Fisher, and **R. U. Halden.** Site-Directed Mutagenesis of the Dioxin Dioxygenase to Improve Activity Towards 2,3,7,8-Tetrachloro-Dibenzo-*p*-Dioxin. National Science Foundation East Asia and Pacific Summer Institute, Toyama, Japan, August 2011.
65. Miller, T. R., D. R. Colquhoun and **R. U. Halden.** Analysis of Wastewater Bacteria-Degrading Triclocarban. International Symposium on Bioremediation and Sustainable Environmental Technologies, Battelle Conference, Reno, NV. June 27 – 30, 2011.
66. Ziv-El, M., S. Popat, K. Cai, **R. U. Halden,** R. Krajmalnik-Brown and B. E. Rittmann. Optimization of the Membrane Biofilm Reactor for Biological Reduction of Trichloroethylene. International Symposium on Bioremediation and Sustainable Environmental Technologies, Battelle Conference, Reno, NV. June 27 – 30, 2011.
67. Hartmann, E. M. and **R. U. Halden.** Use of AQUA and MALDI-TOF/TOF MS to Quantify a Dioxin-Degrading Enzyme. Science Foundation Arizona Grand Challenges Conference, Flagstaff, AZ. May 22 - 24, 2011.
68. Delgado, A. G., M. Ziv-El, **R. U. Halden,** and R. Krajmalnik-Brown. Microbial Trichloroethene Dechlorination by a Novel Enriched Consortium. Science Foundation Arizona Grand Challenges Conference, Flagstaff, AZ. May 22 - 24, 2011.
69. Pycke, B. F. G., T.-C. Chao, T. M. Benn, R. Scholze, P. Herckes, **R. U. Halden,** and P. Westerhoff. 2011. Mass spectrometry-based detection of aqueous and oxidized fullerenes in biological and environmental samples. Nanotechnology GO Meeting, NIEHS, Bethesda, MD, March 4-5, 2011.
70. Wells, E. M., J. Jarrett, C. Verdon, C. D. Ward, K. Caldwell, F. R. Witter, **R. U. Halden,** L. R. and Goldman. Umbilical Cord Blood Methyl and Inorganic Mercury Concentrations and Their Relationship With Ponderal Index. 2011 International Conference on Mercury as a Global Pollutant. Halifax, Nova Scotia, July 24-29, 2011.
71. Seager, T., M. Fraser, M. Holl and **R. U. Halden.** The SUMMIT Approach to Sustainability in Superfund Research Translation. International Conference on Sustainable Remediation. Amherst, MA, June 1-3, 2011.
72. Venkatesan, A. K., B. Pycke, T.-C. Chao and **R. U. Halden.** Occurrence of Triclosan, Triclocarban, and Their Transformation Products in Sediments Up and Downstream of U.S. Wastewater Treatment Plants. Water Environment Federation: Industrial Wastewater Conference. Bally's Hotel, Atlantic City, New Jersey, May 9-10, 2011.
73. Doudrick, K, A. K. Venkatesan, E. M. Hartmann, T. Kalinowski and **R. U. Halden.** Assessment of the Contribution of Triclosan to Dioxin Emissions from Sludge Incineration in the U.S. Using a Mathematical Model. Water Environment Federation: Industrial Wastewater Conference. Bally's Hotel, Atlantic City, New Jersey, May 9-10, 2011.
74. Hartmann, E. M. and **R. U. Halden.** Use of AQUA and MALDI-TOF/TOF MS to Quantify a Dioxin-Degrading Enzyme. 23rd Annual Sanibel Conference on Mass Spectrometry, American Society for Mass Spectrometry (ASMS), St. Pete Beach, FL, January 21-24, 2011.
75. McClellan, K., T. A. Bruton, T. Kalinowski, and **R. U. Halden.** Use of the "In Situ Microcosm Array"(ISMA) Technology for Evaluation of 1,4-Dioxane and Trichloroethene Co-Remediation. Partners in Environmental Technology Technical Symposium & Workshop, Washington, D.C., November 30 - December 2, 2010.
76. Bruton, T. A., K. McClellan, T. Kalinowski, and **R. U. Halden.** Development of Online Sensing Capability for the In Situ Microcosm Array (ISMA) Technology. Partners in Environmental Technology Technical Symposium & Workshop, Washington, D.C., November 30 - December 2, 2010.

77. Roll, I. and **R. U. Halden**. Rationale and Theory for a New In Situ Sampling Device. Partners in Environmental Technology Technical Symposium & Workshop, Washington, D.C., November 30 - December 2, 2010.
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79. **R. U. Halden**, K. McClellan, T. Kalinowski, T. A. Bruton, T. R. Miller, E. M. Hartmann, D. R. Colquhoun, T.-C. Chao, N. Hansmeier, R. P. Deo, A. Sapkota, T. E. A. Chalew, T. A. Young, C. R. Matos-Pérez, E. Walters, R. N. Cole, F. R. Witter and L. R. Goldman. Novel Approaches to Studying the In Situ Bioremediation Potential of Complex Mixtures. Annual Conference of the NIEHS Superfund Program, Portland, OR, November 10 - 12, 2010.
80. McClellan, K., T. Kalinowski, T. A. Bruton, and **R. U. Halden**. Field Application of the *In Situ* Microcosm Array. Annual Conference of the NIEHS Superfund Program, Portland, OR, November 10 - 12, 2010.
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82. Lee, H.-S., A. G. Delgado, C. I. Torres, **R. U. Halden**, B. E. Rittmann and R. Krajmalnik-Brown. Anaerobic Dechlorination of Trichloroethene with Hydrogen Produced from a Microbial Electrolysis Cell. Leading Edge Technologies Conference, Phoenix, AZ, June 1, 2010.
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84. Ziv-El, M. A. Delgado, **R. U. Halden**, and R. Krajmalnik-Brown. 2010. Molecular-biological characterization of a novel, sediment-free mixed culture showing exceptionally rapid dechlorination of TCE to ethane. 13th International Symposium on Microbial Ecology (ISME), Seattle, WA, August 22–27, 2010.
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100. McClellan, K., T. Kalinowski and **R. U. Halden**. ESTCP Project 200914: A New Technology for Remedial Design. Annual Technical Symposium & Workshop hosted by the Strategic Environmental Research and Development Program (SERDP) and the Environmental Security Technology Certification Program (ESTCP), Washington, DC, December 1-3, 2009.
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102. Guerrero-Preston, R., C. LeBron, J. B. Herbstman, **R. U. Halden**, D. Sidransky, and L. Goldman. Global DNA Hypomethylation in Cord Blood Serum of Babies Exposed to Maternal Smoking *In Utero*. 137th APHA Annual Meeting & Exposition, San Antonio, TX, November 7-11, 2009.
103. T. Kalinowski, McClellan, K., and **R. U. Halden**. Novel Approaches to Studying the In Situ Bioremediation Potential of Complex Mixtures. Superfund Research Program 2009 Annual Conference, Columbia University, New York, NY, November 3, 2009.
104. **R. U. Halden**. *In Situ* Downhole Technology for Commercialization. First ASU Spartan Workshop for Technology Commercialization, Scottsdale, AZ, September 19, 2009.
105. **R. U. Halden**. Toward Sustainable Chemistry and Engineering. ASU School of Sustainability and the Built Environment, Student Organization, Invited Seminar, Tempe, AZ, September 4, 2009.
106. Walters, E. K. McClellan and **R. U. Halden**. Fate of Pharmaceuticals and Personal Care Products in Agricultural Soils Modified With Biosolids. 238th American Chemical Society (ACS) National Meeting, Washington, DC, August 16-20, 2009.

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114. Doom, T. R. and **Halden, R. U.**: BME Capstone Design Project Presentation. Tempe, May 1, 2009.
115. Doom, T. R. and **Halden, R. U.**: In Situ Remediation of Contaminated Subsurface Environments: Assessing Industry Needs for Technical Innovations. 19th Annual AEHS Meeting and West Coast Conference on Soils, Sediments, and Water. San Diego, CA, March 10, 2009.
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- Levels. 19th Annual Conference of the International Society for Environmental Epidemiology, Mexico City, Mexico, September 5–7, 2007.
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 125. Heidler, J., and **R. U. Halden**. Behavior of Persistent Biocides During Wastewater Treatment: Mass Balances and Meta Analysis. American Water Resources Association (AWRA) Summer Specialty Conference on "Emerging Contaminants of Concern in the Environment," Vail, Colorado, June 25–27, 2007.
 126. Heidler, J., and **Halden, R. U.** Detection of Persistent Biocides in Sewage Sludge and Human Blood Using LC-ESI-MS and LC-ESI-MS/MS. 55th ASMS Conference on Mass Spectrometry, Indianapolis, IN, June 3–7, 2007.
 127. Colquhoun, D. R. and **R. U. Halden**. Comparative Proteomic Analysis of Cells of the Dioxin Degrading Bacterium *Sphingomonas wittichii* RW1 Grown on Various Substrates. 107th ASM General Meeting, Toronto, Ontario, Canada, May 21–25, 2007.
 128. Miller, T. R., Salzberg, S. L., Eisen, J. A., and **R. U. Halden**. Comparative Sequence Analysis of Catabolic Megaplastids from *Sphingomonas wittichii* RW1 and Related Bioremediation Agents. 107th ASM General Meeting, Toronto, Ontario, Canada, May 21–25, 2007.
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 131. Goldman, L. R., B. J. Apelberg, J. B. Herbstman, **R. U. Halden**, F. R. Witter, A. M. Calafat, Z. Kuklenyik, L. L. Needham. Possible Etiologies of PFAA-Induced Developmental Effects: Reflections from a Pediatric Perspective. Society of Toxicology Conference: Current Concepts in Toxicology—Perfluorinated Alkyl Acids and Related Chemistries: Toxicokinetics and Mode-of-Action Workshop. Arlington, VA, February 14–16, 2007.
 132. **Halden, R. U.**, and T. R. Miller. In Situ Microcosm Array Technology for Remedial Feasibility Assessment and Design. Partnership in Environmental Technology Technical Symposium & Workshop (ESTCP/SERDP), Washington, D.C., November 28–30, 2006.
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 136. Colquhoun, D. R., T. R. Miller, E. M. Hartmann, and **R. U. Halden**. Rapid Characterization of Pollutant Degrading Bacteria Using Matrix Assisted Laser Desorption Ionization—Time of Flight Mass Spectrometry. 106th General Meeting of the American Society for Microbiology, Orlando, FL, May 21–25, 2006.

137. **Halden, R. U.**, and T. R. Miller. Novel Diagnostic In Situ Monitoring Technology. BIO 2006. Annual International Convention. Environmental Biotechnology Session. Chicago, IL, April 9–12, 2006.
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140. Colquhoun, D. R. and **Halden, R. U.**: Phenotypic Characterization of a Dioxin-degrading Bacterium Using MALDI-TOF MS. American Society for Mass Spectrometry, Fall Workshop on Characterization of Microorganisms by Mass Spectrometry, San Diego, CA, December 9, 2005.
141. **Halden, R. U.**: Effect of Lifestyle on Mother/Infant Exposure to Ubiquitous Pollutants. CLF Research Day: Insights Along the Path of Sustainability, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, November 30, 2005.
142. **Halden, R. U.**, A. Sapkota, J. Heidler, J. Keehner, N. Haws, and B. G. Halden: Municipal Sludge Disposal and Sustainable Agriculture: A Pilot Study Showcasing the Challenge of Combining the Two. CLF Research Day: Insights Along the Path of Sustainability, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, November 30, 2005.
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144. Miller, T. R. and **Halden, R. U.**: Enrichment of Xenobiotic-Degrading Bacteria Using a New In Situ Monitoring Device. SETAC 26th Annual Meeting in North America, Baltimore, MD, November 17, 2005. <http://abstracts.co.allenpress.com/pweb/setac2005/document/?ID=56786>
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147. Herbstman, J., A. Sjodin, D. Patterson, B. Apelberg, F. Witter, **R. U. Halden**, J. Heidler, L. Needham, and L. Goldman: PCBs and PBDEs and Thyroid Hormone Levels in Umbilical Cord Blood in an Urban U.S. Population: A Feasibility Study. Dioxin 2005, Toronto, Canada, August 21-26, 2005.
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149. **Halden, R. U.**: Pharmaceuticals and Personal Care Products in Biosolids. New Jersey Water Environment Association Annual Conference, Tropicana Hotel, Atlantic City, NJ, May 4, 2005.
150. **Halden, R. U.**: Pharmaceuticals and Personal Care Products as Indicators of Sewage Spills. Maryland Water Monitoring Council 10th Annual Conference, Linthicum, MD, November 18, 2004. <http://www.mgs.md.gov/mwmc/conf/2004/>
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158. Paull, D.H., and **R. U. Halden**: Monitoring Antimicrobial Compounds as Indicators of Sewerage Problems Impacting Urban Streams. Maryland Water Monitoring Council 9th Annual Conference: Ecological Restoration Assessment and Monitoring, Linthicum, MD, 2003. <http://www.mgs.md.gov/mwmc/conf/abspost03.html#paull>
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<http://www.asmtusa.org/memonly/abstracts/AbstractView.asp?AbstractID=49632>
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183. **Halden, R. U.**: A Kinetic Analysis of Dioxin Degradation in Bioaugmented Soils. 5th Environmental Science & Engineering Conference, Minneapolis, MN, 1997.

184. **Halden, R. U.**, and D. F. Dwyer: Biotransformation of Dioxin-Related Compounds Via Angular Dioxygenation: Bacterial Strains, Degradative Pathways and Their Potential Use for Bioremediation. 3rd International ISEB Symposium, Boston, MA, 1996.
185. **Halden, R. U.**, and D. F. Dwyer: Small Inocula Can Effect In Situ Biodegradation of Carboxydiphenyl Ether in Soil. Proceedings of the North Amer. Water & Environment Congress, ASCE, Somerset, NJ, 1996.
186. **Halden, R. U.**, and D. F. Dwyer: Colonization of Soil by Low Numbers of a Bacterium Constructed to Degrade Dioxin-Related Pollutants. 96th General ASM Meeting, New Orleans, LA, 1996.
187. Raatz, W. A., K. Anderson, **R. U. Halden**, and D. F. Dwyer: Bioremediation of Aquifers Using Introduced Bacteria. 96th General ASM Meeting, New Orleans, LA, 1996.
188. **Halden, R. U.:** Detection and Environmental Fate of Bacteria Able to Degrade Dioxin-Related Compounds. 4th Annual Environmental Science & Engineering Conference, St. Paul, MN. 1996.
189. **Halden, R. U.**, G. W. Mundfrom, E. G. Peters, and D. F. Dwyer: Detection and Environmental Fate of Bacteria Able to Degrade Dioxin-Related Compounds," 55th Annual ASM North Central Branch Meeting, Iowa City, IA, 1995.
190. **Halden, R. U.**, G. W. Mundfrom, E. G. Peters, and D. F. Dwyer: In Situ Bioremediation: Tracking Introduced Diaryl Ether-Degrading Bacteria In Soil. National ASCE Environmental Engineering Conference, Pittsburgh, PA, 1995.
191. **Halden, R. U.**, G. W. Mundfrom, E. G. Peters, and D. F. Dwyer: Bioaugmentation: Monitoring Diaryl Ether-Degrading Bacteria Introduced Into Contaminated Environments Using Molecular-Genetic Methods. 3rd International Bioreclamation Symposium, San Diego, CA, 1995.
192. **Halden, R. U.:** In Situ Biodegradation of Diaryl Ether Compounds in Soil and Sediment. 3rd Annual Environmental Science & Engineering Conference, Minneapolis, MN, 1995.

PUBLICATIONS

Invited Keynotes, Invited Presentations, Invited Webinars, Invited Expert Panel Member & Conference Session Moderation

1. **Halden, R. U.** Analytical Methods for Detecting and Prioritizing Contaminants of Concern. ACS-Invited Symposium Chair. 248th ACS National Meeting & Exposition San Francisco, CA, August 10-14, 2014.
2. **Halden, R. U.** Invited Keynote Address: Sewage Epidemiology - Taking the Chemical Pulse of a Nation at the Sewer. AZ Engineers Club of the West Valley: Sun City West, AZ. March, 7, 2014.
3. **Halden, R. U.** Invited Talk: Sewage Metrology - Taking the Chemical Pulse of our Nation at the Sewer. Johns Hopkins University, School of Public Health. April 24, 2014.
4. **Halden, R. U.** Invited Talk and Nationally Broadcasted Webinar: Chemical Composition of U.S. Sewage Sludges Informed by Analysis of EPA-Collected Biosolids Samples from Across the United States. United States Environmental Protection Agency Headquarter, Washington, DC, April 22, 2014.
5. **Halden, R. U.** Invited Talk and Nationally Broadcasted Webinar: Update on Antimicrobials in the U.S. Environment. United States Food and Drug Administration, Headquarter, Washington, DC, April 22, 2014.
6. **Halden, R. U.** Invited Talk, Panel Member, and Panel Moderator: Potential Human Health Risks of Microplastics. U.S. National Academies, Washington, DC, April 23, 2014.
7. **Halden, R. U.** Fate, Transport, and Toxicity of Wastewater-borne Contaminants by Example of Widely Used Persistent Antimicrobials. SETAC North America 34th Annual Meeting, Nashville, TN, November 17-21, 2013.
8. **Halden, R. U.** Environmental Fate and Human Health Risks of Contaminants of Emerging Concern in the U.S. Environment. Invited Seminar. Distinguished Lecture Series. Simulcast and Taped. <http://icsde.ifas.ufl.edu/Accordent/live/Haden05-21-13/> University of Florida, Gainesville, FL, May 21, 2013.
9. **Halden, R. U.**, K. McClellan and T. Kalinowski. *In Situ* Microcosm Array – A New Decision-Making and Design Tool for In Situ Remediation. Invited Webinar. Technical Practices Network – In Situ Bioremediation Group, AECOM. Presented Online. December 11, 2012.
10. **Halden, R. U.**, S. D. Supowit, I. A. Roll, V. D. Dang, K. J. Kroll and N. D. Denslow. Addressing Risk Assessment Needs for Traditional and Emerging Contaminants Using the Innovative In Situ Sampling/Bioavailability (IS2B) Device. SETAC North America 33rd Annual Meeting, Long Beach, CA, November 11 – 15, 2012. (Invited talk).
11. **Halden, R. U.** Antimicrobials, Antimicrobial Resistance and New Risk Assessment Tools. SETAC North America 33rd Annual Meeting, Long Beach, CA, November 11 – 15, 2012.
12. **Halden, R. U.** Understanding and Minimizing the Health Risks of Plastics. SETAC North America 33rd Annual Meeting, Long Beach, CA, November 11 – 15, 2012.
13. Kalinowski T., K. McClellan and **R. U. Halden**. An Emerging Remediation Technology: The *In Situ* Microcosm Array. Community Informational Group meeting for the Motorola 52nd St. Superfund Site community hosted by the EPA. Sonoran Science Academy-Phoenix K-12 School. Oct. 24, 2012. (Invited talk).
14. **Halden, R. U.**, K. McClellan and T. Kalinowski. *In Situ* Microcosm Array – A New Decision-Making and Design Tool for In Situ Remediation. Invited Interactive Webinar. Remedial Design (In-Situ) Network. Presented Online. September 19, 2012.
15. **Halden, R. U.** and N. Denslow. *In Situ* Sampling Tool for Assessing Bioavailability and Toxicity of Sediments. Invited Webinar Presented Online on May 7, 2012. <http://www.clu-in.org/conf/tio/srpfunding/>

16. **Halden, R. U.**, K. McClellan and T. Kalinowski. *In Situ* Microcosm Array – A New Decision-Making and Design Tool for In Situ Remediation. Invited EPA Clu-in Webinar. Presented Online. August 15, 2012. <http://www.clu-in.org/conf/tio/isma/>
17. **Halden, R. U.** Invited Member of 5-Expert Panel Discussion. *Feed 8 Billion*. Arizona State University, Tempe Campus, AZ, February 2, 2012.
18. **Halden, R. U.** Invited Talk. Polluting While Cleaning: *How Personal Care Products Affect Environmental Quality and Human Health*. Polytechnic Campus, Arizona State University, Mesa, AZ, January 10, 2012.
19. Benny F.G. Pycke, L. A. Geer, A. K. Venkatesan, K. E. Lee, L. B. Barber, A. Crabbé, N. Leys, P. Monsieurs, M. Mergeay, G. Vanermen, H. De Wever, W. Verstraete, and **R. U. Halden**. Invited Talk. Antimicrobial Exposure Assessment From The Cradle To The Grave. *International Conference of the Flemish Centre of Expertise for Environment and Health*. Brussels, Belgium, December 21-22, 2011.
20. **Halden, R. U.** Invited Talk (Webcast). Sustainable Chemistry: Public Health at the Crossroads. Biomedical Informatics Symposium Series, Department of Biomedical Informatics, ASU Mayo Campus, Scottsdale, AZ, November 17, 2011.
21. **Halden, R. U.** Invited Talk. Novel Approaches to Assessing the *In Situ* Treatability and Health Impacts of Toxic Mixtures. Pacific Northwest National Laboratory (PNNL), Richland, WA, November 14, 2011.
22. **Halden, R. U.**, K. McClellan, T. Kalinowski, T. A. Bruton, E. M. Hartmann, T. R. Miller, M. Ziv-El, A. Delgado, D. R. Colquhoun, T.-C. Chao, N. Hansmeier, R. P. Deo, J. Heidler, J. B. Herbstman, B. J. Apelberg, E. M. Wells, G. Neta, F. R. Witter, L. R. Goldman, and R. Krajmalnik-Brown. Novel Approaches to Understanding and Managing Complex Mixtures. Annual Conference of the NIEHS Superfund Program, Lexington, KY, October 23 – 26, 2011.
23. **Halden, R. U.** Invited Talk: Overuse of Antimicrobial Household Products: Environmental and Human Health Effects. American Public Health Association (APHA) Annual Meeting, Washington, DC, October 31, 2011.
24. **Halden, R. U.** Invited Panel Member: Beyond the Hospital: Antibiotic Resistance as a Problem of the Community Environment. American Public Health Association (APHA) Annual Meeting, Washington, DC, October 31, 2011.
25. **Halden, R. U.** Invited Talk: Biosolids: A Diagnostic Matrix Foretelling Exposures in the Anthroposphere. Institute for Food Toxicology and Analytical Chemistry, University of Veterinary Medicine, Hanover, Germany, August 29, 2011.
26. **Halden, R. U.** Invited Talk: Antimicrobial Agents and Sustainable Chemistry, *Science Cafe* Series, hosted by the Center for Nanotechnology in Society, Phoenix, AZ, May 20, 2011.
27. **Halden, R. U.** Invited Talk: Public Health Engineering: From Problem Recognition to Regulation. Presented to the IGERT Program at the University of Minnesota, Minneapolis, MN, May 5, 2011.
28. **Halden, R. U.** Invited Talk: In Situ Microcosm Array and In Situ Sampling Technologies for Technology Transfer. ASU Biodesign Institute, April 21, 2011.
29. **Halden, R. U.** Invited Talk: Sustainable Chemistry & Human Health in the 21st Century. U.S. EPA Emerging Chemicals Workgroup. Presented on April 6, 2011.
30. **Halden, R. U.** Invited Talk at Leroy E. Burney Lecturer Series: Sustainable Chemistry and Human Health in the 21st Century, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, March 7, 2011.
31. **Halden, R. U.** Invited Talk at the U.S. Congress: Environmental Health Risks of Triclosan. Capitol Hill Congressional Briefing Room, Washington, DC, February 17, 2011.
32. **Halden, R. U.** and T. Jones-Lepp. Invited Session Chairs: Contaminants of Emerging Concern in the Natural and Built Environment. 241st American Chemical Society National Meeting & Exposition, Anaheim, California, March 27-31, 2011.
33. **Halden, R. U.** Invited Talk: In Situ Microcosm Array Technology and the SUMMIT Center. Arizona Department of the Environment, Phoenix, AZ, January 31, 2011.

34. **Halden, R. U.** Invited Talk: Sustainable Chemistry and Human Health, *The Wiseguise Seminar Series*, Scottsdale, AZ, November 19, 2010.
35. **Halden, R. U.** Invited Chalk Talk. Sustainable Chemistry for the 21st Century and Beyond. Center for Biological Physics Seminar Series, Arizona State University, Tempe, AZ, October 26, 2010.
36. **Halden, R. U.** Invited Presentation. Antimicrobial Personal Care Products: Are They Good for Us? Science Salon. Spirit of the Senses Seminar Series. Biodesign Institute, Arizona State University, Tempe, AZ, September 30, 2010.
37. **Halden, R. U.** Invited Presentation. The SUMMIT Project. CHiR-Arizona HealthQuery Stakeholder Meeting, ASU Biomedical Campus, Phoenix, AZ, September 20, 2010.
38. **Halden, R. U.:** Invited Seminar. Examining the Sustainability of Persistent Antimicrobial Compounds. Department of Chemical and Environmental Engineering, University of Arizona, Tucson, AZ, April 20, 2010.
39. **Halden, R. U.:** Parallel *In Situ* Screening of Remediation Strategies for Improved Decision Making, Remedial Design, and Cost Savings. Department of Defense, ESTCP Program, Arlington, VA, February 10, 2010.
40. **Halden, R. U.:** Chemicals of Emerging Concern in the U.S. Environment. American Chemical Society Meeting, Las Vegas, November 10, 2009.
41. **Halden, R. U.:** Wastewater Treatment Plants as Chemical Observatories of Persistent and Problematic Contaminants in the Environment. 238th American Chemical Society (ACS) National Meeting, Washington, DC, August 16-20, 2009.
42. **Halden, R. U.** and J. Katz: Occurrence, Fate, and Impact of Triclosan and Other Antimicrobials to Wastewater Treatment Utilities. Microconstituents and Industrial Water Quality, Water Environment Federation (WEF), Baltimore, MD, July 26-29, 2009.
43. **Halden, R. U.:** Invited Panel Member. "Superfund Contaminants: The Next Generation." Invitation-only Special Symposium Tucson, AZ, August 12-14, 2009.
44. **Halden, R. U.:** Invited Speaker. "State of the Science – Antimicrobial Resistance." FDA Discussion: the Problem of Triclosan, Food and Drug Administration, Washington, D.C., July 13, 2009.
45. **Halden, R. U.:** Invited Speaker. "State of the Science – Environmental Fate & Persistence." FDA Discussion: the Problem of Triclosan, Food and Drug Administration, Washington, D.C., July 13, 2009.
46. **Halden, R. U.:** Toward Sustainable Chemistry and Engineering. Invited Seminar presented at the 1st Biological Design Graduate Program Symposium, Tempe, May 6, 2009.
47. Hartmann, E. and **R. U. Halden.** Invited presentation: "Challenges of Detecting Bioterrorism Agents in Complex Matrices." NATO ARW Workshop on "Detection of Biological Agents and Toxins for the Prevention of Bioterrorism in Homeland Security by Advanced Mass Spectrometric Methods," Spezzano Albanese Terme, Italy, June 26-July 2, 2009.
48. **Halden, R. U.:** Invited Speaker. High-throughput Diagnostic Screening and Proteomics in Bioremediation - Opportunities & Challenges. The 19th Annual AEHS Meeting and West Coast Conference on Soils, Sediments, and Water. San Diego, CA, March 10, 2009.
49. **Halden, R. U.:** Invited Speaker. What's in Our Water? National Research Council 6th Workshop of the Standing Committee on Risk Analysis Issues and Reviews. Characterizing the Potential Human Toxicity from Low Doses of Pharmaceuticals in Drinking Water: Are New Risk Assessment Methods or Approaches Required? The National Academies, Washington, D.C., December 11-12, 2008.
50. **Halden, R. U.** and B. Anderson: SBRP Technology Transfer: Statistics & Case Study. Annual Conference of the Superfund Basic Research Program (SBRP) of the National Institute of Environmental Health Sciences. Member of Steering Committee and Invited Speaker of Technology Transfer Session, Pacific Grove, CA, December 7-9, 2008.

51. **Halden, R. U.:** Pharmaceuticals and Personal Care Products in U.S. Water Resources. Invited Keynote at the 2008 Fall Meeting of the Interstate Technology & Regulatory Council (ITRC). Phoenix, AZ, October 21, 2008.
52. **Halden, R. U.:** Invited Panel Member. Antibiotic Resistance: New Approaches to an Old Problem. The American Academy of Microbiology. Invitation-Only International Symposium, Annecy, France, October 12-14, 2008.
53. **Halden, R. U.:** Invited Speaker and Session Chair. Environmental Fate of Antimicrobials: 50 years in 15 minutes. Pacific Southwest Organic Residuals Symposium 2008. Sacramento, October 1-2, 2008.
54. **Halden, R. U.:** Parallel *In Situ* Screening of Remediation Strategies for Improved Decision Making, Remedial Design, and Cost Savings. Department of Defense, ESTCP Program, Arlington, VA, September 16, 2008.
55. **Halden, R. U.:** Occurrence of and Exposure Routes to Triclosan and Triclocarban in the U.S. Environment. State University of New York, Downstate Medical Center, Department of Preventive Medicine and Community Health Seminar, August 28, 2008.
56. **Halden, R. U.:** Work Plan for Field Deployment of the *In Situ* Microcosm Array Technology, Lawrence Livermore National Laboratory, Livermore, CA, July 11, 2008.
57. **Halden, R. U.:** Exposure Sources of Triclosan and Triclocarban in the Environment. Invited Talk at the Food and Drug Administration, Washington, DC, February 27, 2008.
58. **Halden, R. U.:** Field Deployment of the *In Situ* Microcosm Array Technology, Lawrence Livermore National Laboratory, Livermore, CA, February 25, 2008.
59. **Halden, R. U.:** Innovative Technologies. Session Moderator and Planning Committee Member, 20th Anniversary Meeting of the Superfund Basic Research Program, Durham, NC, December 3, 2007.
60. **Halden, R. U.:** Findings from the Johns Hopkins Nationwide Study on the Fate of Pharmaceuticals and Personal Care Products in the Environment. U.S. EPA, Office of Science and Technology, November 28, 2007.
61. **Halden, R. U.:** Forensic Tools for Environmental Assessment and Remediation. University of Delaware, Newark, DE, Department of Civil and Environmental Engineering, October 19, 2007.
62. **Halden, R. U.:** Keynote Speaker. Emerging Knowledge on Emerging Contaminants. New England Interstate Water Pollution Control Commission's (NEIWPCC) 2007 Northeast Water Science Forum – Pharmaceuticals and Personal Care Products: State of the Science Conference, Portland, ME, August 8–9, 2007.
63. **Halden, R. U.:** Guest Speaker. Risks and Benefits of Using Persistent Antimicrobials in Public Health Practice. Public Health Practice Grand Rounds, Live Webcast, MidAtlantic Public Health Training Center (MAPHTC), Baltimore, MD, June 20, 2007.
64. **Halden, R. U.** and K. J. Schwab: Guest Speaker. Environmental Issues Related to Industrial Food Animal Production. National Commission on Industrial Farm Animal Production. Denver, CO, June 5, 2007.
65. **Halden, R. U.:** Keynote Speaker. Antimicrobial Pesticides as Environmental Pollutants. Beyond Pesticides 25th National Pesticide Forum: “*New Opportunities for Protecting Health and the Environment*,” Chicago, IL, June 2, 2007.
66. **Halden, R. U.:** Guest Speaker. Antimicrobial Pesticides in Aquatic Environments – Implications for the Great Lakes. Beyond Pesticides 25th National Pesticide Forum: “*New Opportunities for Protecting Health and the Environment*,” Chicago, IL, June 3, 2007.
67. **Halden, R. U.:** Guest Speaker. Rachel Carson Open House and Centennial Celebration: “U.S. Environmental Quality 45 Years after the Publication of *Silent Spring*,” Silver Spring, MD, May 19, 2007.
68. **Halden, R. U.:** Guest Speaker. USGS Symposium: Rachel Carson Centennial Celebration: “Considering the Microbial Loop in Wildlife Conservation,” USGS Patuxent Wildlife Research Center, Laurel, MD, May 18, 2007.

69. **Halden, R. U.:** Guest Speaker & Session Moderator. Antimicrobial Agents in the Chesapeake Bay Watershed. Pesticides in Chesapeake Waterways: Working Group Meeting, Reisterstown, MD, May 14, 2007.
70. **Halden, R. U.:** Guest Speaker. Emerging Contaminants in U.S. Surface Waters: Challenges and Potential Solutions. Potomac River Basin Drinking Water Source Protection Partnership's Mini-Workshop. Rockville, MD, May 7, 2007.
71. **Halden, R. U.:** Moderator of Film Screening and Invited Discussant. Lifecycle Analysis of Polyvinyl Chloride Products. Chesapeake Sustainable Business Alliance, Visionary Arts Museum, Baltimore, MD, March 19, 2007.
72. **Halden, R. U.:** Keynote Speaker. Antimicrobial Agents in the Environment and Human Exposure Assessment. Chesapeake Potomac Chapter of SETAC Winter Meeting, Washington, DC, February 22, 2007.
73. **Halden, R. U.:** Panel Chair and Keynote Speaker. Reducing Our Ecological Footprint. 10th Anniversary of the Johns Hopkins Center for a Livable Future – Charting A Course To Sustainability Through Research, Education And Service, Baltimore, MD, December 6, 2006.
74. **Halden, R. U.:** Overused Household Biocides Cause Nationwide Pollution. 10th Anniversary of the Johns Hopkins Center for a Livable Future – Charting A Course To Sustainability Through Research, Education And Service, Baltimore, MD, December 6, 2006.
75. **Halden, R. U.:** Persistent Antimicrobials as Emerging Endocrine Disrupting Chemicals in U.S. Water Resources, Biosolids and Sediments. Endocrine Disruptors – What We Know & What We Don't Know. Research Symposium of the Mid-Atlantic Regional Water Program, A Partnership of USDA CSREES & Land Grant Colleges and Universities, Frederick, MD, November 16, 2006.
76. **Halden, R. U.:** Environmental Routes of Human Exposure to Persistent Antimicrobial Compounds – A Human Exposure Assessment. Municipal Institute of Medical Research, Barcelona, Spain, November 3, 2006.
77. **Halden, R. U.:** Environmental Toxins. 44th Annual New Horizons in Science Briefing, sponsored by the Council for the Advancement of Science Writing, hosted by The Johns Hopkins University, Baltimore, MD, October 30, 2006. <http://www.jhu.edu/newhorizons/>
78. **Halden, R. U.:** Persistent Antimicrobial Compounds in the Environment – A Human Health Concern? Christine Mirzayan Science and Technology Policy Graduate Fellowship Program at the National Academies—National Academy of Sciences, National Academy of Engineering, Institute of Medicine, and National Research, Washington, DC, October 25, 2006.
79. **Halden, R. U.:** Contemporary Technologies for Combating Emerging Contaminants. Biodesign Institute, Center for Environmental Biotechnology. Tempe, AZ, October 12, 2006.
80. **Halden, R. U.:** In Situ Microcosm Array (ISMA) Technology for Environmental Monitoring and Toxicity Testing. U.S. Army Invitation-Only Symposium, Massachusetts Institute of Technology. Boston, MA, September 15, 2006.
81. **Halden, R. U.:** Novel Approaches in Environmental Biotechnology. Arizona State University. Tempe, AZ, August 16, 2006.
82. **Halden, R. U.:** Use of Proteomics and In Situ Microcosm Arrays in Environmental Biotechnology. BIO 2006. Annual International Convention. Environmental Biotechnology Session. Chicago, IL, April 9-12, 2006.
83. **Halden, R. U.:** Study on Consumer Products and Pharmaceuticals in the Environment. The Mid-Atlantic States Section of the Air & Waste Management Association (MASS-A&WMA), New Brunswick, NJ, April 6, 2006.
84. **Halden, R. U.:** Environmental Fate of Persistent Antiseptic Compounds. Southern Nevada Water Authority. Las Vegas, NV, February 9, 2006.
85. **Halden, R. U.:** A Novel Tool in Environmental Restoration: Proteomics-enabled In Situ Microcosm Array. Lawrence Livermore National Laboratory, CA, February 6, 2006.
86. **Halden, R. U.:** Fate of Persistent Antimicrobials in the Environment: From Germ Killers to Culinary Curiosities. Colorado School of Mines, Golden, CO, December 14, 2005.

87. **Halden, R. U.:** Environmental Exposure to Persistent Antimicrobial Compounds – A Human Health Concern? Municipal Institute of Medical Research, Barcelona, Spain, November 18, 2005.
88. **Halden, R. U.:** Through a Glass Safely: How Healthy is Our Drinking Water? A Woman’s Journey—Johns Hopkins Premier Woman’s Health Conference, Baltimore, MD, November 12, 2005.
89. **Halden, R. U.:** Sources, Occurrences, and Fate of Pharmaceuticals and Personal Care Products in the Environment. Public Health Risk Assessment Workshop. Harvard School of Public Health, Boston, MA, November 10, 2005.
90. **Halden, R. U.:** Screening of Groundwater Remediation Technologies Using In Situ Microcosm Arrays. Presenter and Chair of Groundwater Remediation Session. International Conference on Safe Water: Exploring Global Demands and Impact of Natural Disasters, San Diego, CA, October 21, 2005.
91. **Halden, R. U.:** Secondary Routes of Exposure to Biocides. Food And Drug Administration, Center For Drug Evaluation And Research (CDER) Nonprescription Drugs Advisory Committee. “Benefits and Hazards of Antiseptic Products Marketed for Consumer Use.” Silver Spring, MD, October 20, 2005.
92. **Halden, R. U.:** Use of Proteomics in Bioremediation. The 21st Annual International Conference on Soils, Sediments, and Water. University of Massachusetts, Amherst, MA, October 18, 2005.
93. **Halden, R. U.:** Measuring Antibacterial Agents in Biosolids and Predicting Their Environmental Fate. Mid-Atlantic Biosolids Association Research Symposium, Washington, DC, September 28, 2005.
94. **Halden, R. U.:** Proteomics in Bioremediation: Opportunities and Challenges. University of Maryland, Department of Chemistry and Biochemistry. College Park, MD, September 9, 2005.
95. **Halden, R. U.:** Potential Application of Proteomics. DoD SERDP/ESTCP Molecular Biological Tools Workshop, Charlottesville, VA, August 9, 2005.
96. **Halden, R. U.:** Fate of Personal Care Products During Wastewater Treatment. 35th Annual Joint Conference and Exhibition. The Chesapeake Water Environment Association and the Waters and Waste Operators Association of Maryland, Delaware and the District of Columbia, Ocean City, MD, July 8, 2005.
97. **Halden, R. U.:** Use of Proteomic Mass Spectrometry and Bioinformatics for the Identification of Environmental Microorganisms. U.S. Department of Agriculture, Beltsville, MD, June 27, 2005.
98. **Halden, R. U.:** ISMA – A Platform Technology with Biomedical Applications. Johns Hopkins University, School of Medicine. Alliance for Science and Technology. Spring 2005 Meeting. April 12, 2005.
99. **Halden, R. U.:** Fate of Polychlorinated Antimicrobial Compounds in the U.S. Environment. U.S. Headquarters of the Soap and Detergent Association (SDA), Washington, D.C., March 29, 2005.
100. **Halden, R. U.:** Polychlorinated Antimicrobials as Indicators of Sewage Spills. Presented at the American Chemical Society Meeting, Maryland Chapter, Baltimore, MD, February 23, 2005.
101. **Halden, R. U.:** Triclocarban: A New Contaminant in Baltimore Streams. Maryland State Water Quality Advisory Committee (SWQAC), Baltimore, MD, December 3, 2004.
102. **Halden, R. U.:** Pharmaceuticals and Personal Care Products as Indicators of Sewage Spills. Presenter and Panelist at the Maryland Water Monitoring Council 10th Annual Conference, Linthicum, MD, November 18, (2004).
<http://mddnr.chesapeakebay.net/MWMC/pub/MWMC10conf.pdf>.
103. **Halden, R. U.:** Antimicrobials Signal High Levels of Pathogens in Baltimore Streams. Herring Run Watershed Association Annual Meeting, Baltimore, MD, November 16, 2004.
104. **Halden, R. U.:** Invited Discussant for Seminar by Dr. Leigh English, Director of the Monsanto Protein Science Team, titled: Genetically Modified Crops: A Jelly Donut of Social Issues Surrounded by Technical Explanations. Institute for Global Studies in Culture, Power and History; Fall Seminar Series: Feeding the World: Ethical, Moral, Legal and Scientific Dimensions, Baltimore, MD, November 11, 2004.

105. **Halden, R. U.:** JHU Center for Water and Health On-going Research. Chesapeake Bay Foundation Research Retreat, Port Isobel, VA, October 3, 2004.
106. **Halden, R. U.:** The Johns Hopkins University Center for Water and Health Nationwide Study on the Fate of Pharmaceuticals and Personal Care Products in the Environment – Preliminary Results for the State of Maryland. Johns Hopkins University, Baltimore, MD, September 21, 2004.
107. **Halden, R. U.:** Pharmaceuticals and Personal Care Products in the Environment. Chesapeake Biological Laboratory, University of Maryland, Solomon, MD, September 9, 2004.
108. **Halden, R. U.:** Leaky Pipes and Cross-Contamination – Is Baltimore’s Aging Sewer System a Threat to Public Health? Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, August 13, 2004.
109. **Halden, R. U.:** Chemical Analysis and Treatment of Perchlorate. Aberdeen Proving Ground, MD, July 23, 2002.
110. **Halden, R. U.:** Aberdeen Proving Grounds Environmental Research. National Defense Industrial Association TACOM – ARDEC Technical Symposium, Rockaway, NJ, April 10, 2002.
111. **Halden, R. U.:** Pharmaceuticals in U.S. Streams – A Public Health Concern? Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, March 27, 2002.
112. **Halden, R. U.:** Microcontaminants in Food and Water. Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, March 12, 2002.
113. **Halden, R. U.:** Toxins as Modifiers of Human Vulnerability to Disease. University of Pennsylvania, 2002 Health-Environment Symposium, Hershey, PA, March 7, 2002.
114. **Halden, R. U.:** Bioremediation: From Pure Culture to the Dirty Reality. Johns Hopkins University, Department of Geography and Environmental Engineering, Baltimore, MD, October 23, 2001.
115. **Halden, R. U.:** From Cloning to Cleaning: Bioremediation in the Real World. University of Maryland Biotechnology Institute – Center of Marine Biotechnology, Baltimore, MD, September 26, 2001.
116. **Halden, R. U.:** Detection and Bioremediation of Fuel Oxygenates, Perchlorate and Trichloroethene. University of Minnesota, School of Public Health, Minneapolis, MN, August 21, 2001.
117. **Halden, R. U.:** Detection and Destruction of Anthropogenic Toxins in Drinking Water Resources. University of California at Berkeley, Center for Environmental Biotechnology Video-taped Lecture Series, Berkeley, CA, March 6, 2001.
118. **Halden, R. U.:** Detection and Destruction of Anthropogenic Toxins in Drinking Water Resources. Johns Hopkins University, Department of Environmental Health Sciences, October 15, 2000.
119. **Halden, R. U.:** Analytical Methods for the Detection of Oxygenates in Ground Water. United States Environmental Protection Agency, MTBE Scientist-to-Scientist Meeting, Argonne National Laboratory, Argonne, IL, June 20, 2000.
120. **Halden, R. U.:** ASTD Deployment of Bioremediation and Natural Attenuation at the Building 834 Complex at Site 300. Lawrence Livermore National Laboratory, Subcon Focus Area Meeting, Livermore, CA, October 9, 2000.
121. **Halden, R. U.:** The Building 834 Study Area at Site 300, CA. Idaho National Engineering and Environmental Laboratory, Idaho Falls, ID, September 9, 1999.
122. **Halden, R. U.:** Where Did that TCE End Up? – Refining the Conceptual Model for Contaminant Fate at LLNL’s Site 300, Building 834. Oregon State University, Department of Civil Engineering, Corvallis, OR, February 5, 1999.
123. **Halden, R. U.:** Engineered In Situ Biodegradation of Dioxins – Do Laboratory Bacteria Function in the Real World? University of Florida at Gainesville, Department of Environmental Engineering Sciences, Gainesville, FL, March 4, 1997.
124. **Halden, R. U.:** Engineered In Situ Biodegradation of Dioxins. Lawrence Livermore National Laboratory, Environmental Protection Department, Livermore, CA, January 16, 1997.

SPONSORED RESEARCH

Halden (0% Effort) In Situ Delivery of Remediation Agents Chevron. Role: PI. (60% Recognition)	04/15/2014 – 01/15/2014 \$38,725
Halden (5% Effort) Thermal <i>In Situ</i> Remediation of Weathered Heavy Hydrocarbons Chevron. Role: PI. (100% Recognition)	01/1/2014 – 12/31/2014 \$75,000
Halden (10% Effort) NIEHS-R01 1R01ES020889 In Situ Sampling Tool for Assessing Bioavailability and Toxicity of Sediments This Project Explores the Bioavailability of Traditional and Emerging Contaminants Role: PI. (100% Recognition)	09/20/2011 – 07/31/2014 \$830,943
DoD ESTCP Project 201122 Halden (16.6% Effort) Cost-effective, Ultra-sensitive Groundwater Monitoring for Site Remediation and Management Role: Sole PI. (100% Recognition)	03/01/2011 – 2/28/2014 \$1,151,152
Halden (0% Effort) Arizona Technology Enterprises (AzTE) The ASU Catalyst Fund Role: PI. (100% Recognition)	06/1/2013 – 05/30/2014 \$25,000
Halden (0% Effort) NIEHS-R01 Supplement 3R01ES020889-03S1 <i>In Situ</i> Sampling / Bioavailability Assessment (IS2B) Tool Addressing Remediation Market Needs This Project Supports the Development for Commercial Application of a Small Sampling Device Role: PI. (100% Recognition)	08/1/2013 – 07/31/2014 \$42,597
Salt River Project (SRP) Halden (8.3% Effort) In Situ Bioremediation – An Innovative Approach for Elevated Chlorinated Volatile Organic Compounds in Groundwater Role: Sole PI. (100% Recognition)	01/01/2013 – 06/30/2014 \$60,000
Halden (10% Effort) Piper Charitable Trust Center for Environmental Security/AZ Public Health Observatory Role: PI. (100% Recognition)	06/1/2012 – 05/30/2015 \$450,000
Halden (0% Effort) AZ Board of Regents Planning, Development and Implementation of a State-wide Research Initiative in Environmental Informatics: “Arizona Environmental Grid Infrastructure Service (AEGIS)” Role: ASU-PI. (PD: Petuskey)	5/24/2013 – 11/23/2014 \$40,000 subcontract of \$450K Total
Halden (0% Effort) TRIF Biodesign Mass Spectrometry Recharge Facility Trial Run Role: PI. (0% Recognition)	01/1/2013 – 12/30/2013 \$60,000

Halden (0% Effort) NASA 2012-T72247 Analysis of Hormones, Steroids, Pharmaceuticals, and Personal Care Products in Water, Wastewater and Preserved Urine Samples Role: PI. (100% Recognition)	03/1/2012 – 02/28/2013 \$15,000
WRF Water Research Foundation (PI: Westerhoff, Co-PI: Halden, 8.3% Effort) Constructed Wetlands for Treatment of Organic and Nanomaterial Pollutants. The major goal of this project is to develop design criteria for constructed wetlands for removal of emerging contaminants. Role: Co-PI (30% Recognition or \$100,200)	9/30/2010 – 8/31/2012 \$334,000 (\$84,000 match. funds)
NIH-NIEHS-RC2 1RC2ES018801-01 (PI: Westerhoff; Co-PI: Halden, Herckes, Hristovski) Detection of Engineered Nanomaterials in Drinking Water, Food, Commercial Products and Biological Samples. The major goal of this project is to develop and validate analytical methods for the determination of nanomaterials in environmental and biological samples. Role: Co-PI (28% Recognition or \$355,144; 8.3% Effort)	9/30/2009 – 7/31/2011 \$1,268,370
Halden (0% Effort; PI: B. Bakkaloglu) ASU Grand Challenges Seed Funding Research Center for Integrated Sub-mm Environmental & Molecular Sensors (iSEMS) Role: Co-PI. (15% Recognition)	01/01/2011 – 12/31/2011 \$100,000
Halden (16.6% Effort) DoD ESTCP ER-200914 Parallel In Situ Screening of Remediation Strategies for Improved Decision Making, Remedial Design, and Cost Savings. Role: Sole PI. (100% Recognition)	03/01/2009 – 12/31/2013 \$1,060,125
Halden (16.6% Effort) Biocides in the U.S. Environment. Role: Sole PI. (100% Recognition)	02/01/2008 – 12/31/2011 \$373,031
Halden (0% Effort) Anonymous Gift, JHU Hopkins Graduate Student Initiative Role: Sole PI. (100% Recognition)	02/01/2008 – 12/31/2011 \$131,468
Halden (0% Effort) NIEHS-R01 3R01ES015445-04W1 Cooperative Supplement to: Novel Approaches to Studying the In Situ Bioremediation Potential of Complex Mixtures Detection of Triclocarban in Human Specimens. Role: Sole PI at ASU. (100% Recognition)	08/12/2009 – 07/31/2012 \$228,164
Halden (0% Effort) NIEHS-R01 3R01ES015445-04S-TT Technology Transfer Supplement to: Novel Approaches to Studying the In Situ Bioremediation Potential of Complex Mixtures Development of a Nutrient Injection Unit for the In Situ Microcosm Array.	08/12/2009 – 07/21/2012

Role: Sole PI. (100% Recognition)	\$152,843
Halden (0% Effort) NIEHS-R01 1R01ES015445S Supplement to: Novel Approaches to Studying the In Situ Bioremediation Potential of Complex Mixtures Evaluation of In Situ Microcosms Arrays for the Study of Chemical Mixtures in Contaminated Environments.	09/28/2009 – 09/27/2012
Role: Sole PI. (100% Recognition)	\$109,375
Halden (16.6% Effort) NIEHS-R01 1R01ES015445 Novel Approaches to Studying the In Situ Bioremediation Potential of Complex Mixtures Evaluation of In Situ Microcosms Arrays for the Study of Chemical Mixtures in Contaminated Environments.	09/28/2006 – 07/31/2012
Role: Sole PI. (100% Recognition)	\$624,261
Halden (8.3% Effort) Central Arizona Project (PI: Westerhoff, Co-PI: Halden and Herckes) Enhancement Project by Central Arizona Project (CAP): Regional Water Quality Monitoring and Evaluation for the Metropolitan-Phoenix Area Water Supply.	01/01/2008 – 04/30/2009
Role: Co-PI. (25% Recognition or \$7,500)	\$30,000
Halden (0% Effort) City of Phoenix Planning Dept. (PI: Westerhoff, Co-PI: Halden and Herckes) Regional Water Quality Monitoring and Evaluation for the Metropolitan-Phoenix Area Water Supply.	07/01/2007 – 06/30/2010
Role: Co-PI. (0% Recognition)	\$155,250
Salt River Project (SRP) Halden (8.3% Effort) In Situ Bioremediation – An Innovative Approach for Elevated Chlorinated Volatile Organic Compounds in Groundwater	06/01/2011 – 5/30/2012
Role: Sole PI. (100% Recognition)	\$75,000
Halden (0% Effort) DOE BER Genome Sequencing Program Genome Sequencing of the Dioxin-Mineralizing Bacterium <i>Sphingomonas wittichii</i> RW1 Sequencing and Annotation of the Genome of a Dioxin-Metabolizing Bacterium.	01/01/2007 – 12/31/2009
Role: Sole PI. (100% Recognition)	Free Genome Sequencing ~\$100,000
Halden (PI: Ketner) JHSPH-Faculty Research Initiative Proteomic Approach to Understanding Viral Infection and Pathogenesis Elucidation of viral infection mechanisms and identification of intervention strategies.	03/01/2007 – 2/28/2009
Role: Co-PI. (50% Recognition or \$17,500)	\$35,000
Halden (PI: Schwab; Co-PI: Halden, Graczyk) R83300201 U.S. EPA Science to Achieve Results (STAR) Program Quantitative Assessment of Pathogens in Drinking Water Development and Evaluation of Novel Methods for the Detection of Emerging Waterborne Pathogens.	04/01/2006 – 12/31/2008
Role: Co-PI. (30% Recognition or \$180,000)	\$600,000
Halden (PI: Lawrence; Co-PI: Silbergeld, Schwab, Halden)	10/01/2005 - 12/31/2007

The Pew Charitable Trusts
National Commission on Industrial Farm Animal Production
A Collaboration Was Formed Between The Pew Charitable Trusts and the Johns Hopkins Bloomberg School of Public Health to Investigate and Summarize in a Report, Issues of Environmental Quality, Public Health, and Ethics Linked to Concentrated Animal Feeding Operations (CAFOs) in the United States.
Role: Co-I. (20% Recognition or \$84,600) \$423,000 (JHU of \$2.4M total)

Halden 10/01/2005 – 09/30/2006
State of Maryland TEDCO
Supporting Funds for International Patent Rights to a Hopkins' Technology (International Patent Application PCT WO 2004/081530).
Role: Sole PI. (100% Recognition) \$10,000

Halden (PI: Goldman) 10/01/2005 – 09/30/2006
JHU-Center for a Livable Future Pilot Project
Exposures to Persistent Contaminants in Food and Fetal Growth and Development.
Determination of Potential Linkages Between Fetal Exposure to Polybrominated Flame Retardants / Perfluorinated Organic Compounds and Adverse Health Outcomes.
Role: Co-I. (10% Recognition) \$20,000

Halden 01/01/2005 – 06/30/2007
JHSPH-Faculty Research Initiative
Carcinogens in Biosolids as Determinants of Human Morbidity and Mortality
Creation of a Nationwide Repository and Database for Application of Municipal Sludge (Biosolids) in Agriculture.
Role: PI. (100% Recognition) \$50,000

Halden 01/1/2006 – 07/30/2006
JHU-NIOSH ERC Pilot Project
Application of Proteomics for the Development of Biomarkers of Occupational Exposure
Proteomic Analysis of Baltimore Cord Blood Serum Samples for the Discovery of Protein Biomarkers of Exposure to Toxic Occupational Contaminants.
Role: Sole PI and Advisor. (100% Recognition) \$14,995

Halden 9/1/2004 – 8/31/2005
JHU-Center for a Livable Future Pilot Project
Municipal Sludge Disposal and Sustainable Agriculture – A Pilot Study Showcasing the Challenge of Combining the Two
Explore the Fate of Persistent Antimicrobial Compounds in Municipal Sludge and Their Potential Uptake into Agricultural Plants as a Pathway for Human Exposure to Carcinogens. Role: Sole PI. (100% Recognition) \$20,000

Halden 06/01/2004 – 05/30/2005
CRF—Maryland Cigarette Restitution Fund
(Matching Funds by the CDC; PI: Needham)
Human Fetal Exposure to Drinking Water Carcinogens in Maryland
Creation and Analysis of a Cord Blood/Cord Tissue Repository and Determination of Fetal Exposure Levels to Carcinogens in Maryland Drinking Water Resources and Water Supply. Role: Sole PI. (100% Recognition) \$150,000

Halden 06/01/2004 – 05/30/2005

CDC—Centers for Disease Control and Prevention
(Matching Funds for CRF Study; PI: Needham)
Human Fetal Exposure to Drinking Water Carcinogens in Maryland
Creation and Analysis of a Cord Blood/Cord Tissue Repository and Determination of Fetal Exposure
Levels to Carcinogens in Maryland Drinking Water Resources and Water Supply. Role: Sole PI of
Parent Grant. (10% Recognition) \$250,000

Halden (PI: Buckley; Co-PI: Halden) 11/1/2004 – 10/30/2005
CRF—Maryland Cigarette Restitution Fund
Statistical Analysis of Drinking Water Quality vis-à-vis Cancer Morbidity and Mortality
Geospatial Analysis to Identify Potential Links Between Drinking Water Quality and Cancer
Morbidity and Mortality in the State of Maryland.
Role: Co-PI. (50% Recognition or \$10,000) \$20,000

Halden 11/1/2003 – 10/31/2004
JHSPH—Technology Transfer Seed Grant
Production and Testing of an In Situ Microcosm Array Prototype
Design, Construction and Initial Testing of an Innovative Environmental Monitoring Device.
Role: Sole PI. (100% Recognition) \$25,000

Halden 9/1/2003 – 8/31/2004
JHU-Center for a Livable Future Pilot Project
Mass Spectrometric Determination of Microbial Pathogens in Waste Streams of
Explore the Use of Mass Spectrometry for Detecting the Bacteriophage MS2 as an Indicator of
Microbial Pathogens Originating from Concentrated Animal Feeding Operations.
Role: Sole PI, Advisor. (100% Recognition) \$20,000

Halden 10/1/2003 – 9/30/2004
JHU-Center for a Livable Future Pilot Project
Effect of Lifestyle on Mother/Infant Exposure to Ubiquitous Pollutants
Determine Whether Exposure to Polyfluorinated Environmental Contaminants is Associated with
Lifestyle Choices. (100% Recognition)
Role: Sole PI. \$20,000

Halden 10/1/2003 – 8/31/2005
JHU-CLF Pre-doctoral Fellowship/Mentor Award
Proteomic Approach to Monitoring Microbes in Waste Streams from Animal Production Facilities
Explore the Use of Mass Spectrometry for Detecting Viruses and Bacterial Pathogens in Samples
from Concentrated Animal Feeding Operations Using MALDI-TOF MS, Nanospray ESI-MS/MS,
and AP-MALDI and ESI-IT-MS Techniques.
Role: Sole PI and Advisor. (100% Recognition) \$99,000

Halden 7/1/2003 – 12/31/2003
JHU-CLF Donor's Gift (No Title)
Environmental Fate of Persistent Personal Care Products.
Role: Sole PI. (100% Recognition) \$3,000

Halden 3/1/2003 – 2/28/2004
JHSPH—Technology Transfer Seed Grant
Down-Well Diagnostic Device for Environmental Monitoring and Bioprospecting
Conceptually Develop and Refine Plans for a Novel Environmental Monitoring Device Amenable to
Automated, High-throughput Analysis Using Genomic and Proteomic Analyses.
Role: Sole PI. (100% Recognition) \$25,000

Halden	10/1/2003 – 9/30/2004
JHU-NIOSH Education and Research Center Grant	
LC-MS Analysis of a Urinary Biomarker of Occupational Exposure to PAHs	
Detection of a Urinary PAH Biomarker in Human Specimens Targeting the Underivatized Conjugate.	
Role: Sole PI. (100% Recognition)	\$9,000
Halden	06/01/2004 – 05/30/2005
Donor's Gift (No Title)	
In Support of Technology Transfer Activities Directed Toward a Down-Well Diagnostic Device for Environmental Monitoring and Bioprospecting (International Patent Application PCT WO 2004/081530).	
Role: Sole PI. (100% Recognition)	\$20,000
Halden	10/1/2002 – 6/30/2003
JHU-Center for a Livable Future Pilot Project	
Bioaccumulation of Methyl Triclosan in Agriculturally Applied Sewage Sludge and in Breast Milk	
Trace Analysis of Biocides in Municipal Sludge and Human Milk.	
Role: Sole PI. (100% Recognition)	\$17,500
Halden	6/1/2002 – 5/30/2003
JHU-NIEHS Center Pilot Project; P30ES03819	
Development of an Exposure Assessment Tool for the Biocide Triclosan	
Development an LC-MS Technique Suitable for Trace Analysis of the Biocides.	
Role: Sole PI. (100% Recognition)	\$15,000
Halden	7/1/2002 – 9/30/2002
JHU-Center for a Livable Future Internship/Mentoring Award	
Sponsored Research Internship in Environmental Health Sciences	
Provide Laboratory Study Opportunities for an Undergraduate Student.	
Role: Sole PI; Student Advisor. (100% Recognition)	\$4,000
Halden	5/1/2002 – 6/30/2003
JHSPH—Faculty Innovation Award	
Environmental Sources, Occurrence and Biodegradation of the Biocide Triclosan	
Pilot Study Designed to Explore the Extent of Environmental Contamination with the Biocide Triclosan.	
Role: Sole PI. (100% Recognition)	\$30,000
Halden	2/12/2002 – 12/31/2002
Bechtel BWXT Idaho, LLC, Research Contract	
Determination of the Microbial Community Structure at a Trichloroethene-Contaminated Area at Site 300, CA, in Support of a Proposed In Situ Bioremediation Deployment	
Use Non-culture-dependent Techniques to Determine the Impact of Chloroethenes on the Microbial Community of a Polluted Aquifer.	
Role: Sole PI (100% Recognition)	\$57,500
Halden	7/1/2001 – 6/30/2002
Shimadzu Corp. Instrumentation Grant (No Title)	
Improve Laboratory Instrumentation Infrastructure for Trace Analysis of Environmental Toxicants.	
Role: Sole PI. (100% Recognition)	\$56,000
Halden (PI: Naples; Co-PI: Shiff, Halden)	11/1/2003 – 10/31/2004

JHSPH—Technology Transfer Seed Grant
 A Product for the Detection and Focal Control of Schistosome Cercariae to Reduce Disease Burden
 and Cercariae Dermatitis, Both in Endemic Areas, and in U.S. Lacustrine Habitats
 Explore the Use of Natural Essential Oils for the Control of Cercariae in Surface Waters. Role: Co-PI.
 (25% Recognition or \$6,250) \$25,000

Halden (PI: Lowe; Co-PI: Halden) 2/12/2002 – 12/31/2002
 DOE—NABIR Research Grant (DE-FG02-01ER63264)
 Development of a Multiplexed, Bead-based Assessment Tool for Rapid Identification and
 Development of Novel Diagnostic Tool for Microbial Community Analysis at Contaminated
 Subsurface Sites.
 Role: Co-PI. (30% Recognition or \$19,444) \$64,812

Halden (Project Director: Rice) 10/1/2000 – 9/30/2001
 LLNL Work-In-the-Public-Interest Grant
 Dioxins in San Francisco Bay
 Determine Potential Avenues for Reducing Environmental Contamination with Dioxin-like
 Compounds.
 Role: PI (20% Recognition or \$26,000) \$130,000

Halden (PI: Happel) 10/1/2000 – 9/30/2001
 DOE—Fossil Fuel Research Project
 Detection and Biodegradation of MTBE from Leaking Underground Storage Tanks
 Determine the Bioremediation Potential of LUFT Sites.
 Role: Co-PI. (10% Recognition or \$5,000) \$50,000

TEACHING

Graduate Students Supervised

Ph.D. Students

1. Sung-Roul Kim (Ph.D.) Environmental Health Sciences, Johns Hopkins. “Assessment of Urban Air Pollution Exposure Among New Mothers and Nursing Infants and Internal Dose Measured in Breast Milk” (2006). (Committee member)
2. Tanya Oxenberg (Ph.D.) Environmental Engineering, Hopkins. “Subsurface Transformation of Depleted Uranium at Aberdeen Proving Ground, Maryland” (2006). (Co-Advisor)
3. David R. Colquhoun (Ph.D.) Environmental Health Sciences, Johns Hopkins. “Public Health Applications of Quantitative Protein Biomarkers” (2007). (Chairman)
4. Jochen Heidler (Ph.D.) Environmental Health Sciences, Johns Hopkins. (Chairman) “Environmental Fate of Persistent Biocides and Human Exposure” (2007).
5. Talia E. A. Chalew (Ph.D.) Environmental Health Sciences, Johns Hopkins. (Expected 2011).” (Past Advisor)
6. Kristin McClellan (Ph.D.) Environmental Engineering, ASU. “A New Approach to Groundwater Remediation Treatability Studies – Moving Flow-through Column Experiments from Laboratory to *In Situ* Operation” (8/2008 – 4/3/2013). (Chairman)
7. Erica M. Hartmann (Ph.D.) Biological Design, ASU. “Application of Proteomic Mass Spectrometry in Bioremediation” (8/2008 – 6/2012). (Chairman)
8. Tomasz Kalinowski (Ph.D.) Biological Design, ASU. “Technical, Economical and Social Aspects of Moving Treatability Studies for the *In Situ* Bioremediation of Contaminated Aquifers from the Laboratory to the Field” (8/2008 – 4/4/2013). (Chairman)
9. Thomas Bruton (Ph.D.) Environmental Engineering, ASU. “Use of Nano Zerovalent Iron in Groundwater Remediation” (2009 - 2012). (Transferred to UC Berkeley)

10. Arjun K. Venkatesan (Ph.D.) Environmental Engineering, ASU. "Contaminants of Emerging Concern in U.S. Sewage Sludges and Forecasting of Associated Ecological and Human Health Risks Using Sewage Epidemiology Approaches" (8/1/2010 - 11/14/2013). (Chairman)
11. Isaac Roll (Ph.D.) Environmental Engineering, ASU. "Novel Tools for Environmental Analysis of Trace Contaminants at Ultra-low Detection Limits" (Expected 2014). (Chairman)
12. Samuel Supowit (Ph.D.) Environmental Engineering, ASU. "Application of and Active Sampling Device for Bioavailability Assessment of Contaminants in Sediment." (Expected 2014). (Chairman)
13. Hansa Done (Ph.D.) Biological Design, ASU. "Antibiotics and Antibiotic Resistant Microbes in U.S. Seafood." (Expected 2016). (Chairman)
14. Alizee Jenck (Ph.D.) Environmental Engineering, ASU. "Application of MALDI-TOF/TOF Mass Spectrometry to Environmental Health Monitoring." (Expected 2016). (Chairman)
15. Maurissa Charles (Ph.D.) Environmental Engineering, ASU. "Application of the In Situ Microcosm Array Technology to Environmental Remediation." (Expected 2016). (Chairman)
16. Burcu Yavuz (Ph.D.) Environmental Engineering, ASU. "To Be Determined (Expected 2017). (Chairman)
17. Erin Driver (Ph.D.) Environmental Engineering, ASU. "To Be Determined." (Expected 2017). (Chairman)
18. Jing Chen (Ph.D.) Biological Design, ASU. "To Be Determined." (Expected 2017). (Chairman)
19. Justin Kidd (Ph.D.) ASU "To Be Determined." (Expected 2018). (Chairman)

M.S., M.S.E, and M.P.H. Students

20. Sharri Hollist (M.P.H.) Public Health, Hopkins. "Incidence of Illness Associated with Recreational Water Contact: Determining and Evaluating a Potential Public Health Problem" (2005). (Capstone Advisor)
21. Toni Nunes (M.P.H.) Public Health, Hopkins. "Pesticides in Ground and Surface Waters of the Chesapeake Bay Watershed: Occurrence, Risks and Potential Solutions" (2007). (Capstone Advisor)
22. Christopher von Seggern (M.P.H.) Public Health, Hopkins. "Biodetection Utilizing Matrix-assisted Laser Desorption/Ionization Mass Spectrometry" (2005). (Capstone Advisor)
23. Meredith Lewis (M.S.E.) Environmental Engineering, ASU. (2009).
24. Guozheng Li (M.S.) Biological Design, ASU (2011).
25. Alison D. Fox (M.S.) Technology (Environmental Management), ASU. "Use of Passive Sampling Devices for Determination of Contaminants in Sewage Sludge" (2010 - 2012). (Graduate Advisor)
26. Sara Carey (M.S.) Environmental Engineering, ASU. "Policy Solutions for Limiting Environmental Release of Persistent, Bioaccumulative and Toxic Compounds." (2012). (Temporary Advisor)
27. Bipin Chari (M.S.) Environmental Engineering, ASU. "Analysis and Modeling of Residual Compounds in Process Streams From U.S. Wastewater Treatment Plants" (4/12/2012). (Thesis Advisor)

Other Graduate Students

28. Peter D'Amato (Ph.D.) Environmental Engineering, Hopkins. "Biodegradation of Polycyclic Aromatic Hydrocarbons" (2003). (Committee Member)
29. Denise Taylor (Ph.D.) Environmental Engineering, Hopkins (2003). (Committee Member)
30. Amir Sapkota (Ph.D.) Environmental Health Sciences, Hopkins (2004). (Committee Member)

31. Kristen Malecki Chossek (Ph.D.) Health Policy and Management, Hopkins (2005). (Committee Member)
32. Michelle Hladik (Ph.D.) Environmental Engineering, Hopkins (2005). (Committee Member)
33. Henry Schuver (Dr.P.H.) Epidemiology, Hopkins (2007). (Committee Member)
34. Ying Yao (M.S.) Environmental Engineering, ASU. (2009). “Development of a Novel Dechlorinating Culture” (2009). (Committee Member)
35. Ed Hilyard (Ph.D.) Marine Biotechnology, University of Maryland, (Expected 2010) (Committee Member 2005-2009)
36. Liang Chen (M.S.) Environmental Engineering, ASU. (2009). (Committee Member)
37. John Schloendorn (Ph.D.) Molecular and Cellular Biology, ASU. “Progress Towards Medical Bioremediation by Enzymatic Transformation of 7-Ketocholesterol and the Pyridinium Bisretinoid A2e” (2009). (Committee Member)
38. Katherine Muto (M.S.) Environmental Engineering, ASU. (2010). (Committee Member)
39. Prathap Parameswaran (Ph.D.) Environmental Engineering, ASU. (2010). (Committee Member)
40. Youneng Tang (Ph.D.) Environmental Engineering, ASU. Biofilm Reduction of Oxidized Contaminants” (2/19/2011). (Committee Member)

Postdoctoral Researchers

41. Guibo Xie (10/2001 – 06/2003)
42. Wenming Dong (2002) (Currently: Staff Scientist, U.S. National Laboratory)
43. Mark P. Franklin (04/2002 – 12/2003)
44. Eric S. Wisniewski (06/2003 – 08/2003) (Currently: Staff Scientist, U.S. Government)
45. Amir Sapkota (11/2004 – 10/2005) (Currently: Tenure-track Assistant Professor, University of Maryland)
46. Todd R. Miller (10/2004 – 10/2007) (Currently: Assistant Professor, University of Wisconsin, Milwaukee)
47. Christopher Higgins (11/2006 – 12/2007) (Currently: Tenure-track Assistant Professor, Colorado School of Mines)
48. Jay Graham (02/2008 – 07/2008) (Currently: Assistant Professor, George Washington University, Washington, DC)
49. Randhir Deo (04/2008 – 2012) (Currently: Assistant Professor, Grand Canyon University, Phoenix, AZ)
50. Tzu-Chiao Chao (01/2009 – 01/2011) (Currently: Faculty, University of Regina, Canada)
51. Gopianth Nallani (02/2011 – 06/2011)
52. Nicole Hansmeier (12/2008 – 6/2012) (Currently: Assistant Professor, Osnabrück University, Germany)
53. Benny Pycke (02/2010 – Present)
54. Bhagyashree Manivannan (03/2013 – 04/2014)
55. Manivannan Yegambaram (03/2013 – 04/2014)
56. Arjun Venkatesan (12/2013 – Present)

Graduate Independent Projects Supervised

57. Jacqueline Heilman, Johns Hopkins University Research Intern (2002) “Antimicrobial Compounds and Their Possible Breakdown Products in Biosolids”
58. Edward Kruse (2007). (M.P.H.) Public Health, Hopkins. “Assessing the Impact of Point and Nonpoint Sources of Pollution on Recreational and Drinking Water Quality in the Springfield Watershed in Dominica” (2007). (Capstone Advisor)
59. Katherine Muto (Spring 2010) “Method for Detection of Chlorinated Carbanilides”
60. Chen Zhou (Spring 2010) “Versatile Roles of Sulfate Reducing Bacteria in Contaminant Remediation”
61. Kristin McClellan (Spring 2010) “Demonstration Plan: Parallel In Situ Screening of Remediation Strategies for Improved Decision Making, Remedial Design, and Cost Savings”

62. Isaac Roll (Fall 2010) “Cost-effective, Ultra-sensitive Groundwater Monitoring for Site Remediation and Management”
63. Thomas Bruton (Fall 2010) “Investigation of Fate and Transport of Zero Valent Iron Nanoparticles Using an In-Situ Microcosm Array”
64. Arjun Venkatesan (Fall 2010) “Analysis of compounds of emerging concern in Biosolids by GC/MS”
65. Kristin McClellan (Fall 2010) “Review Paper on Treatability Studies”
66. Jing Chen (Fall 2013) Rotational Student of the Biological Design Graduate Program, “Determination of Contaminants in Autopsy Tissues of Alzheimer’s Disease Fatalities”
67. Stephen Hart (Fall 2013) Rotational Student of the Biological Design Graduate Program, “Application of the In Situ Microcosm Array in a Fractured Bedrock Aquifer Contaminated with Perchlorate”

Undergraduate Students and High School Interns

68. Stephanie Burge (Research Intern, LLNL) “Optimization Study of Nitrate and Perchlorate Removal by Ion Exchange” (1999).
69. Daniel Paull (Undergraduate Research Intern, Johns Hopkins) “Detection of Antimicrobials by Liquid Chromatography/Mass Spectrometry” (2002).
70. Daniel Paull (Undergraduate Research Intern, Johns Hopkins) “Detection of Triclocarban in Environmental Waters by Liquid Chromatography/Mass Spectrometry” (2003).
71. Beth Links (High School Intern, Johns Hopkins) “Uptake into Plants of Contaminants from Biosolids-Amended Soils” (2004).
72. Cristina Matos (Diversity Research Intern, Johns Hopkins) “*Ab Initio* and *In Situ* Comparison of Organic Wastewater Compounds as Indicators of Sewage-derived Microbes in Surface Waters” (2004).
73. Anna Kalmykov (High School Intern, Johns Hopkins) (2004 – 2005).
74. Amelia DeLaquil (Undergraduate Research Intern, Johns Hopkins) “Fate of Triclosan and Triclocarban in Estuarine Sediment” (2006).
75. Jocelyn Keehner (High School Intern, Johns Hopkins) “Uptake into Plants of Contaminants from Biosolids-Amended Soils” (2006).
76. Erica Hartmann (Undergraduate Research Intern, Johns Hopkins) “Detection of Bioremediation Agents by MALDI Mass Spectrometry” (2006 – 2008).
77. Travis Doom. (B.S.E.) Biomedical Engineering, ASU. “Nutrient Injection Unit: Subsurface Environmental Engineering with In Situ Microcosm Array Tool” (2009).
78. Benjamin Duong (High School Intern, ASU) “Development of a Laboratory Web Page” (2008 – 2009).
79. Patrick Trang (High School Intern, ASU) “Development of a Laboratory Web Page” (2008 – 2009).
80. David E. C. Adams (B.S.E.) Environmental Engineering, ASU. (2010). “Fluorinated Chemicals and the Impacts of Anthropogenic Use” (2010) (Honor Thesis Advisor).
81. James Fernandez (Undergraduate Research Intern, ASU) “Policy Analysis for Atrazine” (2011 – 2012).
82. Benjamin Duong (Undergraduate Research Intern, ASU) “Programming of a Bioremediation Device” (2009 – 2012).
83. Patrick Trang (FURI Undergraduate Research Intern, ASU) “Programming the Nutrient Injection Module” (2009 – 2012).
84. Kristen Latta (Undergraduate Research Intern, ASU) “Environmental Research” (2012).
85. Justin Kidd (Undergraduate Research Intern, ASU) “Theoretical Examination of the Bioavailability of Contaminants in Soils” (2012 – 2013).
86. Olga Epshtein (Undergraduate Research Intern, ASU) “Modeling of the Tres Rios Wetland” (2012 – 2013).
87. Amitis Karris (High School Intern, ASU) “Environmental Research” (2013).
88. Cody Moore (Barrett Honors College Intern, ASU) “Environmental Research” (2012 – 2013).

89. Chris Bean (Undergraduate Research Intern, ASU) “Environmental Research” (2013).
90. Emily North (Barrett Honors College Intern, ASU) “Safety of Plastics” (2012 – 2013).
91. Olga Epshtein (B.S.) Civil Engineering, ASU (Expected 5/2014)
92. Justin Kidd (B.S.) Biology, ASU (Expected 5/2014)

Technicians Employed and Co-supervised

93. Tina Legler (1998 – 1999)
94. Thayer Young (01/2005 – 2007)
95. Kristin McClellan (4/2008 – 8/2008)
96. Sara Murch (11/2012 – 5/2014)

Synergistic Activities

- Supervisor Certificate, 40-Hour SARA/OSHA 8CCR5192(e)(4) (1999).
- Management Certificate, University of the Pacific, 2000.
- DOE Natural and Accelerated Bioremediation Research Program (NABIR) Workshop. Warrenton, VA. Invited Panelist. 3/18-20/2002.
- Johns Hopkins School of Public Health Faculty Title Task Force. Invited Representative of the Junior Faculty, 2003
- Co-organizer of the Johns Hopkins School of Public Health Junior Faculty Meetings, 2003.
- Organizer of the “Exposure Assessment Session” at the Environmental Health Sciences Annual Research Day of the Johns Hopkins Bloomberg School of Public Health, Mount Washington Conference Center, Baltimore, MD, November 14, 2003.
- Water Environment Research Foundation (WERF) Project Advisory Committee. “Contributions of Household Chemicals to Sewage and their Relevance to Municipal Wastewater Systems and the Environment.” Invited Committee Member. 2004-06.
- Water Environment Research Foundation (WERF) Project Advisory Committee. “Fate of Pharmaceuticals and Personal Care Products through Wastewater Treatment Processes.” Invited Committee Member. 2004-2006.
- Maryland Water Monitoring Council: “Ecological Restoration Assessment & Monitoring” Linthicum, MD. Invited Panelist. 11/18/2004.
- Governor Ehrlich’s Maryland Water Security and Wastewater Systems Advisory Council Alternate Member. 01/2004 – 12/2004.
- Governor Ehrlich’s Maryland Department of the Environment – Maryland State Water Quality Advisory Committee (SWQAC) Public Interest Member. Selected by JHSPH Dean Al Sommer to be the Johns Hopkins Representative for this Committee. 1/1/2003 – 12/31/2005.
- DOE/EPA SERDP and ESTCP Expert Panel Workshop on Research and Development Needs for the Environmental Remediation Application of Molecular Biological Tools. Invited Speaker and Voting Panel Member. Specialty: Proteomics. 08/9-10/2005.
- International Conference on Safe Water, Exploring Global Demands and Impacts of Natural Disasters, SAFEWATER 2005. San Diego, CA. Groundwater Remediation Session. Invited Session Chair. 10/21/2005.
- Harvard School of Public Health Risk Assessment Workshop: "Pharmaceuticals and Personal Care Products in the Environment: Emerging Threat or Unwarranted Concern?" Invited Panelist. 11/10/2005.
- National Congress on Assessing and Mitigating Environmental Impacts of Emerging Contaminants – Renewable Natural Resources Foundation. Co-Sponsored by the United States Geological Survey and the Food and Drug Administration. Invited Delegate. 12/1-2/2005.
- Food And Drug Administration, Center For Drug Evaluation And Research (CDER) Nonprescription Drugs Advisory Committee. “Benefits and Hazards of Antiseptic Products Marketed for Consumer Use.” Invited Panelist/Voting Committee Member. 10/20/2005.

- EPA Office of Inspector General, Office of Program Evaluation, Evaluation of Drinking Water Laboratory Procedures. Invited Expert Consultant. 1/19/2006.
- Mid-Atlantic States Section of the Air & Waste Management Association (MASS-A&WMA), Special Symposium on Emerging Environmental Issues and Policies. Invited Speaker/Panelist. New Brunswick, NJ, April 6, 2006.
- Invited Panelist, BIO 2006, World's Largest Annual International Convention on Biotechnology. Chicago, IL. Environmental Biotechnology Session. 04/9-12/2006
- National Research Council of the National Academies. NRSB-O-05-04-A. Conduct a Technical Assessment of Ongoing and Planned Environmental Remediation and Monitoring Programs at the Los Alamos National Laboratory (LANL) and Provide Recommendations to Improve Their Technical and Cost Effectiveness and Reduce Worker, Public, and Environmental Risks. Invited NRC Committee Member, Dual Appointment in the Areas of Groundwater Monitoring and Chemistry. 15-Month Term Starting March, 2006.
- Panel Chair and Keynote Speaker. Reducing Our Ecological Footprint. 10th Anniversary of the Johns Hopkins Center for a Livable Future – Charting A Course To Sustainability Through Research, Education And Service, Baltimore, MD, December 6, 2006.
- Co-Organizer, Annual Conference of the Superfund Basic Research Program (SBRP) of the National Institute of Environmental Health Sciences (NIEHS). Innovative Technologies. Session Moderator and Planning Committee Member, 20th Anniversary Meeting of the Superfund Basic Research Program, Durham, NC, December 3, 2007.
- Co-Organizer, Annual Conference of the Superfund Basic Research Program (SBRP) of the National Institute of Environmental Health Sciences (NIEHS). Member of Steering Committee and Invited Speaker of Technology Transfer Session, Pacific Grove, CA, December 7-9, 2008.
- Invited Panelist, American Academy for Microbiology, "Global Antibiotic Resistance: New Approaches to an Old Problem," Fondation Merieux, Annecy, France, October 2008.
- Invited Speaker and Session Chair. Environmental Fate of Antimicrobials. Pacific Southwest Organic Residuals Symposium 2008. Sacramento, October 1-2, 2008.
- Invited Panelist, Special Symposium on Next Generation Superfund Contaminants sponsored by the National Institute of Environmental Health Sciences (NIEHS), Tucson, AZ, August 2009.
- Symposium Chair and Organizer, Pharmaceuticals, Personal Care Products and Organohalogenes in Biosolids, 238th American Chemical Society (ACS) National Meeting, Washington, DC, August 16-20, 2009.
- Symposium Chair and Organizer, Toward Sustainable Use of Organohalogenes. Spring 2010 National Meeting & Exposition of the American Chemical Society, San Francisco, CA, March 21-25, 2010.
- Symposium Chair and Organizer, Policy Options for Sustainability. Spring 2010 National Meeting & Exposition of the American Chemical Society, San Francisco, CA, March 21-25, 2010.
- Invited Panelist, Workshop on Environmental Estrogens and Endocrine Disrupting Compounds, sponsored by the Johnson Foundation, Wingspread, WI, May 2010.
- Co-Organizer, 25th Anniversary Conference of the Superfund Research Program (SRP) of the National Institute of Environmental Health Sciences (NIEHS). Scientific Session 2: Risk Assessment and Remediation. Planning Committee Member, 25th Anniversary Meeting of the Superfund Basic Research Program, Raleigh, NC, October 21-24, 2012.

Classroom Instruction

Principal Instructor

CEE470	Sustainable Environ. Biotechnologies (87936) (3 credits). Fall 2014. Enrollment: 15
CEE570	Sustainable Environ. Biotechnologies (87937) (3 credits). Fall 2014. Enrollment: 7
HON494	Sustainable Environ. Biotechnologies (88753) (3 credits). Fall 2014. Enrollment: 5
HON494	Biological Design Seminar (89949). Lecture (1 credit). Fall 2014. Enrollment: 9
BDE598	Biological Design Seminar (84106). Lecture (1 credit). Fall 2014. Enrollment: 7
BDE598	Biological Design Seminar (89564). Lecture (1 credit). Fall 2013. Enrollment: 8
HON494	Biological Design Seminar (89591). Lecture (1 credit). Fall 2013. Enrollment: 12
CEE361	Introduction to Environmental Engineering, Lecture (3 credits). Spring 2013 Enrollment: 61
CEE361	Introduction to Environmental Engineering, Laboratory (1 credit). Spring 2013 Enrollment: 61
CEE563	Environmental Chemistry Laboratory (3 credits). Fall 2012. Enrollment: 18
ASU101	The ASU Experience (1 credit). Fall 2011. Enrollment: 16
CEE598*	Sustainable Environmental Biotechnologies (3 credits). Fall 2011. Enrollment: 16
CEE494	Sustainable Environmental Biotechnologies (3 credits). Fall 2011. Enrollment: 2
CEE361	Introduction to Environmental Engineering, Lecture (3 credits). Spring 2011. Enrollment: 56
CEE361	Introduction to Environmental Engineering, Laboratory (1 credit). Spring 2011 Enrollment: 56
CEE790	Reading and Conference, Spring 2011 Enrollment: 1
CEE563	Environmental Chemistry Laboratory (3 credits). Fall 2010. Enrollment: 19
ASU101	The ASU Experience (1 credit). Fall 2010. Enrollment: 19
E2 Camp	Taught one module of ASU101 at Fall 2010 Freshman Camp in Prescott, AZ
CEE790	Reading and Conference. Fall 2010. Enrollment: 3
ASU101-1	The ASU Experience (1 credit). Fall 2009. Enrollment: 19
ASU101-2	The ASU Experience (1 credit). Fall 2009. Enrollment: 19
CEE790	Reading and Conference. Fall 2009. Enrollment: 2
CEE563	Environmental Chemistry Laboratory (3 credits). Fall 2009. Enrollment: 17
CEE598*	Sustainable Environmental Biotechnologies (3 credits). Spring 2009. Enrollment: 7
CEE494	Sustainable Environmental Biotechnologies (3 credits). Spring 2009. Enrollment: 33
CEE598	Environmental Engineering Analytical Laboratory (3 credits). Fall 2008. Enrollment: 11
JHU-Spain	Air, Water and Food Toxics (3 credits). Barcelona, Spain. JHU Fall Institute on Health Policy and Management (October 2008). Enrollment: 7.
182.638	Water & Health (4 credits), 4 th Term, 2006/07. Enrollment: 12.
182.852	Air, Water, and Food Toxics (3 credits), 3 rd Annual JHU Fall Institute in Health Policy and Management, Barcelona, Spain, 2006. Enrollment: 14.
182.638	Fundamentals of Water Quality Engineering for Public Health (4 credits), 4 th Term, 2005/06. Enrollment: 13.
182.639	Introductory Principles of Water Quality Engineering for Public Health Water (3 credits). Highest-ranked Course of the 2 nd Annual JHU Fall Institute in Health Policy and Management, Barcelona, Spain, 2005. Enrollment: 6.
183.849	SSR: Water-borne Diseases: Emerging Threats To Potable Water Supplies. 2004. Enrollment: 6.

Online Training Modules for the Center of Public Health Preparedness

(No Code)	Chemical Weapons and Water Safety, 2005. http://www.jhsph.edu/preparedness/training/online/chemagents_water_safety.html .
(No Code)	Water Safety, 2005. http://www.jhsph.edu/preparedness/training/online/water_safety.html

- (No Code) Water Safety—A Case Study, 2005. http://www.jhsph.edu/preparedness/training/online/water_safety_case_study.html
- (No Code) Monitoring Chemical Agents, 2005. http://www.jhsph.edu/preparedness/training/online/monitoring_chem_agents.html
- Guest Lectures**
- MIC445 Molecular Biology & Genetics, Fall 2012. Enrollment: 50
- PFF Preparing Future Faculty, Fall 2012. Enrollment: 32
- BDE 598 Biological Design. Fall 2011. Enrollment: 13.
- BDE 701 Biological Design. Fall 2009. Enrollment: 13.
- CEE 100 Introduction to Civil and Environmental Engineering. Spring 2009. Enrollment: 60.
- BDE 598 Biological Design. Fall 2008. Enrollment: 13.
- 180.609 Principles of Environmental Health I. 2004, 2006. Sources and Types of Water Contamination.
- 180.609 Principles of Environmental Health I. 2004. Water and Wastewater Treatment Systems.
- 182.640 Food and Waterborne Diseases, 3rd Term, 2002, 2004, 2006. Microcontaminants in Water.
- 180.880 Special Studies in Environmental Health Community Outreach. 2004. Sewage Spills: Turning a Community Concern into a Science Project.
- (No Code) Diversity Student Summer Seminar Series. 2004. Pharmaceuticals and Personal Care Products in the Environment.
- (No Code) Maryland Public Television Summer Institute. 2004.
- 550.865 Public Health Perspectives on Research. 2002. Environmental Health Engineering—Making a Career of Protecting the Environment and Human Health.
- AS 020.151 General Biology I. Fall. Bioremediation. Enrollment: 297 (2004), 250 (2005). TBD (2006).
- AS 020.161 Biology Workshop I. Fall. Bioremediation. Enrollment: 48 (2004), 48 (2005), TBD (2006).
- (Taped) Environmental Biotechnology Lecture Series, UC Berkeley, Berkeley, CA. 2001. Detection and Destruction of Anthropogenic Toxins in Drinking Water.

OTHER SIGNIFICANT TEACHING ACTIVITIES AND INSTRUCTIONAL TRAINING

- 2009 Spartan Entrepreneurial Workshop, Crash Course for Faculty Entrepreneurs. ASU Sky Song, Scottsdale, September 17-19.
- 2009 Preparing Future Faculty, Conducted Mock Interviews with Graduate Students, ASU.
- 2007 Teaching Well, Saving Time. A Teaching Workshop, Johns Hopkins University, January 12, 2007.
- 2005 Extreme Course Make-overs: Using Student Evaluations to Improve Your Course. Johns Hopkins University Workshop, Bloomberg School of Public Health, January 19.
- 2004 Creating the Loop: Developing Learning Objectives and Assessment Methods. Johns Hopkins University Workshop, Bloomberg School of Public Health, July 26.
- 2004 Lecturing & Active Learning: Strategies for Excellence Johns Hopkins University Workshop, Bloomberg School of Public Health, January 13-14.
- 1998 – 2001 Mentor, Science & Technology Education Program, Lawrence Livermore National Laboratory. Supervised four undergraduate research semester (URS) and two summer students.
- 1999 – 2001 Supervisor, 40 Hour SARA/OSHA Hazardous Waste Site Operator, 8CCR5192(e)(4), Lawrence Livermore National Laboratory.
- 1996 – 1997 Participant, University of Minnesota, Graduate School. Participated in the Bush Faculty Development Program for Excellence and Diversity in Teaching Program Preparing Doctoral Candidates for Their Role as Future Faculty: Introduction to

Diverse Teaching Methods, Peer-reviewed Practice Teaching, Design of Effective Courses/Exams/Homework Assignments, Acknowledging Students' Diversity and Learning Styles.

1993 – 1997

Teaching Assistant, University of Minnesota, Department of Civil Engineering. Organized and Conducted Laboratory Section of Graduate Courses Titled “Microbiology for Environmental Engineers” and “Groundwater Microbiology.”

Exhibit F

Statement of Kim Harley

I, Kim Harley, am writing this statement in support of the Petition to the CPSC to regulate four categories of household products containing non-polymeric additive organohalogen flame retardants.

1. I, Kim Harley PhD, am Associate Adjunct Professor in Maternal and Child Health and Associate Director for Health Effects, Center for Environmental Research and Children's Health at UC Berkeley. I am an environmental epidemiologist by training, and my research interests include the reproductive effects of PBDEs, prenatal exposure to environmental contaminants and the effects of endocrine disrupting compounds on birth outcome, fertility and the onset of puberty. I have been working in this field for 14 years and have attached my CV and list of publications.

2. I am one of the researchers running the CHAMACOS Study, a longitudinal birth cohort study investigating the role of chemicals and other environmental factors in the health of low-income, Mexican-American children living in the Salinas Valley of California. In 1999-2000, we enrolled 601 pregnant women living in Salinas and monitored the women and their children's health for the past 14 years. We carried out detailed physical exams and neurodevelopmental tests on the children every 1 to 2 years. At the time the mothers were pregnant, the organohalogen Penta PBDE mixture was the predominant flame retardant used in furniture. We found a strong positive correlation between the levels of flame retardants in pregnant mothers' bodies and the length of time they had lived in California¹. We also found a significant increase of over 26% in total PBDE levels among women who had three or more pieces of upholstered furniture in their homes, suggesting that indoor contamination was contributing to this exposure.² The levels of flame retardants in the blood of these Latino children, who were all born in California, were among the highest levels ever published³, three times higher than their mothers during pregnancy, and seven times higher than children living in Mexico⁴. The PBDE levels in children were positively correlated with the total PBDE levels in maternal serum during pregnancy, duration of exclusive breastfeeding, and absence of a safe place to play in their neighborhood.⁵ In terms of health effects, we found that the women with higher levels of flame retardants in their blood: (i) took significantly longer to get pregnant, i.e. had reduced fecundability⁶; (2) had babies with lower birth weight (over 100 g decrease in birth weight for every 10 fold increase in PBDE levels)⁷; and (iii) had lower thyroid hormone levels during pregnancy⁸, which may have implications for both maternal health and development of the fetus. We also assessed the development of over 300 children and found that, by the time they were 5 to 7 years old, their mother's flame retardant exposure during pregnancy was associated with lower IQ (a decrease by 6 points on average), attention problems, and impaired

fine motor coordination, particularly in the non-dominant hand⁹. Thus, pregnant women's exposure to PBDEs is of concern because it may have long-term adverse effects on the children.

3. Other scientific studies of completely different populations found similar adverse health effects, including alterations in thyroid hormone during pregnancy^{10,11}, decreased birth weight¹², and impaired neurodevelopment, cognitive and behavioral performance in children^{13,14,15,16,17,18,19}. Other studies also found associations between PBDEs and decreased semen quality²⁰, hormonal changes in men^{21,22,23}, cryptorchidism (undescended testicles, which increases the risk of infertility and testicular cancer later in life)^{24,25}, and early puberty in girls²⁶. These human studies are corroborated by several studies on rats and mice showing adverse neurodevelopmental effects^{27,28,29,30,31,32,33,34,35,36,37,38,39,40,41} and adverse reproductive effects, including alterations in sex hormone levels, reduced sperm count and changes in the structure of the ovaries^{42,43,44,45,46,47}.

4. Our published studies on pregnant women and children relate to the Penta BDE mixture, which was the predominant chemical used to meet TB117 in 2000 when the study began. According to the Center for Disease Control biomonitoring studies, 97% of the US population has PBDEs in their blood. This is because additive organohalogen flame retardants such as PBDEs migrate out of consumer products into dust and get into people's bodies.

5. Now Penta BDE has been replaced in upholstered furniture by other organohalogen flame retardant chemicals such as chlorinated Tris and FireMaster 550, both found in 100% of California homes and childcare facilities tested⁴⁸. Chlorinated tris has been listed as a carcinogen by the state of California under Proposition 65⁴⁹ and recently banned in several states⁵⁰, which exemplifies the problem of regrettable substitution. Human studies are also starting to show effects of some of these other organohalogen flame retardants on thyroid hormone levels⁵¹, and animal studies have found adverse reproductive and developmental^{52,53,54,55,56}, neurobehavioral^{57,58,59} and endocrine^{60,61,62,63,64} effects.

6. Based on my research on the impacts of PBDE flame retardants on the health of pregnant women and their children and the increasing evidence of harm from the replacement flame retardants, it is my professional opinion that all organohalogen flame retardants may pose similar risks, especially to fetuses and young children. To protect the health of our population, including the most vulnerable pregnant women and children, I support this petition to ban certain household products containing additive organohalogen flame retardants. This ban is necessary to avoid exposure of pregnant women and children to this class that includes chemicals that I studied and found to be harmful to human health.

Yours sincerely,



Kim Harley, Ph.D.

Associate Adjunct Professor, Maternal & Child Health

Associate Director for Health Effects, Center for Environmental Research & Children's Health

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- ¹ Castorina R., Bradman A., Sjodin A., Fenster L., Jones R. S., Harley K., Eisen E. A., Eskenazi B. (2011) Determinants of serum polybrominated diphenyl ether (PBDE) levels among pregnant women in the CHAMACOS cohort. *Environ Sci Technol.* 45(15):6553-6560
- ² Castorina R., Bradman A., Sjodin A., Fenster L., Jones R. S., Harley K., Eisen E. A., Eskenazi B. (2011) Determinants of serum polybrominated diphenyl ether (PBDE) levels among pregnant women in the CHAMACOS cohort. *Environ Sci Technol.* 45(15):6553-6560
- ³ Eskenazi B., Chevrier J., Rauch S. A., Kogut K., Harley K. G., Johnson C., Trujillo C., Sjodin A., Bradman A. (2012) In utero and childhood polybrominated diphenyl ether (PBDE) exposures and neurodevelopment in the CHAMACOS study. *Environ Health Perspect.* 121(2):257-262
- ⁴ Eskenazi B., Fenster L., Castorina R., Marks A. R., Sjodin A., Rosas L. G., Holland N., Guerra A. G., Lopez-Carillo L., Bradman A. (2011). A comparison of PBDE serum concentrations in Mexican and Mexican-American children living in California. *Environ Health Perspect.* 119(10):1442-1448
- ⁵ Bradman A., Castorina R., Sjodin A., Fenster L., Jones R. S., Harley K. G., Cevrier J., Holland N. T., Eskenazi B. (2012) Factors associated with serum polybrominated diphenyl ether (PBDE) levels among school-age children in the CHAMACOS cohort. *Environ Sci Technol.* 46(13):7373-7381
- ⁶ Harley K. G., Marks A. R., Chevrier J., Bradman A., Sjodin, A., Eskenazi B. (2010) PBDE concentrations in women's serum and fecundability. *Environ Health Perspect.* 118(5):699-704
- ⁷ Harley K. G., Cevrier J., Schall R. A., Sjodin A., Bradman A., Eskenazi B. (2011) Association of prenatal exposure to polybrominated diphenyl ethers and infant birth weight. *Am J Epidemiol.* 174(8):885-892
- ⁸ Chevrier J., Harley K. G., Bradman A., Gharbi M., Sjodin A., Eskenazi B. (2010) Polybrominated diphenyl ether (PBDE) flame retardants and thyroid hormone during pregnancy. *Environ Health Perspect.* 118(10):1444-1449
- ⁹ Eskenazi B., Chevrier J., Rauch S. A., Kogut K., Harley K. G., Johnson C., Trujillo C., Sjodin A., Bradman A. (2012) In utero and childhood polybrominated diphenyl ether (PBDE) exposures and neurodevelopment in the CHAMACOS study. *Environ Health Perspect.* 121(2):257-262
- ¹⁰ Stapleton H. M., Eagle S., Anthopolos R., Wolkin A., Miranda M. L. (2011) Associations between polybrominated diphenyl ether (PBDE) flame retardants, phenolic metabolites, and thyroid hormones during pregnancy. *Environ Health Perspect.* 119(10):1454-1459
- ¹¹ Zota A. R., Park J. S., Wang Y., Petreas M., Zoeller R. T., Woodruff T. J. (2011) Polybrominated diphenyl ethers, hydroxylated polybrominated diphenyl ethers, and measures of thyroid

function in second trimester pregnant women in California. *Environ Sci Technol.* 45(18):7896-7905. doi: 10.1021/es200422b

¹² Chao H. R., Wang S. L., Lee W. J., Wang Y. F., Papke O. (2007) Levels of polybrominated diphenyl ethers (PBDEs) in breast milk from central Taiwan and their relation to infant birth outcome and maternal menstruation effects. *Environ Int.* 33(2):239-245

¹³ Herbstman J. B., Sjolín S., Kurzon M., Lederman S. A., Jones R. S., Raugh V., Needham L. L., Tang D., Niedzwiecki M., Wang R. Y., Perera F. (2010) Prenatal exposure to PBDEs and neurodevelopment. *Environ Health Perspect.* 118(5):712-719

¹⁴ Gascon M., Fort M., Martinez D., Carcin A. E., Fornis J., Grimalt J. O., Santa Marina L., Lertxundi N., Sunyer J., Vrijheid M. (2012) Polybrominated diphenyl ethers (PBDEs) in breast milk and neurophysiological development in infants. *Environ Health Perspect.* 120(12):1760-1765

¹⁵ Gascon M., Vrijheid M., Martinez D., Fornis J., Grimalt J. O., Torrent M., Sunyer J. (2011) Effects of pre and postnatal exposure to low levels of polybromodiphenyl ethers on neurodevelopment and thyroid hormone levels at 4 years of age. *Environ Int.* 37(3):605-611

¹⁶ Roze E., Meijer L., Bakker A., Van Braeckel K. N., Sauer P. J., Bos A. F. (2009) Prenatal exposure to organohalogens, including brominated flame retardants, influences motor, cognitive, and behavioral performance at school age. *Environ Health Perspect.* 117(12):1953-1958. doi: 10.1289/ehp.0901015

¹⁷ Hoffman K., Adgent M., Goldman B. D., Sjödin A., Daniels J. L. (2012) Lactational exposure to polybrominated diphenyl ethers and its relation to social and emotional development among toddlers. *Environ Health Perspect.* 120(10):1438-1442. doi: 10.1289/ehp.1205100

¹⁸ Costa L. G., Giordano G. (2007) Developmental neurotoxicity of polybrominated diphenyl ether (PBDE) flame retardants. *Neurotoxicology.* 28(6):1047-1067

¹⁹ Jurewicz J., Polańska K., Hanke W. (2013) Exposure to widespread environmental toxicants and children's cognitive development and behavioral problems. *Int J Occup Med Environ Health.* 26(2):185-204. doi: 10.2478/s13382-013-0099-x

²⁰ Akutsu K., Takatori S., Nozawa S., Yoshiike M., Nakazawa H., Hayakawa K., Makino T., Iwamoto T. (2008) Polybrominated diphenyl ethers in human serum and sperm quality. *Bull Environ Contam Toxicol.* 80(4):345-350. doi: 10.1007/s00128-008-9370-4

²¹ Johnson P. I., Stapleton H. M., Mukherjee B., Hauser R., Meeker J. D. (2013) Associations between brominated flame retardants in house dust and hormone levels in men. *Sci Total Environ.* 445-446:177-184. doi: 10.1016/j.scitotenv.2012.12.017

²² Meeker J. D., Johnson P. I., Camann D., Hauser R. (2009) Polybrominated diphenyl ether (PBDE) concentrations in house dust are related to hormone levels in men. *Sci Total Environ.* 407(10):3425-3429. doi: 10.1016/j.scitotenv.2009.01.030

²³ Meeker J. D., Stapleton H. M. (2010) House dust concentrations of organophosphate flame retardants in relation to hormone levels and semen quality parameters. *Environ Health Perspect.* 118(3):318-323. doi: 10.1289/ehp.0901332

²⁴ Toppari J. (2012) Male reproductive health as a sentinel for environmental endocrine disruption. *Acta Vet Scand.* 54(Suppl. 1)

²⁵ Krysiak-Baltyn K., Toppari J., Skakkebaek N. E., Jensen T. S., Virtanen H. E., Schramm K. W., Shen H., Vartiainen T., Kiviranta H., Taboureau O., Audouze K., Brunak S., Main K. M. (2012)

Association between chemical pattern in breast milk and congenital cryptorchidism: modeling of complex human exposures. *Int J Androl.* 35(2):294-302. doi: 10.1111/j.1365-2605.2012.01268.x

²⁶ Chen A., Chung E., DeFranco E. A., Pinney S. M., Dietrich K. N. (2011) Serum PBDEs and age at menarche in adolescent girls: analysis of the National Health and Nutrition Examination Survey 2003-2004. *Environ Res.* 111(6):831-837. doi: 10.1016/j.envres.2011.05.016

²⁷ Bellés M., Alonso V., Linares V., Albina M. L., Sirvent J. J., Domingo J. L., Sánchez D. J. (2010) Behavioral effects and oxidative status in brain regions of adult rats exposed to BDE-99. *Toxicol Lett.* 194(1-2):1-7. doi: 10.1016/j.toxlet.2010.01.010

²⁸ Eriksson P., Viberg H., Jakobsson E., Orn U., Fredriksson A. (2002) A brominated flame retardant, 2,2',4,4',5-pentabromodiphenyl ether: uptake, retention, and induction of neurobehavioral alterations in mice during a critical phase of neonatal brain development. *Toxicol Sci.* 67(1):98-103

²⁹ Fujimoto H., Woo G. H., Inoue K., Takahashi M., Hirose M., Nishikawa A., Shibutani M. (2011) Impaired oligodendroglial development by decabromodiphenyl ether in rat offspring after maternal exposure from mid-gestation through lactation. *Reprod Toxicol.* 31(1):86-94. doi: 10.1016/j.reprotox.2010.09.003

³⁰ Johansson N., Viberg H., Fredriksson A., Eriksson P. (2008) Neonatal exposure to decabrominated diphenyl ether (PBDE 209) causes dose-response changes in spontaneous behaviour and cholinergic susceptibility in adult mice. *Neurotoxicology.* 29(6):911-919. doi: 10.1016/j.neuro.2008.09.008

³¹ Koenig C. M., Lango J., Pessah I. N., Berman R. F. (2012) Maternal transfer of BDE-47 to offspring and neurobehavioral development in C57BL/6J mice. *Neurotoxicol Teratol.* 34(6):571-80. doi: 10.1016/j.ntt.2012.09.005

³² Liang S. X., Gao H. X., Zhao Y. Y., Ma X. M., Sun H. W. (2010) Effects of repeated exposure to decabrominated diphenyl ether (BDE-209) on mice nervous system and its self repair. *Environ Toxicol Pharmacol.* 29(3):297-301. doi: 10.1016/j.etap.2010.02.005

³³ Mariussen E., Fonnum F. (2003) The effect of brominated flame retardants on neurotransmitter uptake into rat brain synaptosomes and vesicles. *Neurochem Int.* 43(4-5):533-542

³⁴ Rice D. C., Reeve E. A., Herlihy A., Zoeller R. T., Thompson W. D., Markowski V. P. (2007) Developmental delays and locomotor activity in the C57BL6/J mouse following neonatal exposure to the fully-brominated PBDE, decabromodiphenyl ether. *Neurotoxicol Teratol.* 29(4):511-520

³⁵ Suvorov A., Takser L. (2011) Delayed response in the rat frontal lobe transcriptome to perinatal exposure to the flame retardant BDE-47. *J Appl Toxicol.* 31(5):477-483. doi: 10.1002/jat.1667

³⁶ Viberg H., Fredriksson A., Eriksson P. (2007) Changes in spontaneous behaviour and altered response to nicotine in the adult rat, after neonatal exposure to the brominated flame retardant, decabrominated diphenyl ether (PBDE 209). *Neurotoxicology.* 28(1):136-142

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KIM HARLEY

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Berkeley, CA 94707
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CURRENT POSITIONS

Associate Adjunct Professor, Maternal and Child Health Division
School of Public Health, U.C. Berkeley

Associate Director for Health Effects, Center for Environmental Research and Children's Health
School of Public Health, U.C. Berkeley

EDUCATION

Ph.D. **University of California at Berkeley**
Epidemiology, 2004

Dissertation: *Examining an Epidemiologic Paradox: The Role of Acculturation, Nutrition, and Social Support in the Birth Outcomes of Women of Mexican Descent*

M.P.H. **University of California at Berkeley**
Maternal and Child Health, 1998

Thesis: *Maternity Hospital Practices that Affect Breastfeeding at Four Months in Egypt*

B.A. **Vassar College**
Anthropology, 1992

Independent Study Project: *Modern Magic: Medical Care in Rural Bali*

RESEARCH INTERESTS

- Reproductive and perinatal epidemiology
- Endocrine disruptor exposure to adolescent girls and effects on puberty and fertility
- Reproductive and developmental effects of Bisphenol A, PBDEs, pesticides, and other endocrine disruptors

TEACHING EXPERIENCE

Spring 2008 - Present	Instructor, Practical Issues in Maternal and Child Health Data Analysis (PH 293-6)	UC Berkeley
Spring 2007 - Present	Instructor, Reproductive and Perinatal Epidemiology (PH 210D)	UC Berkeley
Spring 2004 Spring 2003	Graduate Student Instructor, Reproductive and Perinatal Epidemiology (PH 210D)	UC Berkeley
Fall 2000	Graduate Student Instructor, Epidemiologic Methods II (PH 250B)	UC Berkeley

MENTORING EXPERIENCE (MASTER'S PROJECT COMMITTEE)

2012-2013	Mariko Sweetnam (Committee Chair) Ayca Erkin-Cakmak Kristina Kastler Emily Murphy
2011-2012	Rasika Behl (Committee Chair) Shayla Livingston (Committee Chair) Brett Augspurger Vidita Chopra Marlowe Dieckmann
2010-2011	Alison Gemmill (Committee Chair) Jocelyn Audelo Dewight Cowley Aarti Kale Hannah Sheehy Emilia Wilkins
2009-2010	Maria Elena Young Hatav Khademi Elizabeth Cretti
2008-2009	Lauren Hubner
2007-2008	Celina Trujillo
2006-2007	Jennifer Wright

RESEARCH EXPERIENCE

1998-present	CENTER FOR CHILDREN'S ENVIRONMENTAL HEALTH RESEARCH U.C. Berkeley Associate Director (2007-present)
	<ul style="list-style-type: none"> • Manage research study investigating the health of pregnant women and children in a farmworker community. (Salinas Valley, CA) • Supervise staff of study coordinator, data analysts, interviewers, graduate students. • Devise research questions, design studies, oversee data collection • Analyze data, author scientific research articles • Present research findings to scientists, public health providers, funders. • Write grant applications and reports to funders.
	Study Coordinator (2004-2007), Researcher/Graduate Student (1998-2004)

OTHER PUBLIC HEALTH EXPERIENCE

2008-2010	ENVIRONMENTAL HEALTH SCIENCES Charlottesville, VA Science Communication Fellow
	<ul style="list-style-type: none"> • Work with media relations and policy experts to advance public understanding of environmental health issues. • Identify scientific studies to be prioritized for media attention. • Translate and explain relevance of findings for journalists.

- Summer 1997 **WELLSTART INTERNATIONAL** San Diego, CA
Evaluation and Resource Development Consultant
- Fundraising and grant-writing for public health non-profit organization.
 - Evaluated changes in breastfeeding practices over a ten-year international promotion project.
 - Conducted cost-benefit analysis of breastfeeding promotion in US hospitals.
- 1993-1996 **PROJECT CONCERN INTERNATIONAL** San Diego, CA
Grants Coordinator (1996)
- Managed grant proposal submissions, resulting in \$800,000 for international public health programs.
 - Monitored progress, ensured grant obligations were met, represented Project Concern to donors.
 - Coordinated proposal and report writing process, collaborated with overseas staff and headquarters staff in fundraising, program and finance departments.
 - Supervised two full-time employees and one part-time employee.
- Foundation Grants Officer** (1994 - 1995), **Corporate Grants Officer** (1993 - 1994)
- 1992-1993 **JOHN SNOW INC.** Arlington, VA
Staff Associate
- Coordinated USAID-funded shipments of contraceptives to developing nations.
 - Responsible for processing USAID missions' contraceptive orders, tracking the progress of shipments and communicating instructions to shipping company.
 - Provided headquarters support to overseas advisors.

GRANT SUPPORT

Decreasing Endocrine Disruptor Exposure in Latina Teens (HERMOSA Study)

Principal Investigator: K. Harley

Grant Number: 18BB1800 Funder: CA Breast Cancer Research Amount: \$646,431

Grant Period: 9/30/2009 - 7/31/2011

Role: PI

Bisphenol A and Children's Growth and Development

Principal Investigator: K. Harley and B. Eskenazi (Multiple PIs)

Grant Number: 1RC2ES018792 Funder: NIEHS Amount: \$1,493,880

Grant Period: 9/30/2009 - 7/31/2011

Role: PI

Administrative Supplement to Bisphenol A and Children's Growth and Development

Principal Investigator: K. Harley

Grant Number: 3RC2ES018792-S1 Funder: NIEHS Amount: \$76,620

Grant Period: 5/28/2010 - 7/31/2011

Role: PI

Center for Children's Environmental Health Research

Principal Investigator: B. Eskenazi

Grant Number: PO1 ES009605 Funder: NIEHS/EPA Amount: \$4,160,551

Grant Period: 9/24/2009 - 7/31/2014

Role: Co-investigator

DDT & PBDE Exposure, Puberty Onset, and Neurodevelopment in Mexican-American Girls.

Principal Investigator: B. Eskenazi
Grant Number: RO1 ES017054 Funder: NIEHS Amount: \$3,285,313
Grant Period: 8/1/2009 – 4/30/2014
Role: Co-investigator

PBDEs, DDT and Neurodevelopment in School-Aged Mexican-American Children

Principal Investigator: B. Eskenazi
Grant Number: RO1 ES015572 Funder: NIEHS Amount: \$1,960,631
Grant Period: 8/7/2007 – 4/30/2011
Role: Co-investigator

PON1 and Developmental Sensitivity to OP Pesticides

Principal Investigator: N. Holland
Grant Number: RO1 ES012503 Funder: NIEHS Amount: \$1,748,016
Grant Period: 1/1/2006 – 12/31/2010
Role: Co-investigator

PROFESSIONAL AFFILIATIONS

International Society for Environmental Epidemiology

PROFESSIONAL SERVICE

Reviewer: American Journal of Epidemiology, Environmental Health Perspectives, Environmental Health, Journal of Exposure Science and Environmental Epidemiology.

Publication List – Kim Harley

1. Eskenazi, B. and **Harley, K.** (2001). Commentary: Revisiting the primipaternity theory of pre-eclampsia. *International Journal of Epidemiology*, 30(6): p. 1323-1324.
2. Eskenazi, B., **Harley, K.**, Bradman, A., Weltzien, E., Jewell, N.A., Barr, D.B., Furlong, C.E., and Holland, N.T. (2004). Association of in utero organophosphate pesticide exposure and fetal growth and length of gestation in an agricultural population. *Environmental Health Perspectives*, 112(10): p. 1116-1124.
3. **Harley, K.**, Eskenazi, B., and Block, G. (2005). The association of time in the US and diet during pregnancy in low-income women of Mexican descent. *Paediatric and Perinatal Epidemiology*, 19(2): p. 125-134.
4. Duramad, P., **Harley, K.**, Lipsett, M., Bradman, A., Eskenazi, B., Holland, N.T., and Tager, I.B. (2006). Early environmental exposures and intracellular Th1/Th2 cytokine profiles in 24-month-old children living in an agricultural area. *Environmental Health Perspectives*, 114(12): p. 1916-1922.
5. Fenster, L., Eskenazi, B., Anderson, M., Bradman, A., **Harley, K.**, Hernandez, H., Hubbard, A., and Barr, D.B. (2006). Association of in utero organochlorine pesticide exposure and fetal growth and length of gestation in an agricultural population. *Environmental Health Perspectives*, 114(4): p. 597-602.
6. **Harley, K.** and Eskenazi, B. (2006). Time in the United States, social support and health behaviors during pregnancy among women of Mexican descent. *Social Science & Medicine*, 62(12): p. 3048-3061.
7. Warner, M.L., **Harley, K.**, Bradman, A., Vargas, G., and Eskenazi, B. (2006). Soda consumption and overweight status of 2-year-old Mexican-American children in California. *Obesity*, 14(11): p. 1966-1974.
8. Eskenazi, B., Marks, A.R., Bradman, A., **Harley, K.**, Barr, D.B., Johnson, C., Morga, N., and Jewell, N.A. (2007). Organophosphate pesticide exposure and neurodevelopment in young Mexican-American children. *Environmental Health Perspectives*, 115(5): p. 792-798.
9. **Harley, K.**, Stamm, N.L., and Eskenazi, B. (2007). The effect of time in the US on the duration of breastfeeding in women of Mexican descent. *Maternal and Child Health Journal*, 11(2): p. 119-125.
10. Eskenazi, B., Rosas, L.G., Marks, A.R., Bradman, A., **Harley, K.**, Holland, N., Johnson, C., Fenster, L., and Barr, D.B. (2008). Pesticide toxicity and the developing brain. *Basic & Clinical Pharmacology & Toxicology*, 102(2): p. 228-236.
11. **Harley, K.G.**, Marks, A.R., Bradman, A., Barr, D.B., and Eskenazi, B. (2008). DDT exposure, work in agriculture, and time to pregnancy among farmworkers in California. *J Occup Environ Med*, 50(12): p. 1335-42.

12. **Harley, K.G.**, Macher, J.M., Lipsett, M., Duramad, P., Holland, N.T., Prager, S.S., Ferber, J., Bradman, A., Eskenazi, B., and Tager, I.B. (2009). Fungi and pollen exposure in the first months of life and risk of early childhood wheezing. *Thorax*, 64(4): p. 353-8.
13. Huen, K., **Harley, K.**, Brooks, J., Hubbard, A., Bradman, A., Eskenazi, B., and Holland, N. (2009). Developmental changes in PON1 enzyme activity in young children and effects of PON1 polymorphisms. *Environ Health Perspect*, 117(10): p. 1632-8.
14. Rosas, L.G., **Harley, K.**, Fernald, L.C., Guendelman, S., Mejia, F., Neufeld, L.M., and Eskenazi, B. (2009). Dietary Associations of Household Food Insecurity among Children of Mexican Descent: Results of a Binational Study. *J Am Diet Assoc*, 109(12): p. 2001-9.
15. Chevrier, J., **Harley, K.G.**, Bradman, A., Gharbi, M., Sjodin, A., and Eskenazi, B. (2010). Polybrominated diphenyl ether (PBDE) flame retardants and thyroid hormone during pregnancy. *Environ Health Perspect*, 118(10): p. 1444-9.
16. Eskenazi, B., Huen, K., Marks, A., **Harley, K.G.**, Bradman, A., Barr, D.B., and Holland, N. (2010). PON1 and Neurodevelopment in Children from the CHAMACOS Study Exposed to Organophosphate Pesticides in Utero. *Environ Health Perspect*, 118(12): p. 1775-81.
17. **Harley, K.G.**, Marks, A.R., Chevrier, J., Bradman, A., Sjodin, A., and Eskenazi, B. (2010). PBDE concentrations in women's serum and fecundability. *Environ Health Perspect*, 118(5): p. 699-704.
18. Huen, K., **Harley, K.**, Bradman, A., Eskenazi, B., and Holland, N. (2010). Longitudinal changes in PON1 enzymatic activities in Mexican-American mothers and children with different genotypes and haplotypes. *Toxicol Appl Pharmacol*.
19. Marks, A.R., **Harley, K.**, Bradman, A., Kogut, K., Barr, D.B., Johnson, C., Calderon, N., and Eskenazi, B. (2010). Organophosphate Pesticide Exposure and Attention in Young Mexican-American Children: The CHAMACOS Study. *Environ Health Perspect*, 118(12): p. 1768-74.
20. Rosas, L.G., **Harley, K.G.**, Guendelman, S., Fernald, L.C., Mejia, F., and Eskenazi, B. (2010). Maternal perception of child weight among Mexicans in California and Mexico. *Matern Child Health J*, 14(6): p. 886-94.
21. Weldon, R.H., Webster, M., **Harley, K.G.**, Bradman, A., Fenster, L., Davis, M.D., Hubbard, A., Barr, D.B., Holland, N., and Eskenazi, B. (2010). Serum Persistent Organic Pollutants and Duration of Lactation among Mexican-American Women. *J Environ Public Health*, doi: 10.1155/2010/861757 [Online: July 31, 2010]: p. 861757.
22. Bouchard, M.F., Chevrier, J., **Harley, K.G.**, Kogut, K., Vedar, M., Calderon, N., Trujillo, C., Johnson, C., Bradman, A., Barr, D.B., and Eskenazi, B. (2011). Prenatal exposure to organophosphate pesticides and IQ in 7-year-old children. *Environ Health Perspect*, 119(8): p. 1189-95.
23. Bradman, A., Castorina, R., Barr, D.B., Chevrier, J., Harnly, M.E., Eisen, E.A., McKone, T.E., **Harley, K.**, Holland, N., and Eskenazi, B. (2011). Determinants of

organophosphorus pesticide urinary metabolite levels in young children living in an agricultural community. *Int J Environ Res Public Health*, 8(4): p. 1061-83.

24. Castorina, R., Bradman, A., Sjodin, A., Fenster, L., Jones, R.S., **Harley, K.G.**, Eisen, E.A., and Eskenazi, B. (2011). Determinants of serum polybrominated diphenyl ether (PBDE) levels among pregnant women in the CHAMACOS cohort. *Environ Sci Technol*, 45(15): p. 6553-60.
25. Chevrier, J., **Harley, K.G.**, Bradman, A., Sjodin, A., and Eskenazi, B. (2011). Prenatal exposure to polybrominated diphenyl ether flame retardants and neonatal thyroid-stimulating hormone levels in the CHAMACOS study. *Am J Epidemiol*, 174(10): p. 1166-74.
26. Chevrier, J., **Harley, K.G.**, Kogut, K., Holland, N., Johnson, C., and Eskenazi, B. (2011). Maternal Thyroid Function during the Second Half of Pregnancy and Child Neurodevelopment at 6, 12, 24, and 60 Months of Age. *J Thyroid Res*, 2011: p. 426427.
27. **Harley, K.G.**, Chevrier, J., Schall, R.A., Sjodin, A., Bradman, A., and Eskenazi, B. (2011). Association of prenatal exposure to polybrominated diphenyl ethers and infant birth weight. *Am J Epidemiol*, 174(8): p. 885-92.
28. **Harley, K.G.**, Huen, K., Schall, R.A., Holland, N.T., Bradman, A., Barr, D.B., and Eskenazi, B. (2011). Association of organophosphate pesticide exposure and paraoxonase with birth outcome in Mexican-American women. *PLoS One*, 6(8): p. e23923.
29. Rosas, L.G., Guendelman, S., **Harley, K.**, Fernald, L.C., Neufeld, L., Mejia, F., and Eskenazi, B. (2011). Factors associated with overweight and obesity among children of Mexican descent: results of a binational study. *J Immigr Minor Health*, 13(1): p. 169-80.
30. Bradman, A., Castorina, R., Sjodin, A., Fenster, L., Jones, R.S., **Harley, K.G.**, Chevrier, J., Holland, N.T., and Eskenazi, B. (2012). Factors associated with serum polybrominated diphenyl ether (PBDE) levels among school-age children in the CHAMACOS cohort. *Environ Sci Technol*, 46(13): p. 7373-81.
31. Ehrlich, S.F., Rosas, L.G., Ferrara, A., King, J.C., Abrams, B., **Harley, K.G.**, Hedderson, M.M., and Eskenazi, B. (2012). Pregnancy glucose levels in women without diabetes or gestational diabetes and childhood cardiometabolic risk at 7 years of age. *J Pediatr*, 161(6): p. 1016-21.
32. Gonzalez, V., Huen, K., Venkat, S., Pratt, K., Xiang, P., **Harley, K.G.**, Kogut, K., Trujillo, C.M., Bradman, A., Eskenazi, B., and Holland, N.T. (2012). Cholinesterase and paraoxonase (PON1) enzyme activities in Mexican-American mothers and children from an agricultural community. *J Expo Sci Environ Epidemiol*, 22(6): p. 641-8.
33. Huen, K., Bradman, A., **Harley, K.**, Yousefi, P., Boyd Barr, D., Eskenazi, B., and Holland, N. (2012). Organophosphate pesticide levels in blood and urine of women and newborns living in an agricultural community. *Environ Res*, 117: p. 8-16.
34. Chevrier, J., Gunier, R.B., Bradman, A., Holland, N.T., Calafat, A.M., Eskenazi, B., and **Harley, K.G.** (2013). Maternal urinary bisphenol a during pregnancy and maternal and

- neonatal thyroid function in the CHAMACOS study. *Environ Health Perspect*, 121(1): p. 138-44.
35. Ehrlich, S.F., Rosas, L.G., Ferrara, A., King, J.C., Abrams, B., **Harley, K.G.**, Hedderson, M.M., and Eskenazi, B. (2013). Pregnancy Glycemia in Mexican-American Women Without Diabetes or Gestational Diabetes and Programming for Childhood Obesity. *Am J Epidemiol*.
 36. Eskenazi, B., Chevrier, J., Rauch, S.A., Kogut, K., **Harley, K.G.**, Johnson, C., Trujillo, C., Sjodin, A., and Bradman, A. (2013). In utero and childhood polybrominated diphenyl ether (PBDE) exposures and neurodevelopment in the CHAMACOS study. *Environ Health Perspect*, 121(2): p. 257-62.
 37. *Gemmil, A., Gunier, R.B., Bradman, A., Eskenazi, B., and **Harley, K.G.** (2013). Residential proximity to methyl bromide use and birth outcomes in an agricultural population in California. *Environ Health Perspect*, 121(6): p. 737-43.
 38. Gunier, R.B., Bradman, A., Jerrett, M., Smith, D.R., **Harley, K.G.**, Austin, C., Vedar, M., Arora, M., and Eskenazi, B. (2013). Determinants of Manganese in Prenatal Dentin of Shed Teeth from CHAMACOS Children Living in an Agricultural Community. *Environ Sci Technol*, 47(19): p. 11249-11257.
 39. **Harley, K.G.**, Aguilar Schall, R., Chevrier, J., Tyler, K., Aguirre, H., Bradman, A., Holland, N.T., Lustig, R.H., Calafat, A.M., and Eskenazi, B. (2013). Prenatal and Postnatal Bisphenol A Exposure and Body Mass Index in Childhood in the CHAMACOS Cohort. *Environ Health Perspect*.
 40. Harley, K.G., Gunier, R.B., Kogut, K., Johnson, C., Bradman, A., Calafat, A.M., and Eskenazi, B. (2013). Prenatal and early childhood bisphenol A concentrations and behavior in school-aged children. *Environ Res*.
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 43. *Volberg, V., **Harley, K.**, Calafat, A.M., Dave, V., McFadden, J., Eskenazi, B., and Holland, N. (2013). Maternal bisphenol A exposure during pregnancy and its association with adipokines in Mexican-American children. *Environ Mol Mutagen*, 54(8): p. 621-628.
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 45. *Volberg, V., Heggseth, B., **Harley, K.**, Huen, K., Yousefi, P., Dave, V., Tyler, K., Vedar, M., Eskenazi, B., and Holland, N. (2013). Adiponectin and leptin trajectories in Mexican-American children from birth to 9 years of age. *PLoS One*, 8(10): p. e77964.

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52. Huen, K., Yousefi, P., Bradman, A., Yan, L., **Harley, K.G.**, Kogut, K., Eskenazi, B., and Holland, N. (2014). Effects of age, sex, and persistent organic pollutants on DNA methylation in children. *Environ Mol Mutagen*, 55(3): p. 209-22.
53. Warner, M., Wesselink, A., **Harley, K.G.**, Bradman, A., Kogut, K., and Eskenazi, B. (2014). Prenatal exposure to dichlorodiphenyltrichloroethane and obesity at 9 years of age in the CHAMACOS study cohort. *Am J Epidemiol*, 179(11): p. 1312-22.
54. Eskenazi, B., Kogut, K., Huen, K., **Harley, K.G.**, Bouchard, M., Bradman, A., Boyd-Barr, D., Johnson, C., and Holland, N. (2014). Organophosphate pesticide exposure, PON1, and neurodevelopment in school-age children from the CHAMACOS study. *Environ Res*, 134C: p. 149-157.

* Student paper

Exhibit G

Statement of Julie Herbstman



Statement for Julie Herbstman

June 11, 2014

I, Julie Herbstman, am writing this statement in support of the Petition to the CPSC to regulate four categories of household products containing non-polymeric additive organohalogen flame retardants.

1. I am an environmental epidemiologist, currently holding the position of Assistant Professor in the Department of Environmental Health Sciences at the Columbia University Mailman School of Public Health. I completed a master's of science (ScM) and a doctoral degree (PhD) in environmental epidemiology from the Johns Hopkins Bloomberg School of Public Health. I completed a postdoctoral fellowship in environmental health at the Columbia Mailman School of Public Health before joining the faculty. At Columbia, I am affiliated with the Columbia Center for Children's Environmental Health, the Columbia Center for Environmental Health in Northern Manhattan, and the Cancer Epidemiology Program at the Herbert Irving Comprehensive Cancer Center at the Columbia University Medical Center.

2. Since 2002, I have been studying the impact of prenatal exposure to polybrominated diphenyl ethers (PBDE) on children's thyroid hormone levels and neurodevelopment, first at Hopkins and now at Columbia. In my research, I have collected umbilical cord blood and have worked with the Centers for Disease Control and Prevention (CDC) to measure PBDE components (congeners) associated with the penta-brominated diphenyl ether (penta-BDE) mixture. I have found that all the neonates in my research studies in Baltimore and in New York had detectable levels of at least one penta-BDE congener in their cord blood [1,2]. We found evidence suggesting that prenatal exposure to penta-BDE congeners may impact perinatal thyroid hormone levels [3]. We also found that children who were exposed prenatally to higher concentrations of penta-BDE congeners (relative to children in the study with lower exposure) scored significantly lower on cognitive tests, including such tests as full-scale, verbal, and performance intelligence quotient (IQ) at ages 4 and 7 [1].

3. Based on this evidence along with evidence provided by other researchers in the field, I conclude that generally, infants in the US are born with detectable concentrations of penta-BDE in their circulating blood. This occurs because the mothers are exposed to penta-BDE either before or during pregnancy, and these chemicals are then transferred to the neonates while *in utero*. Additional research has shown that children's exposure to penta-BDE continues through the ingestion of penta-BDE-containing breast milk [4] and household dust [5]. Research shows that it is likely that penta-BDE in dust is the result of penta-BDE added to consumer products like furniture, toys, and electronics, which subsequently migrates into the household environment. I can conclude from this that other organohalogen flame retardants found in additive form in household consumer products also have the potential to migrate, leading to human exposure, especially in children.

4. Based on my research and the research of other investigators in the field, there is ample evidence indicating that prenatal exposure to penta-BDEs is associated with lower scores on indices of both cognition (e.g., IQ) and behavior throughout childhood. Since PBDEs have been phased out of use in new consumer products, new

compounds have been used instead. Some of these compounds are also organohalogen flame retardants, meaning they are in the same chemical family as PBDEs and other flame retardants that have been banned or phased out (e.g., brominated tris).

5. I have carefully reviewed the statement from Dr. Terry Collins about the toxicity mechanisms of organohalogen flame retardants, and the hazard screen performed by Dr. David Eastmond's group on 85 non-polymeric organohalogen flame retardants. Based on the information in these statements and my research and experience as an environmental epidemiologist, my professional opinion is that there is reason to be concerned that the entire class of organohalogen flame retardants may cause injury or illness to humans, particularly to fetuses and young children. Therefore, I support regulations designed to prevent human exposure to these chemicals from consumer products.

Sincerely,

Julie Herbstman, Ph.D.

References

1. Herbstman JB, Sjodin A, Kurzon M, Lederman SA, Jones RS, et al. (2010) Prenatal exposure to PBDEs and neurodevelopment. *Environ Health Perspect* 118: 712-719.
2. Herbstman JB, Sjodin A, Apelberg BJ, Witter FR, Patterson DG, et al. (2007) Determinants of prenatal exposure to polychlorinated biphenyls (PCBs) and polybrominated diphenyl ethers (PBDEs) in an urban population. *Environ Health Perspect* 115: 1794-1800.
3. Herbstman JB, Sjodin A, Apelberg BJ, Witter FR, Halden RU, et al. (2008) Birth delivery mode modifies the associations between prenatal polychlorinated biphenyl (PCB) and polybrominated diphenyl ether (PBDE) and neonatal thyroid hormone levels. *Environ Health Perspect* 116: 1376-1382.
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5. Stapleton HM, Eagle S, Sjödin A, Webster TF. (2012) Serum PBDEs in a North Carolina toddler cohort: associations with handwipes, house dust, and socioeconomic variables. *Environ Health Perspect* 120(7): 1049-1054.

Julie Beth Herbstman

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TRAINING:

Columbia University, Mailman School of Public Health, New York, NY 2006-2010
Postdoctoral Research Fellow
Columbia Center for Children's Environmental Health
Mentor: Dr. Frederica P. Perera, DrPH

Johns Hopkins University, Bloomberg School of Public Health, Baltimore, MD 2007
PhD, Environmental Epidemiology (degree completed: June 2006)
Dissertation: "Prenatal Exposure to Polybrominated Diphenyl Ethers:
Effect on Birth Weight, Gestational Age, and Thyroid
Function"
Advisor: Dr. Lynn R. Goldman, MD MPH

Johns Hopkins University, School of Public Health, Baltimore, MD 2002
ScM, Epidemiology
Thesis: "Respiratory Effects of Inhalation Exposure Among Workers
During the Clean-Up Effort at the World Trade Center Disaster
Site"
Advisor: Dr. Margo Schwab, PhD

Johns Hopkins University, School of Public Health, Baltimore, MD 2001
Certificate in Risk Sciences and Public Policy

Tufts University, Medford, MA 1998
B.A. (*cum laude*), Major: Comparative Religion; Minor: Engineering
Science; Certificate in Community Health

FELLOWSHIPS AND AWARDS:

Career Development Award 2012-2014
*Center for Environmental Health in Northern Manhattan,
Columbia University*

K99-R00 "Pathway to Independence" Career Development Award (NIEHS) 2009-2014
Sponsor (for K99 phase): Dr. Frederica Perera

National Cancer Institute Postdoctoral Fellowship 2006-2009
Principal Investigator: Dr. Alfred Neugut

Center for a Livable Future Research Award 2004, 2005
Principal Investigator: Dr. Lynn Goldman

Doctoral Fellowship in Environmental Public Health Tracking 2004-2005
Principal Investigator: Dr. Thomas Burke

The Charlotte Ferenze Fellowship 2004
Johns Hopkins Department of Epidemiology

Maternal Child Health – Epidemiology Fellowship in Applied Epidemiology	2003-2004
<i>Principal Investigator: Dr. Pat O’Campo</i>	
National Cancer Institute Summer Fellowship	2001
<i>Mentor: Dr. Montserrat Garcia-Closas</i>	
 <u>SCIENCE ADVISORY BOARD/REVIEW PANELS:</u>	
Columbia’s Center for Environmental Health in Northern Manhattan, Pilot grant review	2012
Einstein-Montefiore Institute for Clinical and Translational Research, Mentored Clinical and Translational Research Career Development Awards review	2012
University of Michigan Environmental Health Science Core Center, Pilot grant review	2012
Harvard School of Public Health NIEHS Center, Pilot grant review	
NIEHS R13 Peer Review Panel	October 2012
U.S. EPA Science Advisory Board Panel on Perchlorate	2012-2013
NIH, Infectious Disease, Reproductive Health, Asthma and Pulmonary Conditions Study Section (IRAP), Ad Hoc Member	June 2013
New York Academy of Sciences, Scientific conferences review	2013
Canadian Institutes of Health Research, external reviewer.	2013
NIH, Neurological, Aging, Musculoskeleton, and Epidemiology Study Section (NAME), Ad Hoc Member	October 2014
South African Medical Research Council (MRC), external reviewer.	2014
 <u>RESEARCH EXPERIENCE:</u>	
Assistant Professor	2010-present
Research Fellow/Scientist	2006-2010
Columbia Center for Children’s Environmental Health	
NIEHS Center for Environmental Health in Northern Manhattan	
Herbert Irving Cancer Center Member	
Department of Environmental Health Sciences	
Columbia Mailman School of Public Health	
New York, NY	
 Research Investigator	 2006-present
Research Assistant	2003-2006
“Tracking Health Related to Environmental Exposures” (THREE) Study	
Department of Environmental Health Sciences	
Johns Hopkins Bloomberg School of Public Health	
Baltimore, MD	
 Research Fellow	 2003-2006
Johns Hopkins Center of Excellence in Environmental Health Tracking	
Department of Health Policy and Management	
Johns Hopkins Bloomberg School of Public Health	
Baltimore, MD	

Research Fellow	2001-2004
Johns Hopkins World Trade Center (WTC) Research Team Department of Environmental Health Sciences Johns Hopkins Bloomberg School of Public Health Baltimore, MD	
Research Intern, Environmental Epidemiology Branch	2001
Department of Cancer Epidemiology and Genetics National Cancer Institute Rockville, MD	
Research Assistant	2000
North Dakota Children's Health Study Department of Epidemiology Johns Hopkins School of Public Health Baltimore, MD	
Research Assistant	1998-2000
Nurses' Health Study Channing Laboratory Brigham and Women's Hospital Boston, MA	
Research Intern	1998
Silent Spring Institute Newton, MA	
<u>TEACHING EXPERIENCE:</u>	
Instructor, Postgraduate Course at the American Thoracic Society Meeting	2012, 2014
• The Epigenetics of Lung Disease (1 day)	
Instructor, Workshop in Risk Assessment and Molecular Epidemiology Shanghai Fudan University	2010
• Molecular Epidemiology (1 week)	
Course Director/Instructor, Department of Environmental Health Sciences	2006-Present
Columbia Mailman School of Public Health	
• Analysis of Environmental Data (2013, 2014), Course Director	
• Molecular Epidemiology (2006-present), Lecturer	
• Journal Club (2011), Lecturer	
Teaching Assistant, Department of Epidemiology	
Johns Hopkins Bloomberg School of Public Health	
• Introduction to Epidemiology (2 years)	2001-2002
• Intermediate Epidemiology (2 years)	2004
• Quantitative Methods (4 years)	2002-2005
• Health Services Research (1 year)	2003
Johns Hopkins Krieger School of Arts and Sciences	
• Introduction to Epidemiology (1 year)	2003

Instructor, Experimental College

Tufts University

- Freshman literature course (1 year) 1998

MENTORING/ADVISING (COLUMBIA UNIVERSITY, UNLESS NOTED):

Jelena Vujcic, MPH, Department of Epidemiology	2009
Susan Edwards, MPH, Department of Environmental Health Sciences	2009
Erin Paxson, MS, Department of Human Nutrition	2009
Jennifer Mall, MPH, Department of Environmental Health Sciences	2010
Steven Cook, MPH, Department of Environmental Health Sciences	2011
Rosie Martinez, MPH, Department of Environmental Health Sciences	2012-2014
Shoko Kubotera, MPH, Department of Environmental Health Sciences	2012-2014
Whitney Cowell, PhD candidate, Department of Environmental Health Sciences	2012-present
Kristin White, MPH, Department of Epidemiology	2012
Zaynah Abid, MPH, Yale School of Public Health	2012
Katherine Schleiss, MPH, Department of Epidemiology	2013
Madeleine Hopson, MPH, Department of Environmental Health Sciences	2013-present
Erin Eimutus, MPH, Department of Environmental Health Sciences	2014-present

SELECTED ORAL PRESENTATIONS:

Prenatal Programming and Toxicity (PPTox) IV: Environmental Stressors in Disease and Implications for Human Health. (2014, Boston, MA)

Title: Cell distribution prediction from DNA methylation data using a reference set derived from umbilical cord blood

Northeast Regional Chapter of the Society of Toxicology Annual Meeting: Toxicological Aspects of Epigenetics (2014, Storrs, CT)

Title: DNA methylation and the challenge of linking prenatal exposures to childhood health outcomes

Duke University Integrated Toxicology and Environmental Health Program Spring Symposium (2013, Durham, NC)

Title: Detecting Methylation Changes Associated with Prenatal Exposure to Air Pollutants

Third Symposium on Anesthesia and Neurodevelopment in Children (2012, New York, NY)

Title: Use of Epigenetic Analyses in Studies of Neurodevelopment

American Academy of Pediatrics Julius B. Richmond Center of Excellence Visiting Lectureship and Grand Rounds (2012, Baton Rouge, LA)

Title: Human Epigenetics of Air Pollution

NIEHS Core Centers Meeting: Young Investigator Presentation (2012, Boston, MA)

Title: Using Sibling Pairs to Identify PAH-related Methylation Differences

International Society for Environmental Epidemiology (2011, Barcelona, Spain)

Title: Prenatal Exposure to PBDEs and Child Behavior at 3-7 Years

12th Annual Brominated and Other Flame Retardants (2011, Boston, MA)

Title: PBDE Levels In Children Determined Longitudinally From Birth To Age 9

Dioxin 2010 (2010, San Antonio, TX)

Title: Prenatal Exposure to PBDEs and Neurodevelopment

Am. Assoc. of Cancer Research, Future of Molecular Epidemiology (2010, Miami, FL)

Title: Using sibling pairs to study the epigenetic effects of prenatal PAH exposure

International Society for Environmental Epidemiology (2009 Dublin, Ireland)

Title: Prenatal exposure to polycyclic aromatic hydrocarbons and CpG methylation

International Society for Environmental Epidemiology (2008 Pasadena, CA)

Title: Prenatal Exposure to PBDEs and Neurodevelopment

International Society for Environmental Epidemiology (2007 Mexico City, MX)

Title: PBDE Exposure, Maternal-Fetal Transfer and Birth Outcomes

American Public Health Association (2005 Philadelphia, PA)

Title: State Capacity to Address Non-Communicable Disease Clusters

Dioxin 2005 (2005 Toronto, ON)

Title: PCBs and PBDEs and Thyroid Hormone Levels in Umbilical Cord Blood in an Urban U.S. population: A Feasibility Study.

Johns Hopkins Center for a Livable Future Research Day (2005 Baltimore, MD)

Title: The Effect of Brominated Flame Retardants (PBDEs) on Thyroid Hormone Status, Birthweight and Gestational Age.

American Industrial Hygiene Association, Chesapeake Section (2002 Baltimore, MD)

Title: Respiratory Health of Rubble Removal Workers at the World Trade Center Disaster Site

International Society of Environmental Epidemiology (2002 Vancouver, BC)

Title: Respiratory Health of Rubble Removal Workers at the World Trade Center Disaster Site

Title: Comparison of Exposure Surrogates for Predicting Health Status among Rubble Removal Workers at the WTC Disaster Site.

RESEARCH INTERESTS:

Perinatal and developmental epidemiology, health effects of endocrine disrupting chemicals, neurodevelopment, environmental public health surveillance, cancer, and children's health

PEER-REVIEWED PUBLICATIONS:

Barr RG, **Herbstman J**, Speizer FE, Camargo CA Jr. Validation of self-reported chronic obstructive pulmonary disease in a cohort study of nurses. *American Journal of Epidemiology*. 2002 May 15;155(10):965-71. [PMID: 11994237]

Garcia-Closas M, **Herbstman J**, Schiffman M, Glass A, Dorgan JF. Relationship between serum hormone concentrations, reproductive history, alcohol consumption and genetic polymorphisms in pre-menopausal women. *International Journal of Cancer*. 2002 Nov 10;102(2):172-8. [PMID: 12385014]

Landrigan PJ, Liroy PJ, Thurston G, Berkowitz G, Chen LC, Chillrud SN, Gavett SH, Georgopoulos PG, Geyh AS, Levin S, Perera F, Rappaport SM, Small C; **NIEHS World Trade Center Working Group**. Health and environmental consequences of the World Trade Center disaster. *Environmental Health Perspectives*. 2004 May;112(6):731-9. [PMID: 15121517]

Herbstman J, Frank R, Schwab M, Williams DL, Samet J, Breyse P and Geyh A Respiratory effects of inhalation exposure among workers during the clean-up effort at the World Trade Center disaster site. *Environmental Research*. 2005 September; 99(1):85-92. [PMID: 16053932]

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Breyse P, Williams, DL, **Herbstman J**, Symons JM, Chillrud, S, Ross J, Henshaw S, Rees K, Watson M, Geyh A. Asbestos Exposures to Truck Drivers During World Trade Center Clean-Up Operations. *Journal of Occupational and Environmental Hygiene*. 2005 August;2(8):400-5. [PMID: 16009648]

Herbstman JB, Sjödin A, Paterson DG, Apelberg BJ, Witter FR, Halden RU, Heidler J, Needham LL, Goldman, LR. PCBs and PBDEs and Thyroid Hormone Levels in Umbilical Cord Blood in an Urban U.S. population: A Feasibility Study. *Organohalogen Compounds*, 2005.

Juzuch NS, Resnick B, Streeter R, **Herbstman J**, Zablotsky J, Fox M, Burke TA. State Capacity to Address Non-Communicable Disease Clusters: Is it Adequate in the Era of Environmental Public Health Tracking. *American Journal of Public Health*. 2007 Apr; 97 Suppl 1: S163-9. [PMID: 17413060]

Apelberg BJ, Goldman LR, Calafat AM, **Herbstman JB**, Kuklennyik Z, Heidler J, Neeham LL, Halden RU, Witter FR. Determinants of Fetal Exposure to Perfluorinated Compounds in Baltimore, Maryland. *Environmental Science and Technology*. 2007 Jun 1; 41(11):3891-7. [PMID: 17612165]

Apelberg BJ, Witter FR, **Herbstman JB**, Calafat AM, Halden RU, Needham LL, Goldman LR. Cord serum concentrations of perfluorooctane sulfonate (PFOS) and perfluorooctanoate (PFOA) in relation to weight and size at birth. *Environmental Health Perspectives*. 2007 Nov; 115(11):1670-6. [PMID: 18008002]

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Perfluoroalkane acids: Apelberg et Al. Respond. *Environmental Health Perspectives*, 2008 Jun;116(6):A238-9.
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- Wells EM, Jarrett JM, Lin YH, Caldwell KL, Hibbeln JR, Apelberg BJ, **Herbstman J**, et al. Body burdens and descriptors of mercury, lead, selenium and copper among Baltimore newborns, *Environmental Research*. 2011 Apr;111(3):411-7. [PMID: 21277575]
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- Perera FP and **Herbstman JB**. Prenatal Environmental Exposures, Epigenetics, and Disease. *Reproductive Toxicology*, 2011 Apr;31(3):363-73. [PMID: 21256208]
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- Wells EM, Navas-Acien A, Apelberg BJ, **Herbstman JB**, Jarrett JM, Lin YH, Caldwell KL, Hibbeln JR, Halden RU, Witter FR, and Goldman LR. Selenium and maternal blood pressure during childbirth, *Journal of Exposure Science and Environmental Epidemiology*. 2012 Mar-Apr; 22(2): 191-7. [PMID: 22108761]

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- Perera F, Vishnevetsky J, **Herbstman JB**, Calafat AM, Xiong W, Rauh V, Wang S. Prenatal Bisphenol A exposure and child behavior in an inner city cohort. *Environmental Health Perspectives*, 2012 Aug; 120(8):1190-4. [PMID: 22543054]
- Tang WY, Levin L, Talaska G, Cheung YY, **Herbstman J**, Tang D, Miller RL, Perera F, Ho SM. Maternal Exposure to Polycyclic Aromatic Hydrocarbons and 5'-CpG Methylation of Interferon- γ in Cord White Blood Cells. *Environmental Health Perspectives*. 2012 Aug; 120(8): 1195-200. [PMID: 22562770]
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- Abid Z, Roy A, **Herbstman JB**, Ettinger AS. Urinary Polycyclic Aromatic Hydrocarbon Metabolites and Attention Deficit/Hyperactivity Disorder, Learning Disability, and Special Education in U.S. children Aged 6-15. *J Environ Public Health*. 2014; 2014:628508. [PMID: 24624143]
- Herbstman JB** and Mall JK. PBDEs and Neurodevelopment, *Current Environmental Health Reports*. (2014), June; 1(2): 101-112.
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- Perera FP, Chang HW, Tang D, Roen EL, **Herbstman J**, Margolis A, Huang TJ, Miller RL, Wang S, Rauh V. Early-life exposure to polycyclic aromatic hydrocarbons and ADHD behavior problems. *PLoS One*. 2014 Nov 5;9 (11).
- Hansmeier N, Chao TC, **Herbstman JB**, Goldman LR, Witter FR, Halden RU. Elucidating the Molecular Basis of Adverse Health Effects from Exposure to Anthropogenic Polyfluorinated Compounds Using Toxicoproteomic Approaches. *J Proteome Res*. 2014 Nov 11 (*in press*).
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BOOK CHAPTERS:

Miller RL and **Herbstman JB**. Epigenetic mechanisms in asthma, In: Epigenetics Nutrition and Environmental Health. Wiley Publishers, 2009.

PEER-REVIEW ACTIVITIES: MANUSCRIPT REVIEWER

Chemosphere, Environmental Research, Environmental Health Perspectives, Environmental Science and Technology, Ecotoxicology and Environmental Safety, Environment International, Environmental Health, Pediatrics, Journal of Hazardous Materials, Emerging Health Threats, PLoS ONE, American Journal of Epidemiology, Epidemiology, PLoS Genetics, New England Journal of Medicine, Environmental and Molecular Mutagenesis, Epigenetics, Nature Communications.

Exhibit H

Statement of Susan Kasper



Department of Environmental Health
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October 7, 2014

I, Susan Kasper, am writing this statement in support of the Petition to the CPSC to ban certain household products containing additive monomer organohalogen flame retardants.

1. I, Susan Kasper PhD, am an Associate Professor in the Department of Environmental Health at the University of Cincinnati, College of Medicine. I have a Ph.D. and a M.Sc. in Physiology/Endocrinology from the University of Manitoba, Canada. Please see my CV and list of publications attached.

2. Research in my laboratory has focused on the mechanisms by which cancers develop and progress to become therapy resistant. This includes the role of chemicals such as organohalogen flame retardants on cancer progression. Many organohalogen flame retardants are Persistent Organic Pollutants (POPs), indicating that they are resistant to degradation and capable of remaining in the environment for many years. Furthermore, they are readily absorbed in the food chain and stored in fatty tissues¹. Most Americans, when tested, were found to have trace levels of flame retardants in multiple tissues, including adipose, liver, muscle, skin and blood². Importantly, organohalogen flame retardants can interfere with normal hormonal function in that they act as “endocrine disrupting chemicals” (EDCs) to either mimic or inhibit the action of naturally occurring hormones^{3,4}. Exposure to organohalogen flame retardants has been linked to developmental defects, altered neurologic function, infertility, and cancer (reviewed in Koprass et al., 2014)⁵. Indeed, exposures to EDCs during the critical time of growth and development can result in genetic modifications that are passed down to subsequent generations⁶.

3. For the past few years, we have studied the endocrine disrupting activities of Firemaster® 550 (FM 550), a new-generation flame-retardant mixture and previously the second most commonly detected flame retardant in polyurethane foam in the United States⁷. FM 550 might now be the most commonly used flame retardant in polyurethane foam since the previously most common compound, TDCPP, has been listed as a carcinogen under California Proposition 65 and is therefore slowly being phased out.

4. FM 550 is a mixture of two organohalogens (2-ethylhexyl-2,3,4,5-tetrabromobenzoate or TBB and bis(2-ethylhexyl)-2,3,4,5-tetrabromophthalate or TBPH) and organophosphates (isotropylated triphenylphosphate isomers or ITPs, and triphenyl phosphate or TPP). The organohalogen components TBB and TBPH have been found in indoor dust, outdoor air, marine mammal tissues, wastewater and sewage sludge^{8,9,10,11,12,13,14}. Stapleton and coworkers determined that exposure to FM 550 components could be measured in tissues of pregnant rat dams and offspring. In pregnant dams, TBB increased serum thyroxine levels and reduced

hepatic carboxylesterase activity; in offspring, exposure to FM 550 in the mother's milk resulted in male cardiac hypertrophy, advanced female puberty, significant weight gain in both males and females, and altered exploratory behaviors^{15,16}. These results demonstrate for the first time that at environmentally relevant levels, FM 550 affects multiple biological processes, including organ development and function, weight gain, and behavior.

5. In our lab we are studying the effects of FM 550 on prostate cancer stem cells (CSC). Prostate CSCs comprise less than 0.1% of the total number of tumor cells, but they are central to promoting tumor growth, metastasis, and the emergence of treatment-resistant disease^{17,18}. Using prostate CSC-like cells derived from human patient biopsy specimens, our initial findings imply that three FM 550 components, namely ITP, TBPH and TBB, are capable of stimulating the rapid expansion of prostate cancer stem cells. Moreover, this response is similar to that observed in CSC-like cells treated with the antiandrogens Casodex and hydroxyflutamide. Therefore, FM 550 could act as an endocrine disrupting chemical to promote the expansion of CSCs. Since prostate CSCs are thought to be resistant to androgen deprivation therapy, expansion of this cell type by FM 550 activity could promote resistance to clinical treatment.

6. The observation that FM 550 exerts anti-androgenic-like activity in prostate cancer implies a high probability that FM 550 will also exert its anti-androgenic effects on non-cancerous processes. These include the development and function of the male reproductive system (prostate, seminal vesicles, penis, testes, epididymis), spermatogenesis, and male fertility¹⁹ as well as normal ovary development in females²⁰.

7. The available data on organohalogen flame retardants indicates a high likelihood that other yet unstudied members of this class of chemicals are also endocrine disruptors, which means they can impair normal cell development, and thus cause substantial personal injury or substantial illness. Therefore, I support this petition to the CPSC to ban consumer products containing organohalogen flame retardants in additive form, where there is a high risk of human exposure.

Yours sincerely,



Susan Kasper, Ph.D.
Associate Professor,
Environmental Health,
University of Cincinnati College of Medicine

¹ Bartrons M, Grimalt JO, de Mendoza G, Catalan J. Pollutant dehalogenation capability may depend on the trophic evolutionary history of the organism: PBDEs in freshwater food webs. *PLoS One*. 2012;7(7):e41829.

² Szabo DT, Diliberto JJ, Hakk H, Huwe JK, Birnbaum LS. Toxicokinetics of the flame retardant hexabromocyclododecane alpha: effect of dose, timing, route, repeated exposure, and metabolism. *Toxicol Sci*. 2011;121(2):234-44.

³ Stapleton HM, Sharma S, Getzinger G, Ferguson PL, Gabriel M, Webster TF, Blum A. Novel and high volume use flame retardants in US couches reflective of the 2005 PentaBDE phase out. *Environ Sci Technol*. 2012;46:13432-39.

⁴ Birnbaum LS. When environmental chemicals act like uncontrolled medicine. *Trends Endocrin Met*. 2013;24:321-3.

⁵ Koprass E, Potluri V, Bermudez ML, Williams K, Belcher S, Kasper S. Actions of endocrine-disrupting chemicals on stem/progenitor cells during development and disease. *Endocr Relat Cancer*. 2014;21(2):T1-12.

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- ⁶ Patisaul HB, Roberts SC, Mabrey N, McCaffrey KA, Gear RB, Braun J, Belcher SM, Stapleton HM. Accumulation and endocrine disrupting effects of the flame retardant mixture Firemaster® 550 in rats: an exploratory assessment. *J Biochem Mol Toxicol.* 2013;27(2):124-36.
- ⁷ Stapleton HM, Sharma S, Getzinger G, Ferguson PL, Gabriel M, Webster TF, Blum A. Novel and high volume use flame retardants in US couches reflective of the 2005 PentaBDE phase out. *Environ Sci Technol.* 2012;46:13432-39.
- ⁸ Ma Y, Venier M, Hites RA. 2-Ethylhexyl tetrabromobenzoate and bis(2-ethylhexyl) tetrabromophthalate flame retardants in the Great Lakes atmosphere. *Environ Sci Technol.* 2012;46:204-8.
- ⁹ Lam JC, Lau RK, Murphy MB, Lam PK. Temporal trends of hexabromocyclododecanes (HBCDs) and polybrominated diphenyl ethers (PBDEs) and detection of two novel flame retardants in marine mammals from Hong Kong, South China. *Environ Sci Technol.* 2009;43:6944-9.
- ¹⁰ La Guardia MJ, Hale RC, Harvey E, Chen D. Flame-retardants and other organohalogenes detected in sewage sludge by electron capture negative ion mass spectrometry. *Environ Sci Technol.* 2010;44:4658-64.
- ¹¹ Klosterhaus SL, Stapleton HM, La Guardia MJ, Greig DJ. Brominated and chlorinated flame retardants in San Francisco Bay sediments and wildlife. *Environ Int.* 2012;47:56-65.
- ¹² Davis EF, Klosterhaus SL, Stapleton HM. Measurement of flame retardants and triclosan in municipal sewage sludge and biosolids. *Environ Int.* 2012;40:1-7.
- ¹³ Ali N, Harrad S, Goosey E, Neels H, Covaci A. "Novel" brominated flame retardants in Belgian and UK indoor dust: implications for human exposure. *Chemosphere* 2011;83:1360-1365.
- ¹⁴ Ali N, Harrad S, Goosey E, Neels H, Covaci A. "Novel" brominated flame retardants in Belgian and UK indoor dust: implications for human exposure. *Chemosphere* 2012;83:1360-5.
- ¹⁵ Springer C, Dere E, Hall SJ, McDonnell EV, Roberts SC, Butt CM, Stapleton HM, Watkins DJ, McClean MD, Webster TF, Schlezinger JJ, Beekelheide K. Rodent thyroid, liver, and fetal testis toxicity of the monoester metabolite of bis-(2-ethylhexyl) tetrabromophthalate (TBPH), a novel brominated flame retardant present in indoor dust. *Environ Health Perspect.* 2012;120:1711-9.
- ¹⁶ Patisaul HB, Roberts SC, Mabrey N, McCaffrey KA, Gear RB, Braun J, Belcher SM, Stapleton HM. Accumulation and endocrine disrupting effects of the flame retardant mixture Firemaster® 550 in rats: an exploratory assessment. *J Biochem Mol Toxicol.* 2013;27(2):124-36.
- ¹⁷ Gu G, Yuan J, Wills M, Kasper S. Prostate cancer cells with stem cell characteristics reconstitute the original human tumor in vivo. *Cancer Res.* 2007;67(10):4807-15.
- ¹⁸ Chaffer CL, Weinberg RA. A perspective on cancer cell metastasis. *Science.* 2011;331(6024):1559-64.
- ¹⁹ Koprass E, Potluri V, Bermudez ML, Williams K, Belcher S, Kasper S. Actions of endocrine-disrupting chemicals on stem/progenitor cells during development and disease. *Endocr Relat Cancer.* 2014;21(2):T1-12.
- ²⁰ Prizant H, Gleicher N, Sen A. Androgen actions in the ovary: balance is key. *J Endocrinol.* 2014. pii: JOE-14-0296.

CURRICULUM VITAE

SUSAN KASPER, Ph.D.

PRESENT ADDRESS: Department of Environmental Health
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BIRTH PLACE: Winnipeg, MB, Canada

EDUCATIONAL BACKGROUND:

1972-74; 1976-78	B. Sc. Honours in Zoology University of Manitoba, Winnipeg, Manitoba, Canada
1974 – 75	Department of Forestry University of British Columbia, Vancouver, BC, Canada
1975 – 76	Bodenseehof School, Friedrichshafen, Germany
1978 – 81	M. Sc. in Physiology/Endocrinology Department of Physiology, Faculty of Medicine University of Manitoba, Winnipeg, Manitoba, Canada
1981 – 84	Ph.D. in Physiology/Endocrinology Department of Physiology, Faculty of Medicine University of Manitoba, Winnipeg, Manitoba, Canada
1984 – 86	Ph.D. Fellow Department of Physiology, Faculty of Medicine University of Manitoba, Winnipeg, Manitoba, Canada
1986-87	Postgraduate: Medical Research Council of Canada Postdoctoral Fellow Dana Farber Cancer Institute, Harvard Medical School, Boston, MA.
1987-89	Postgraduate: Medical Research Council of Canada Postdoctoral Fellow Department of Molecular Medicine, New England Medical Center Hospitals, Boston, MA.

ACADEMIC AND PROFESSIONAL POSITIONS:

2008-present	Associate Professor (tenured), Department of Environmental Health, College of Medicine, University of Cincinnati, Cincinnati, OH.
2001-08	Assistant Professor (tenure track), Department of Urologic Surgery, Vanderbilt University Medical Center, Nashville, TN.
2001-08	Assistant Professor, cross-appointment in the Department of Cancer Biology.

- 2001-08 Assistant Professor, cross-appointment in the Department of Cell and Developmental Biology
- 2001-08 Member, Vanderbilt Ingram Cancer Center
- 1996-01 Research Assistant Professor (non-tenured), Department of Urologic Surgery, Vanderbilt University Medical Center, Nashville, TN.
- 1989-96 Research Associate, Department of Physiology, University of Manitoba, Winnipeg, MB, Canada.

AWARDS:

- 2014 *Endocrinology* Outstanding Reviewer Award
- 2000 American Urological Association Gallery Best Poster Award
- 1998 Society for Basic Urologic Research Travel Award
- 1997 Society for Basic Urologic Research Travel Award
- 1997 Stowell-Orbison Award, USCAP Best Poster
- 1996 CaP CURE Award, *Co-Investigator* (PI: RJ Matusik RJ), "Progression of Prostate Cancer to Androgen Dependence: The Role of the Androgen Receptor and Tumour-Derived Transcription Factors." [1 of only 2 awarded in Canada]
- 1996 American Urological Association Gallery Best Poster Award
- 1995 American Urological Association Gallery Best Poster Award
- 1993 Society for Basic Urologic Research Award (for Outstanding Science)
- 1986-88 Medical Research Council of Canada Postdoctoral Fellowship Award
- 1985 Drewry Memorial Scholarship and Medal for best Ph.D. dissertation in the Academic Year of 1985, Faculty of Medicine, Univ. of Manitoba

PATENTS/LICENSES:

- 2007 HPET cancer stem cell lines (licensed to Pfizer Global Research and Development, La Jolla laboratories, San Diego, CA).

GRANTS:

Active:

- 2013-2018 National Institutes of Health, NCI, *Co-Investigator* (PI: Gail Prins) "Estrogen Receptors in Human Prostate Stem-Progenitor Cells", R01 CA172220
- 2014-2015 CEG Pilot Projects Program 2014, *Principal Investigator*, "Exposure to Flame Retardants and Prostate Cancer".

Pending Support

- 2014-2019 National Institutes of Health, *Co-Investigator* (PI: Susan Waltz), "The HGGL:Ron receptor tandem in prostate cancer".
- 2015-2020 National Institutes of Health, *Principal Investigator*, "Inertial Microfluidics for Isolating Clinically Predictive Circulating Tumor Cells".
- 2015-2020 Department of Defense, Synergistic Idea Development Award application, *Principle Investigator*, "Circulating tumor cell subpopulations in early stages of prostate cancer progression".

Completed:

- 2009-13 Department of Defense Prostate Cancer Research Program, *Principal Investigator*, “DJ-1 in the Development of Hormone Refractory Prostate Cancer”, W81XWH-08-1-0370.
- 2009-13 Department of Defense Prostate Cancer Research Program, *Principal Investigator*, “The Function of AR-Negative Cancer Stem Cells in Prostate Cancer”, W81XWH-08-1-0662.
- 2003-11 National Institutes of Health, NIDDK, *Principal Investigator*, “Development of Androgen-Independent Prostate Cancer”, DK060957
- 2004-09 National Institutes of Health, NCI, *Co-Investigator* (PI: RJ Matusik), “A Transgenic Mouse Model for Prostate Cancer”, CA076142-08
- 2003-08 National Institutes of Health, NIDDK, *Co-Investigator* (PI: RJ Matusik), “Control of Prostate-Specific Gene Expression DK055748-06
- 2003- 04 Vanderbilt Ingram Cancer Center, *Co-Investigator* (PI: RJ Matusik), “PPG Pilot Project on Prostate Cancer”
- 2002-07 National Institutes of Health, NIDDK, *Principal Investigator*, “Developmental Biology of the Normal Mouse Prostate”, DK059142
- 2000-03 Department of Defense, *Co-Investigator* (PI: RJ Matusik RJ), “Growth Inhibitory and Stimulatory Signals in Prostate Cancer”, DAMD 17-00-1-0105
- 1999-04 National Institutes of Health, NCI, *Co-Investigator* (PI: RJ Coffey), “Mouse Cancer Models Via TGF β RII Loss”, 5U01 CA84239
- 1997-98 NCI Cancer Center Support Grant, *Principal Investigator*, “Progression of Prostate Cancer to Androgen Independence: a Role for the Androgen Receptor, IP30 CA68485
- 1996-97 National Institutes of Health, NIDDK, *Principal Investigator* (Director: MC Orgebin-Crist), “Peptide Growth Factors in Male Genitourinary Development”, HD05797-25

PROFESSIONAL SOCIETY MEMBERSHIPS:

American Association for the Advancement of the Sciences, American Society of Cell Biology, American Urological Association, the Endocrine Society, Society for Basic Urologic Research, Vanderbilt Urology Society.

COMMITTEE SERVICE:**EXTRAMURAL (National and International):**

- 2014-present Member, Planning Committee, Fall 2015 meeting, Society for Basic Urologic Research
- 2014 *Chair*, Abstract Committee, 2014 Fall Meeting, Society for Basic Urologic Research
- 2014-present Member, Planning Committee, Spring 2015 meeting, Society for Basic Urologic Research
- 2010-11 Organizing Committee, World Congress Urological Research, Innsbruck, Austria, September 15-17, 2011
- 2010-11 Advisory Board, Gordon Research Conference on Hormone Action in Development and Cancer, Bryant University, Smithfield, RI, July 31-August 5, 2011
- 2011 Endocrine Society, Annual Meeting 2011, Abstracts Review Committee

- 2009-10 Organizing Committee, Fall Meeting, Society for Basic Urologic Research, Atlanta, GE, November 11-14, 2010
- 2008-09 Advisory Board, Gordon Research Conference on Hormone Action in Development and Cancer, Holderness School, Holderness, NH, July 26-31, 2009 2008 American Urology Association Conference, Abstracts Review Committee
- 2007-09 *Chair*, ByLaws Committee, Society for Basic Urologic Research
- 2004-07 *Chair*, Membership Committee, Society for Basic Urologic Research
- 2001-03 Executive Board, Society for Basic Urologic Research
- 1997-2008 Nashville Symphony Chorus, Soprano II
- 1995-96 *Chair*, Eden Health Care Services
- 1994 Vice Chair, Eden Health Care Services
- 1993 Secretary, Eden Mental Health Centre Hospital Board
- 1990-96 Board of Directors, Eden Health Care Services including Eden Mental Health Centre Hospital, Linden Place, Recovery of Hope counseling services, Enns Court Supported Housing Apartments, Segue Vocational Program.

INTRAMURAL:

- 2014-15 *Coordinator*, Department of Environmental Health Wednesday Seminar Series; Fall and Spring series.
- 2012-present Appointment, Reappointment, Promotion, and Tenure (ARPT) committee, Dept. of Environmental Health, UC
- 2012 Department of Environmental Health Wednesday Seminar spring series; co-organizer
- 2011-present Institutional Biosafety Committee, University of Cincinnati
- 2005-08 Executive Committee, HBCU Partnership grant, Department of Defense, Prostate Cancer Research Grant, Vanderbilt and Meharry Universities
- 2005-08 Institutional Biosafety Committee, Vanderbilt University
- 2004-08 American Cancer Society Pilot Project Review Committee, Vanderbilt Ingram Cancer Center
- 2003 The Pilot and Feasibility Committee of the Vanderbilt Diabetes Center
- 2000-08 The Vanderbilt Prostate Cancer Center, Member
- 1998-01 Institutional Animal Care and Use Committee, Vanderbilt University

PROFESSIONAL SERVICE and ACTIVITIES:

Journal Reviewer (ad Hoc): *American Journal of Pathology; Cancer; Cancer Letters; Cancer Research; Cancer Epidemiology Biomarkers and Prevention; Carcinogenesis; Cell Death and Differentiation; Clinical Cancer Research; Current Gene Therapy; Developmental Biology; Differentiation; Endocrine-Related Cancer, Endocrinology; Endocrine-Related Cancer; Future Oncology; Gynecologic Oncology; Histology and Histopathology; International Journal of Cancer; Investigative Urology; Journal of Biological Chemistry; Journal of Mass Spectrometry; The Journal of Steroid Biochemistry and Molecular Biology; Journal of Urology; Molecular Biology of the Cell; Molecular Cancer, Molecular Cancer Therapeutics; Molecular Carcinogenesis; Molecular and Cellular Biology; Molecular Endocrinology; Nature; Nature Communications; Nature Medicine; Nature Reviews Urology; Oncogene; PLOS ONE; Reproductive Toxicology; Science; Stem Cells; Stem Cell Reviews; Steroid Biochemistry & Molecular Biology; The Prostate; Translational Andrology and Urology; Transgenic Research; Urology; Urologic Oncology: Seminars and Original Investigations*

Editorial Boards:

- 2012-present *Endocrinology*
- 2012-present *The Prostate*

Grant Review Panels and Study Sections:

2014	NCI Omnibus (R03 and R21) SEP ZCA1 SRB-V(O1) (June 26-27)
2013	Prostate Cancer UK, Pilot Award, PA13-028 (August 27; external reviewer)
2013	Innovative Molecular Analysis Technologies, IMAT (August, <i>ad hoc</i>)
2013	NCI Review Meeting, Molecular Analysis Technologies, RFA-CA-13-002 (July, <i>ad hoc</i>)
2013	Prostate Cancer UK (Spring; external reviewer)
2013	Innovative Molecular Analysis Technologies, IMAT (February, <i>ad hoc</i>)
2012	Austrian Science Fund, Vienna, Austria, Biological and Medical Sciences (October)
2011	NCI, RFA-CA-11-010, "Cancer Target Discovery and Development (CTDD) Network (U01) (November, <i>ad hoc</i>)
2011	Innovative Molecular Analysis Technologies, IMAT (March, <i>ad hoc</i>)
2010	Department of Defense, PCRPP PRE-END peer review panel (April 8)
2009	Innovative Molecular Analysis Technologies, IMAT (November, <i>ad hoc</i>)
2009	ARRA Grand Opportunities Grant Review, NCI Molecular Target Discovery and Development Centers Pilot Program (August, <i>ad hoc</i>)
2009	Innovative Molecular Analysis Technologies, IMAT (June, <i>ad hoc</i>)
2009	American Cancer Society Ohio Division Supported Research (May, <i>ad hoc</i>)
2009	Innovative Molecular Analysis Technologies, IMAT (March, <i>ad hoc</i>)
2009	British Prostate Cancer Charity (January)
2008	British Prostate Cancer Charity (January)
2007	Department of Defense, Prostate Cancer Research Program PCT-1
2007	Israel Science Foundation, Life Sciences & Medicine
2006	Molecular Oncogenesis Study Section (<i>ad hoc</i>)
2006	North Carolina Biotechnology Center Multidisciplinary Research Grants Program
2005-07	Molecular, Cellular, and Developmental Neuroscience Study Section
2005	NIH Special Emphasis Panel: Cell Selective Research Tools and Methods for Studies of the Genitourinary Tract (June)
2005	Australian NHMRC Grant Review Panel 3A, Endocrinology and Reproduction
2004	NIH Special Emphasis Panel: Cell Selective Research Tools and Methods for Studies of the Genitourinary Tract (October).
2004	Urologic and Kidney Development and Genitourinary Disease Study Section (October, <i>ad hoc</i>)
2004	Renal and Urological Sciences Integrated Review Group, (October, <i>ad hoc</i>)
2004	NIH Special Emphasis Panel: Cell Selective Research Tools and Methods for Studies of the Genitourinary Tract (June)
2004	Urologic and Kidney Development and Genitourinary Disease Study Section (June, <i>ad hoc</i>)
2004	Renal and Urological Sciences Integrated Review Group (June, <i>ad hoc</i>)
2004	Department of Defense, Clinical and Experimental Therapeutics # 3
2004	Urologic and Kidney Development and Genitourinary Disease Study Section (March, <i>ad hoc</i>)
2004	Renal and Urological Sciences Integrated Review Group (March, <i>ad hoc</i>)
2003	Endocrinology Study Section (<i>ad hoc</i>)
2003	Reproductive Endocrinology Study Section (October, <i>ad hoc</i>)
2003	Reproductive Endocrinology Study Section (June, <i>ad hoc</i>)
2003	NIDDK Special Emphasis Panel: Androgen Receptor and Prostate Cancer
2003	Department of Defense, Clinical and Experimental Therapeutics # 3.
2002	Urologic and Kidney Development and Genitourinary Disease Study Section (<i>ad hoc</i>)
2002	Renal and Urological Sciences Integrated Review Group (<i>ad hoc</i>)
2001	Department of Defense, Cell Biology # 3

- 1999 Department of Defense, External Reviewer
 1998 Fonds pour la Formation de Cherchers et l'Aide à la Recherche, Canada

Scientific Session/Symposium Moderator:

- 2011 GRC Hormone Action in Development & Cancer, Hormonal Regulation Of Development & Cancer, Bryant University, Smithfield, RI, July 31, 2011: Keynote Lectures: Hormonal and Dietary Control of Metabolism
 2010 Society for Basic Urological Research, Atlanta GA, November 12, 2010: Aging, Obesity, and Co-Morbidities: Immunologic Impacts on Urologic Function
 2010 Annual Endocrine Meeting, San Diego CA, June 21, 2010: Tumor and Normal Stem Cells in Breast and Prostate
 2010 6th Annual National Symposium on Prostate Cancer, Clark Atlanta University, Atlanta GA, March 16, 2010: Steroid Receptors in Prostate Cancer
 2009 GRC Hormone Action in Development & Cancer, Hormonal Regulation Of Development & Cancer, Holderness NH, July 29, 2009: Common Signaling Pathways: Development Pathways Gone Awry in Cancer
 2008 Society for Basic Urological Research: Epigenetics and Genitourinary Disorders
 2007 DOD Innovative Minds in Prostate Cancer Today (IMPACT) conference: Stem Cells

TEACHING:

- 2014 CCHMC/UC: Introduction to Functional Genomics (GNTD8001C and CS7097C in CoM and CEAS; Course Directors: Jarek Meller and Robert Brackenbury). Lecturer – “AR: a key regulator of normal and abnormal prostate growth”.
 2013 CCHMC/UC: Introduction to Functional Genomics Introduction to Functional Genomics (GNTD8001C and CS7097C in CoM and CEAS; Course Directors: Jarek Meller and Robert Brackenbury). Lecturer – “Estrogen Receptor – Structure and Function”.
 2013 UC: Environmental Genetics & Molecular Toxicology(EGMT)Course: Lecturer For 2 Courses Sections - Stem cells; Male and Female Reproductive Toxicology.
 2011 UC: Environmental Genetics & Molecular Toxicology (EGMT) Course: Course Coordinator
 2010 UC: Environmental Genetics & Molecular Toxicology (EGMT) Course: Lecturer- Stem cells.
 2009 UC: Environmental Genetics & Molecular Toxicology (EGMT) Course: Lecturer - Stem cells.
 2007 VU: Current Topics in Cancer Biology: Cancer and Metastasis: Course Coordinator and Lecturer
 1995-96 UM Faculty of Medicine: Medicine I Endocrinology and Metabolism:Lecturer/tutorials
 1990-96 UM Course in Medical Physiology: Endocrinology: Lecturer
 1979-81 University of Manitoba Special Pre-medical Studies Program: Tutor

LABORATORY TRAINEES AND STUDENT PROGRAMS:

PhD Thesis Supervisor:

- 2002-07 Jennifer Erin Tillman (Advisor: Susan Kasper, PhD, Dept. of Urologic Surgery, VUMC)
 2002-07 Ritwik Ghosh (DOD Predoctoral Training Award recipient) (Advisor: Susan Kasper, PhD, Dept. of Urologic Surgery, VUMC)

Doctoral Dissertation Committee:

- 2014-present Nicholas Brown (Advisor: Susan Waltz, PhD, Dept of Cancer and Cell Biology, UC)
 2013-present Logan Fulford (Advisor: Tanya Kalin, MD, PhD, Department of Pediatrics, UC)
 2013-present Evan Frank (Advisor: Jagjit Yadav, PhD, EH Division of Environmental Genetics and Molecular Toxicology, UC)
 2013-present Abby Johnson (Advisor: Susan Waltz, PhD, Dept of Cancer and Cell Biology, UC)
 2012-present Qin Wang (Advisor: Alvaro Puga, PhD, EH Division of Environmental Genetics and Molecular Toxicology, UC)
 2011-present Andrew Paluch (Advisor: Susan Waltz, PhD, Dept of Cancer and Cell Biology, UC)

- 2010-present Eunice Varughese (Advisor: Jagjit Yadav, PhD, EH Division of Environmental Genetics and Molecular Toxicology, UC)
- 2010-present Nivedita Nivedita (Advisor: Ian Papautsky, PhD, BioMicroSystems Lab, School of Electronic and Computing Systems, UC)
- 2010-2012 Jian Zhou (Advisor: Ian Papautsky, PhD, BioMicroSystems Lab, School of Electronic and Computing Systems, UC)
- 2007-09 Maria Abreu, Department of Cancer Biology, VU
- 2007-09 Jie Wang, Department of Pathology, VU
- 2005-08 Ashwath Jayagopal, Department of Biomedical Engineering, VU

UC Training Grants/graduate student mentor:

- 2009-2012 Brian Wortham (graduate student, EH Gene-Environment Interactions Training Program, UC)
- 2009-2011 Marina Galvez, Ph.D. (EH T32 training program, UC)
- 2009-2011 Rebekah Karns (graduate student, EH Division of Epidemiology/Biostatistics, UC)

UC Young Faculty Mentor:

- 2009-present Tianying Wu, MD, PhD, ScM (Assistant Professor, EH Division of Epidemiology and Biostatistics, UC)

Vanderbilt Integrated Graduate Program Qualifying Exam Committee (IGP):

- 2008 Carrie Whiting (PhD)
- 2007 Maria Abreu (PhD)
- 2006 Jie Wang (PhD)
- 2004 Yue He (PhD)
- 2003 Mingfang Ao (PhD)
- 2002 Ildiko Csiki (MD, PhD)
- 2002 Li Yang (PhD)

Vanderbilt Initiative for Maximizing Student Diversity (IMSD) Program (Faculty Advisor/Mentor):

- 2005-2006 Gerren Ector
- 2002-2006 Tamela Hunt

Vanderbilt Introduction to Biomedical Research Program (Faculty Advisor/Mentor):

- 2003 Julia Kristina Wood (medical student)

Undergraduate courses/summer training:

- 2014 Emma Eschker (Niles North High School, Chicago, IL, Susie Posnock, teacher)
- 2013 Sloane Harris and Meghan Cholak (Walnut Hills High School, Science Project Competition, Renee Mahaffey Harris, Correspondent)
- 2011-12 Preetom Borah (Sycamore High School, Capstone Project research project, Beth Quinones, Science Teacher)
- 2011-12 Nicholas Aube (Sycamore High School, Capstone Project research project, Beth Quinones, Science Teacher)
- 2010 William Hunt (Biology, Summer Undergraduate Research Fellow (SURF), Office of Research and Graduate Education, UC)
- 2010 James Cross (B. Sc Biology undergraduate student/technician, UC)
- 2009 James Cross (B. Sc Biology Summer Undergraduate Research Fellow (SURF), Office of Research and Graduate Education, UC)
- 2009 John Hegman (Biomedical Engineering undergraduate student/technician, UC)
- 2006 Carrie Johnson (Summer Internship, Belmont University, Nashville, TN)

2005	Carrie Johnson (Summer Internship, Belmont University, Nashville, TN)
2005-2006	Carrie Johnson (Biology Course Project, Belmont University, Nashville, TN)
2004	Sheree Carney (Vanderbilt Minority Summer Research Program)
2003	Ashwin Sastry (Undergraduate summer student)
2002	Yash A. Choksi (Undergraduate summer student)

Postdoctoral Fellows:

2010-12	Premkumar Vummidi Giridhar, PhD
2007-08	Seungchan Yang, PhD
2006-08	Mohammed Atiqur Rahman, PhD
2005	Shwetank Sharma, PhD
2004	Zhang Han PhD
2003-07	Guangyu Gu, MD
2001-03	Tiina Pikänen-Arsiola, PhD

Research Scientists:

2009-2013	Karin Williams, PhD
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Other Trainees:

2013	Veena Potluri, MD
2013-2014	Mei-Ling Bermudez (PhD rotation student)
2014	Andrew Vonhandorf (PhD rotation student)

Research Residents:

2008	Michelle E. Koski, MD
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Medical Students:

2013	Karan Motiani, Department of Urology, UC. Research rotation. [Dr. Motiani's abstract was the only submissions from the UC Departments of Urology and Environmental Health accepted. Importantly, it was selected for a prestigious podium presentation for research excellence.]
2007-2011	Thesis Advisor, Thomas Reinhold MD, Universität Witten/Herdecke Witten, Germany [Dr. Reinhold's thesis earned him a <i>cum laude</i> degree]
2006-07	Thomas Reinhold (Universität Witten / Herdecke Witten, Germany: Medical Student rotation)

Research Awards to Trainees:

2011-2012	I served as project director and mentor to a team of two Sycamore High School students, Preetom (Ruku) Borah and Nicholas Aube, on their Capstone research Project research. - Ruku and Nick won a "Superior" rating for their Capstone Research Project, "IGF-1 and its Effects on Human Breast Cancer Cells" at Sycamore High School. - They were winners in the Southwest Ohio District Science & Engineering Expo competition held at UC on Saturday, March 10, 2012. - At the OH State Science Fair on Saturday, May 5, 2012, they won a "Superior" rating with a perfect score of 50/50 from both judges. They also won the following awards for their research on: "IGF-1 and its Effects on Human Breast Cancer Cells": 1) Interdisciplinary Research Award, sponsored by Sigma Xi Scientific Research Society, 2) Veterinary Medicine Award, sponsored by the Ohio Veterinary Medical Association, 3) University of Akron Scholarship.
2006	Jennifer Erin Tillman, PhD student, Travel Award, Society for Basic Urologic Research
2006	Ritwik Ghosh, PhD student, DOD Predoctoral Training Award

2005 Guangyu Gu, MD, Travel Award, Society for Basic Urologic Research
 2003 Tiina Pikänen-Arsiola, PhD, Travel Award, Society for Basic Urologic Research

INVITED LECTURES:

National and International Meetings:

Clark Atlanta University 10th Annual National Symposium on Prostate Cancer, Atlanta GA, March 17, 2014: "Inhibition of Stathmin1 Accelerates the Metastatic Process".

The 10th World Congress on Urological Research, Society for Basic Urologic Research Fall Symposium, Nashville TN, November 21-24, 2013 (substitute speaker for Dr. Gail Prins who could not attend), Plenary Session IV: Stem Cells are Part of the Urologic Tissue Heterogeneity and Therapeutic Solutions: "Cancer Stem Cell Self-renewal and Differentiation".

Underwriters Laboratories – Flame Retardants and Health Summit/Furniture Flammability and Human Health, Atlanta GA, April 16, 2013: "Flame Retardants as Endocrine Disrupting Chemicals that Promote Prostate Cancer".

Clark Atlanta University 9th Annual National Symposium on Prostate Cancer, Atlanta, GA, March 19, 2013: "Mechanisms Which Preserve the Prostate Cancer Stem Cell Phenotype".

Endocrine Society Annual Meeting, Houston, TX, June 23, 2012: "Notch-Androgen Receptor Axis in Prostate Cancer Stem Cells".

Clark Atlanta University 8th Annual National Symposium on Prostate Cancer, Atlanta, GA, March 19, 2012: "Cancer Stem Cell Strategies for Promoting Androgen Resistance".

Society for Basic Urologic Research Fall Symposium, Las Vegas, NE, November 10-13, 2011, Session: Genetic, Epigenetic and Stem Cell Determinants of Development and Disease. "Stem Cell Strategies for Escaping Differentiation".

American Society of Andrology 34th Annual Meeting, Philadelphia, PA, April 5, 2009: "Prostate Stem Cells: Friend or Foe".

Clark Atlanta University 5th Annual National Symposium on Prostate Cancer, Atlanta, GA, March 17, 2009: "Androgen Receptor Function in Hormone-Sensitive and Castrate-Resistant Prostate Cancer

Reproductive Tract Biology Gordon Research Conference (GRC), Andover, NH, August 3-8, 2008: "Regeneration of Human Prostate Tumors from Prostate Cells with Cancer Stem Cell Characteristics".

Endocrine Society Annual Meeting, San Francisco, CA, June 16, 2008: "Stem Cells in Prostate Cancer Initiation & Progression".

Prostate Cancer Research Foundation Forum (United Kingdom), Toronto, Ontario, Canada, June 13, 2008: "Isolation and characterization of cancer stem cells from human prostate tissues".

Society for Basic Urological Research Spring Session, Orlando, FL, May 17, 2008: "Prostate Cancer and Cancer Stem Cells".

Gordon Research Conference on Hormone Action in Development & Cancer, New London, NH, July 15-20, 2007: "Regeneration of Human Prostate Tumors from Prostate Cells with Cancer Stem Cell Characteristics".

Clark Atlanta University 2nd Annual National Symposium on Prostate Cancer, Atlanta, GA, March 31, 2006: "Cancer Stem Cells and the Androgen Receptor in Prostate Cancer".

American Urological Association, Research Conference, Houston, TX, August 1, 1999: "BPH Animal Models - An Overview".

Roswell Park Cancer Institute Workshop: Prostate Cancer, Prouts Neck, ME, October 24, 1999.

Society for Basic Urologic Research/ European Society for Urologic Oncology and Endocrinology Joint Symposium, The Second World Congress on Urological Research, Pacific Grove, CA, December 10-14, 1997: "Gene Therapy Vectors for Prostate Cancer."

Visiting Professor Lectureships:

Green Science Policy Flame Retardant Dilemma Symposium, San Francisco CA, February 14, 2014: "Do Flame Retardants Impact Men's Hormones?"

Prostate Cancer Foundation, 1250 Fourth Street Santa Monica, CA 90401, August 31, 2012. "Inhibition of Stathmin1 Accelerates the Metastatic Process"

Clark Atlanta University CCRTD/RCMI Program, November 10, 2010: "Mechanisms Required to Maintain Epithelial Cell Architecture and Function."

East Tennessee State University, Department of Biochemistry, Johnson City, TN, October 20, 2009: "Beating the Androgen Receptor at Its Own Game".

University of Illinois at Chicago Cancer Center, Chicago, IL, June 17, 2009: "Cancer Stem Cells – Disrupting the Status Quo".

University of Manitoba, Department of Physiology, Winnipeg, MB, Canada, May 7, 2009: "The Androgen Receptor, Cancer Stem Cells and Prostate Tumorigenesis".

Kimmel Cancer Center, Department of Cancer Biology, Philadelphia, PA, October 23, 2008: "In search of the Prostate Stem Cell".

University of Rochester, Department of Pathology, Rochester, NY, August 27, 2008: "Dissecting Androgen Receptor Function in the Prostate".

University of Cincinnati, Department of Environmental Health, Kettering Lab Complex, Cincinnati, OH, July 10, 2008: "Ideas Stemming from Primary Prostate Cell Culture".

Pfizer Global Research and Development, La Jolla laboratories, San Diego, CA, June 18, 2008: "Ideas Stemming from Primary Cell Culture".

University of Cincinnati, Department of Environmental Health, Kettering Lab Complex, Cincinnati, OH, April 23, 2008: "Stem Cells – the Root of Prostate Cancer?"

Boston Medical Center, Section of Endocrinology, Diabetes & Nutrition, Boston, MA, February 12, 2008: "Androgen Receptor Functions in Prostate Development and Disease."

John Hopkins University, Department of Urology, Baltimore, MD, January 17, 2008: "Stem Cells: the Key to Prostate Cancer?"

University of Miami Seminar Series, Miami, FL, December 1, 2005: "Mechanisms Leading to the Development of Hormone Resistant Prostate Cancer".

Wake Forest University Medical Center, Department of Cancer Biology, Winston-Salem, NC, August 15, 2005: "Prostate Tumorigenesis: Insights from Androgen Receptor Studies and Primary Cell Culture Models".

University of Massachusetts Medical School, Department of Surgery/Urology Research, Worcester MA, May 10, 2005: "Development of Androgen-Independent Prostate Cancer".

The University of Texas Health Science Center at San Antonio, Institute of Biotechnology, Department of Molecular Medicine, San Antonio, TX, September 7, 2004: "Prostate Cancer Progression: Escaping Androgen Control".

University of South Florida, College of Medicine, Department of Pathology, Tampa, FL, June 1, 2001: "Modeling Prostate Cancer in LPB-Tag mice: a Lady's Perspective".

University of Massachusetts Medical School, Department of Surgery, Worcester, MA, November 8, 1999.

Tufts University, Department of Biology, Boston, MA, November 9, 1998.

Eastern Virginia Medical School, Department of Microbiology and Immunology, Norfolk, VA, June 19, 1998.

New England Medical Center and Tufts University School of Medicine, Division of Endocrinology, Diabetes, Metabolism and Molecular Medicine, Boston, MA, November 3, 1998.

UC Lectureships:

Cincinnati Prostate Cancer Information Group, Feb 27, 2013: "How do prostate cancer cells become metastatic and why do they migrate to bone?"

GEITP Seminar Series, Jan 15, 2013: "Inhibition of Stathmin1 Accelerates the Metastatic Process".

UC Chemical Engineering Program, Graduate Seminar Series, October 12, 2013: "Separating Fragile Prostate Cancer Stem Cells and Circulating Tumor Cells".

Division of Urology, Urology Oncology Meeting, May 11, 2012: "Stem Cell/CSC Strategies for Promoting Androgen Resistance".

GEITP Seminar Series, February 7, 2012: "Confocal Microscopy".

Division of Urology, Urology Oncology Meeting, April 15, 2011: "Cancer stem cells: Why are they clinically important?"

Cincinnati Children's Hospital Medical Center, Endoderm Club, April 5, 2011: "Using Cancer Stem Cells to Map Normal Prostate Development".

Division of Urology, Urology Oncology Meeting, April 14, 2009: “Androgen Receptor and Prostate Cancer Stem Cells”.

Department of Cancer Cell Biology Seminar Series, March 26, 2009: “The Androgen Receptor, Stem Cells and Prostate Tumorigenesis”.

Cincinnati Cancer Consortium Leaders Meeting, March 3, 2009: “Androgen Receptor, Stem Cells and Prostate Cancer”.

GEITP Seminar Series, February 24, 2009: “In Search of the Prostate Stem Cell”.

Vanderbilt Lectureships:

Center for Stem Cell Biology Seminar, September 11, 2008: “Prostate Stem Cell Models”.

Surgical Oncology Research Seminar, April 18, 2008: “Cancer Stem Cells: the Key to Prostate Cancer?”

Signal Transduction and Cell Proliferation Program Seminar, November 15, 2005: “Development of hormonal resistance in prostate cancer: Insights from androgen receptor and primary cell culture studies”.

32th Annual Vanderbilt Urology Society Visiting Professorship and Rhamy-Shelley Lecture, November 13, 2003: “Update in Prostate Cancer Research”.

Surgical Research Conference, September 13, 2002: “Prostate Cancer Progression: Schemes for Escaping Androgen Control”.

Vanderbilt Ingram Cancer Center Cancer, Biology Seminar Series, September 11, 2002: “Molecular Mechanisms of Prostate Cancer Progression.”

28th Annual Vanderbilt Urology Society Visiting Professorship and Rhamy-Shelley Lecture, November 11, 1999: “BPH Animal Models: An Overview”.

Surgical Research Conference, April 18, 1997.

Center for Reproductive Biology Research, April 8, 1997.

PUBLICATIONS:

Total Publications: 66; h-Index: 27; Total Citations: 2171; Research Gate (RG) score: 36.54

PEER-REVIEWED JOURNAL ARTICLES:

1. **Kasper S**, Worsley IG, Rowe JM, Shiu RPC, and Friesen HG, 1982. Chondrocyte growth factor from the human pituitary gland. *J Biol Chem* 257:5226-5230.
2. Rowe JM, **Kasper S**, and Shiu RPC, 1986. Purification and characterization of a human mammary tumor-derived growth factor. *Cancer Res* 46:1408-1412.
3. **Kasper S**, and Friesen HG, 1986. Human pituitary tissue secretes a potent growth factor for chondrocyte proliferation. *J Clin Endocrinol Metab* 62:70-76.
4. Fink JS, Verhave M, **Kasper S**, Tsukada T, Mandel G, and Goodman RH, 1989. The CGTCA sequence motif is essential for biological activity of the vasoactive intestinal peptide gene cAMP regulated enhancer. *Proc Natl Acad Sci USA* 85:6662-6666.

5. **Kasper S**, Popescu RA, Torsello A, Vrontakis ME, Ikejiani C, and Friesen HG, 1992. Tissue-specific regulation of vasoactive intestinal peptide messenger ribonucleic acid levels by estrogen in the rat. *Endocrinology* 130:1796-1801
6. Leite V, Vrontakis ME, **Kasper S**, and Friesen HG, 1993. Bromocriptine inhibits galanin gene expression in the rat pituitary gland. *Mol Cell Neuroscience* 4:418-423.
7. **Kasper S**, Rennie PS, Bruchofsky N, Sheppard PC, Cheng H, Lin L, Snoek R, and Matusik RJ, 1994. Cooperative binding of the androgen receptor to two DNA sequences is required for androgen induction of the probasin gene. *J Biol Chem* 269:31763-31769.
8. Snoek R, Rennie PS, **Kasper S**, Matusik RJ and Bruchofsky N, 1996. Induction of cell-free, *in vitro* transcription by recombinant androgen receptor peptides. *J Steroid Biochem Mol Biol* 59 (3-4): 243-250.
9. Yan Y, Sheppard PC, **Kasper S**, Lin L, Hoare S, Kapoor A, Dodd JG, Duckworth ML, and Matusik RJ, 1997. Large fragment of the probasin promoter targets high levels of transgene expression to the prostate of transgenic mice. *The Prostate* 32(2):129-139.
10. Metts JC, Kotkin L, **Kasper S**, Shyr Y, Adams MC, and Brock JW, 1997. Genital malformations and coexistent urinary tract or spinal anomalies in patients with imperforate anus. *J Urology* 158:1298-1300.
11. Bai G, **Kasper S**, Matusik RJ, Rennie PS, Moshier JA, and Krongrad A, 1998. Androgen regulation of the human ornithine decarboxylase promoter in prostate cancer cells. *J of Androl*, 19(2): 127-135.
12. Lareyre JJ, Mattei M-G, **Kasper S**, Ong DE, Matusik RJ and Orgebin-Crist M-C, 1998. Genomic organization and chromosomal localization of the murine epididymal retinoic acid binding protein (mE-RABP) gene. *Mol Reprod Dev*, 50, 387-395.
13. **Kasper S**, Sheppard PC, Yan Y, Pettigrew N, Borowsky AD, Prins GS, Dodd JG, Duckworth ML and Matusik RJ, 1998. Development, progression, and androgen-dependence of prostate tumors in probasin-large T antigen transgenic mice: A model for prostate cancer. *Lab Invest* 78:i-xv (Erratum, June 1998).
14. Lareyre JJ, Zheng WL, Zhao GQ, **Kasper S**, Newcomer ME, Matusik RJ, Ong DE and Orgebin-Crist MC, 1998. Molecular cloning and hormonal regulation of a murine epididymal retinoic acid-binding protein messenger ribonucleic acid. *Endocrinology*, 139 (6), 2971-2981.
15. Snoek R, Bruchofsky N, **Kasper S**, Matusik RJ, Gleave M, Sato N, Mawji NR, Rennie PS, 1998. Differential transactivation by the androgen receptor in prostate cancer cells. *The Prostate*, 36, 256-263.
16. Lareyre JJ, Mattei M-G, **Kasper S**, Newcomer ME, Ong DE, Matusik RJ and Orgebin-Crist M-C, 1998. Structure and putative function of a murine epididymal retinoic acid-binding protein (mE-RABP). *J of Reprod Fertil Suppl* 53:59-65.
17. Lareyre JJ, Thomas TZ, Zheng W-L, **Kasper S**, Ong DE, Matusik RJ, and Orgebin-Crist M-C, 1999. A 5 kilobase pair promoter fragment of the murine epididymal retinoic acid-binding protein gene drives the tissue-specific, cell-specific, and androgen-regulated expression of a foreign gene in the epididymis of transgenic mice. *J Biol Chem* 274(12): 8282-8290.
18. **Kasper S**, Rennie PS, Bruchofsky, Lin L, Cheng H, Snoek R, Dahlman-Wright K, Gustafsson J-A, Shiu, RPC, Sheppard PC, Matusik RJ, 1999. Selective activation of the probasin androgen-responsive region by steroid hormones. *J Mol Endocrinology* 22:313-325.
19. Shappell SB, Boeglin WE, Olson SJ, **Kasper S**, Brash AR, 1999. 15-Lipoxygenase-2 (15-LOX-2) is expressed in benign prostatic epithelium and reduced in prostate adenocarcinoma. *Am J Pathol* 155(1):235-245.
20. Brash AR, Jisaka M, Boeglin WE, Chang MS, Keeney DS, Nanney LB, **Kasper S**, Matusik RJ, Olson SJ, Shappell S.B, 1999. Investigation of a second 15S-lipoxygenase in humans and its expression in epithelial tissues. *Adv Exp Med Biol* 469:83-89.
21. Zhang J-F, Thomas TZ, **Kasper S**, Matusik RJ, 2000. A small composite probasin promoter confers high levels of prostate-specific gene expression through regulation by androgens and glucocorticoids *in vitro* and *in vivo*. *Endocrinology* 141(12):4698-4710.

22. Lareyre J-J, Reid K, Nelson C, **Kasper S**, Rennie PS, Orgebin-Crist M-C, Matusik RJ, 2000. Characterization of an androgen-specific response region within the 5' flanking region of the murine epididymal retinoic acid binding protein gene. *Biol Reprod* 63:1881-1892.
23. Lareyre J-J, Winfrey VP, **Kasper S**, Ong DE, Matusik RJ, Olson GE, and Orgebin-Crist M-C, 2001. Gene duplication gives rise to a new 17 kDa lipocalin that shows epididymal region-specific expression and testicular factors(s) regulation. *Endocrinology* 142:1296-1308.
24. Masumori N, Thomas TZ, Chaurand P, Case T, Paul M, **Kasper S**, Caprioli R, Tsukamoto T, Shappell S, Matusik RJ, 2001. A probasin-large T antigen transgenic mouse line develops prostate adenoand neuroendocrine-carcinoma having metastatic potential. *Cancer Res* 61:2239-2249.
25. Andriani F, Nan B, Ju Y, Li X, Weigel NL, McPhaul MJ, **Kasper S**, Kagawa S, Fang B, Matusik RJ, Denner L, Marcelli M, 2001. The third generation probasin promoter ARR₂PB drives bax overexpression and apoptosis in androgen receptor positive prostate cancer cells in a dihydrotestosterone-dependent way. *J Natl Cancer Inst* 93:1314-24.
26. Chaurand P, DaGue BB, Ma S, **Kasper S**, Caprioli RM, 2001. Strain-based sequence variations and structure analysis of murine prostate specific spermine binding protein using mass spectrometry. *Biochem* 40:9725-33.
27. Zhang Y, Yu J, Unni E, Shao TC, Nan B, Snaboon T, **Kasper S**, Andriani F, Denner L, Marcelli M, 2002. Monoand poly-gene therapy for the treatment of experimental prostate cancers by use of apoptotic genes Bax and Bad driven by the prostate-specific promoter ARR2PB. *Human Gene Therapy* 13:2051-64.
28. Tu WH, Thomas TZ, Masumori N, Bhowmick NA, Gorska AE, Shyr Y, **Kasper S**, Case T, Roberts RL, Shappell SB, Moses HL and Matusik RL, 2003. The loss of TGF-beta signaling promotes prostate cancer metastasis. *Neoplasia* 5:267-77.
29. Zhang J, Gao N, **Kasper S**, Reid K, Nelson C, Matusik RJ, 2004. An androgen dependent upstream enhancer is essential for high levels of probasin gene expression. *Endocrinology* 145:134-48.
30. Masumori N, Tsuchiya K, Tu W, Lee C, **Kasper S**, Tsukamoto T, Shappell S, Matusik RJ, 2004. An allograft model of androgen independent prostatic neuroendocrine carcinoma derived from a large probasin promoter-T antigen transgenic mouse line. *J Urol* 171:439-442.
31. Jin RJ, Wang Y, Masumori N, Ishii K, Tsukamoto T, Shappell SB, Hayward SW, **Kasper S**, Matusik RJ, 2004. NE-10 neuroendocrine cancer promotes the LNCaP xenograft growth in castrated mice. *Cancer Res* 64:5489-5495.
32. Shao TC, Li H, **Kasper S**, Matusik RJ, Ittmann M, Cunningham GR, 2006. Comparison of the Growth-Promoting Effects of Testosterone and 7- α -Methyl-19-Nor-Testosterone (MENT) on the Prostate and Levator Ani Muscle of LPB-Tag Transgenic Mice. *The Prostate*, 66(4):369-76.
33. Pitkänen-Arsiola T, Tillman JE, Gu G, Yuan JL, Roberts RL, Wantroba M, Coetzee GA, Cookson MS, and **Kasper S**, 2006. Androgen and Antiandrogen Treatment Modulate Androgen Receptor Activity and DJ-1 Stability. *The Prostate* 66:1177-93.
34. Wang Y, **Kasper S**, Yuan J, Jin RJ, Zhang J, Ishii K, Wills ML, Hayward SW, Matusik RJ, 2006. Androgen-dependent prostate epithelial cell selection by targeting ARR(2)PBneo to the LPB-Tag model of prostate cancer. *Lab Invest.* 2006 Oct;86(10):1074-88.
35. Gipp J, Gu G, Crylen C, **Kasper S**, Bushman W, 2007. Hedgehog Pathway Activity in the LADY Prostate Tumor Model. *Molecular Cancer* 6:19-26.
36. Tillman EJ, Yuan J, Gu G, Fazli L, Ghosh R, Flynt AS, Gleave M, Rennie PS, and **Kasper S**, 2007. DJ-1 binds androgen receptor directly and mediates its activity in hormonally treated prostate cancer cells. *Cancer Res* 67:4630-4637.
37. Gu G, Yuan J, Wills ML and **Kasper S**, 2007. Prostate cancer cells with stem cell characteristics reconstitute the original human tumor in vivo. *Cancer Res*, 67:4807-4815.
38. Ghosh R, Gu G, Tillman EJ, Yuan J, Wang YQ, Friedman D, Fazli L, Rennie PS, and **Kasper S**, 2007. Increased expression and differential phosphorylation of stathmin may promote prostate cancer progression. *The Prostate* 67:1038-1052.

39. Chaurand P, Rahman MA, Hunt T, Mobley JA, Gu G, Caprioli RM and **Kasper S**, 2008. Monitoring mouse prostate development by profiling and imaging mass spectrometry. *Mol Cell Proteomics* 7:411-23.
40. Zhang J-F, Gao N, DeGraff D, Yu X, Sun Q, Case T, **Kasper S**, Matusik, RJ, 2010. Characterization of cis elements of the probasin promoter necessary for prostate-specific expression. *Prostate* 70:934-51.
41. Liu J, Pascal LE, Isharwal S, Metzger D, Ramos Garcia R, Pilch J, Kasper S, Williams K, Basse PH, Nelson JB, Chambon P, Wang Z, 2011. Regenerated luminal epithelial cells are derived from preexisting luminal epithelial cells in adult mouse prostate. *Mol Endocrinol.* 25:1849-57.
42. Williams K, Ghosh R, Vummidi Giridhar P, Gu G, Case T, Belcher SM and **Kasper S**, 2012. Inhibition of Stathmin1 Accelerates the Metastatic Process. *Cancer Res*:72:5407-17. PMID: 22915755
43. Kendig EL, Buesing DR, Christie SM, Cookman CJ, Gear RB, Hugo ER, **Kasper S**, Kendzioriski JA, Ungi KR, Williams K, Belcher SM. 2012. Estrogen-like disruptive effects of dietary exposure to bisphenol A or 17 α -ethinyl estradiol in CD1 mice. *Int J Toxicol* 31:537-50. PMID: 23160314
44. Zhou J, Giridhar PV, **Kasper S**, Papautsky I, 2013. Modulation of aspect ratio for complete separation in an inertial microfluidic channel. *Lab Chip* 13:1919-29. PMID: 23529341
45. Cai Y, Balli D, Ustiyani V, Fulford L, Hiller A, Misetich V, Zhang Y, Paluch AM, Waltz SE, **Kasper S**, Kalin TV, 2013. Foxm1 expression in prostate epithelial cells is essential for prostate carcinogenesis. *J Biol Chem.* 288:22527-41. PMID: 23775078
46. Zhou J, **Kasper S**, Papautsky I, 2013. Enhanced size-dependent trapping of particles using microvortices. *Microfluid Nanofluid* 1007/s10404-013-1176-y. PMID: 24187531
47. Zhou J, Vummidi Giridhar P, **Kasper S**, Papautsky I, 2014. Modulation of rotation-induced lift for cell filtration in a low aspect ratio microchannel. *Biomicrofluidics* 8, 044112; doi: 10.1063/1.4891599.

INVITED REVIEWS/EDITORIALS:

1. **Kasper S**, Matusik RJ: Rat Probasin, 2000. Structure and function of an outlier lipocalin. (Review) *Biochim Biophys Acta* 18(1-2):249-258.
2. **Kasper S**, Tu W, Roberts RL, Shappell SB, 2003. Transgenic mouse models for prostate cancer: Identification of an androgen-dependent promoter and creation and characterization of the LPB-tag model. *Methods Mol Med* 81:113-47.
3. **Kasper S** and Smith JA, 2004. Genetically Modified Mice and Their Use in Developing Therapeutic Strategies. *J Urol* 172:12-19.
4. **Kasper S**, 2005. Survey of Genetically Engineered Mouse Models for Prostate Cancer: Analyzing the Molecular Basis of Prostate Cancer Development, Progression and Metastasis. *J Cell Biochem* 94:279-297.
5. **Kasper S** and Cookson MS, 2006. Mechanisms leading to the development of hormone resistant prostate cancer. *Urologic Clinics of North America* 33:201-210.
6. **Kasper S**, 2007. Characterizing the Prostate Stem Cell. *J Urol* 178:375.
7. **Kasper S**, 2007. Mechanisms that Promote Androgen Receptor-mediated Recurrence of Prostate Cancer. *J Urol* 178:1288.
8. **Kasper S**, 2008. Stem cells: The Root of Prostate Cancer? *J Cell Physiol* 216:332-336.
9. **Kasper S**, 2008. Exploring the Origins of the Normal Prostate and Prostate Cancer Stem Cell. *Stem Cell Rev* 4:193-201.

10. **Kasper S**, 2009. Identification, characterization, and biological relevance of prostate cancer stem cells from clinical specimens. *Urol Oncol* 27:301-3. PMID: 19414117
11. Williams K, Motiani K, Vummidi Giridhar P, **Kasper S**, 2013. CD44 integrates signaling in normal stem cell, cancer stem cell and (pre)metastatic niches. *Exp Biol Med* 238:324-38. PMID: 23598979
12. Kopras E, Potluri V, Bermudez M-L, Williams K, Belcher S, **Kasper S**, 2014. Actions of endocrine disrupting chemicals on stem/progenitor cells during development and disease. *Endocrine Related Cancer*, 21:T1-T12. doi: 10.1530/ERC-13-0360.

BOOK CHAPTERS:

1. Friesen HG, Dean HJ, and **Kasper S**, 1985. A perspective on growth hormone and growth. In: *Human Growth Hormone* (Raiti, S., ed) Pergamon Press, Plenum Publ. Co.
2. **Kasper S**, and Friesen HG, 1986. Growth factors: a selected review. In: *Growth Hormone* (Tolis G., and Ludecke, D.K. eds) Raven Press, NY.
3. Goodman RH, Verhave M, **Kasper S**, Tsukada T, Mandel G, and Fink JS, 1988. Regulation of expression of the human pre-pro VIP gene. In: *Perspectives in Neuroendocrinology*. (Wass, J. and Scanlon M., eds.). Springer-Verlag.
4. Cattini PA, Nachtigal MW, Ludwig SM, Klassen ME, **Kasper S**, and Nickel BA, 1992. Implantation and transfection procedure: use of gene transfer to examine expression and regulation of human placental hormone. In: *Neuroendocrine Research Methods*. (Greenstein, B.D., ed.).
5. Matusik RJ, Masumori M, Thomas TZ, Case T, Paul M, **Kasper S**, Shappell SB, 2000. Transgenic mouse models of prostate cancer. In: *Transgenics in Endocrinology*, ed. By MM Matzuk, CW Brown, and TR Kumar. The Humana Press Inc. (Totowa, NJ) pp 399-423.
6. Shappell SB., Masumori M, Thomas TZ, Case T, Paul M, **Kasper S**, Matusik RJ, 2004. Transgenic mouse models of prostate carcinoma: Anatomic, Histopathologic, and molecular considerations. In: *Prostate Cancer: Scientific and Clinical Aspects of Bridging the Gap*, PD Abel and E-N Lalani (eds), Imperial College Press (London), pp 245-319.
7. Williams K, Vummidi Giridhar P, **Kasper S**, 2013. CD44 integrates signaling in stem cell microenvironments. CRC Press, Dittmar T & Zänker KS, Eds. In: *Role of Cancer Stem Cells in Cancer Biology and Therapy*, pp129-150.

Exhibit I

Statement of Donald Lucas



Sept. 11, 2014

I, Donald Lucas, am writing this statement in support of the Petition to the CPSC to regulate four categories of household products containing non-polymeric additive organohalogen flame retardants.

1. I am a scientist at the Lawrence Berkeley National Laboratory (LBNL) and a Professional Researcher in the School of Public Health at the University of California, Berkeley (UCB). I officially retired in 2011, but I continue to perform research in the areas of combustion byproducts at LBNL, UCB, and the Energy and Resources Group at UCB. Before retiring I was a Principal Investigator in the Combustion Group of the Environmental Energy Technologies Division (EETD), and was a Deputy Director for EETD and the Environment, Health, and Safety Division. I am on the Executive Committee for the International Congress on Toxic Combustion Byproducts and their Health Effects, and received their Adel Sarofim Award in 2013. I also serve as a consultant to the Green Science Policy Institute. I received a B.S. in Chemistry from the Illinois Institute of Technology in 1972 and a Ph.D. in Physical Chemistry from the University of California, Berkeley in 1977. I have attached a copy of my curriculum vitae and a list of my scientific publications.

2. Based on my expertise, it is my opinion that, in the case of fires, organohalogen flame retardants used in plastic, foam, fabrics, and other products in residences can lead to the formation of increased amounts of toxic combustion byproducts. It is also my opinion that, as currently used, organohalogen flame retardants do not provide fire safety benefits that justify their use (Talley, 1995; Mehta, 2012; Blais and Carpenter, 2013; Tao, 2005; BEARHFTI, 2002; Babrauskas, 1983; Schuman and Hartzell, 1987). Other experts I collaborate with have described the human and environmental health effects associated with organohalogen flame retardants and their combustion byproducts, so my statements below will be limited to the formation of products of combustion.

3. Organohalogen flame retardants are used in products and assemblies such as electronic enclosures, furniture foam, building insulation, and other items, but they do not make the products flameproof. If a large enough ignition source is involved, flaming combustion of fire-retarded items can occur; for smaller ignition sources, smoldering combustion may happen.

4. Most fire deaths and injuries result from inhalation of smoke containing narcotic/asphyxiant and/or irritant combustion byproducts such as toxic gases and particulates (Hall 2011; Stec and Hull, 2010). These combustion byproducts may be directly toxic or cause such irritation that they impair vision and breathing, ultimately resulting in incapacitation. In addition to the combustion products of immediate concern for survival in a fire, other harmful by-products including halogenated dioxins and furans (generally referred to as dioxins) can cause chronic health effects in those exposed to the fires, contaminate the air, soil, and water long-term, and spread from the

fire site when burned materials are removed.

5. Though in some sense every fire is different, a few factors most strongly influence toxic product yield. These factors include material composition, such as the presence or absence of organohalogen flame retardants (Stec and Hull, 2010). The incorporation of organohalogen flame retardants into the material composition can increase the generation of combustion byproducts of concern for both acute and chronic fire toxicity, for reasons described in detail below.

6. Fire effluents from the combustion of materials containing organohalogen flame retardants can be **more acutely toxic** for the following reasons:

- i. Greater amounts of irritant gases, such as hydrogen chloride (HCl) or hydrogen bromide (HBr) combustion products, and particulate matter of varying size and toxicity can be produced (Stec and Hull, 2010). In fact, these irritant gases are the active fire retardant species, which act by preventing the complete oxidation of the fuel to carbon dioxide and water. HCl and HBr can cause incapacitation, reducing ability to escape a fire. If inhaled, these can also penetrate deep into the lung and injure tissue. If a fire occurs where large amounts of materials with added organohalogen flame retardants burn, significant amount of HCl or HBr will be produced, since HCl and HBr are the thermodynamically favored products for organohalogen flame retardants. For example, furniture foam with chlorinated flame retardants can produce 10 grams of HCl per kg of foam burned for every 1% by mass of chlorine it contains (the amount of halogenated fire retardants in foam varies, but it is commonly used at levels up to 5% (Allen et al., 2008). While the actual concentration depends on the room size and ventilation rate, it should be noted that the American Conference of Governmental Industrial Hygienists (ACGIH) ceiling limit for HCl is 2 ppm, and that in a small room (50 m³) with little ventilation, 100 ppm of HCl can be produced by 1 kg of burning foam.
- ii. Greater amounts of asphyxiant/narcotic gases that are combustion byproducts, such as carbon monoxide and hydrogen cyanide, can be produced, leading to loss of consciousness and ultimately death if people are exposed to high levels or for long amounts of time (Braun et al., 1987; Levin et al., 1985; Purser, 1990, Krasny et al., 2001).
- iii. Greater amount of soot and smoke can be produced, which obscures visibility and impedes escape. The action of chlorine and bromine radicals from organohalogen flame retardants can prevent the complete oxidation of the hydrocarbons present in most fires, resulting in higher yields of partial combustion products, which are apparent as greater amounts of soot and smoke (Stec and Hull, 2010).

7. In addition to increasing the amount of acutely toxic gases and particles produced, the presence of organohalogen flame retardants in products during fires can increase the amounts of persistent organic pollutants produced by combustion processes, thus **increasing the chronic toxicity of fires**.

8. In particular, incomplete combustion of products containing organohalogen flame retardants leads to the formation of halogenated dioxins and furans, substances that are considered amongst

the most toxic chemicals known (Ebert and Bahadir, 2003; Babrauskas et al., 1988; Weber and Kuch, 2003).

9. Based on my research and knowledge of fire toxicity, I support regulations that prevent the use of organohalogen flame retardants in the four categories of consumer products covered in this petition.



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Education:

UC, Berkeley	Ph.D.	1977	Chemistry
Illinois Institute of Technology	B.S.	1972	Chemistry (with Honors)

Professional Experience

Management

2007- 2011	Deputy Director, Environmental, Health and Safety Division, LBNL
2005- 2007	Assistant Division Director, Environmental Energy Technologies Division Member, EET Division Council
2000- 2009	Safety Review Committee, LBNL (Chair 2005 – 2009)
2003- 2007	Program Director, High Performance Commercial Building Systems
2002- 2004	Deputy Director, Berkeley Superfund Basic Research Program
2000- 2007	Chair, Safety Committee, Environmental Energy Technologies Division
2003 -2005	Chair, Laser Safety Committee, LBNL
2000- 2005	Safety Manager, Environmental Energy Technologies Division

Research and Teaching

1980- present	Scientist, Lawrence Berkeley National Laboratory (Environmental Energy Technologies Division – rehired retiree)
1982 – present	Professional Researcher and Visiting Scholar, University of California, Berkeley (Environmental Health Sciences, Mechanical Engineering)
1994 - present	Affiliate, Energy and Resources Group, UC Berkeley
2011 – 2014	Visiting Lecturer, East China University of Science and Technology, Shanghai, China
1988, 1990	Lecturer, University of California, Berkeley (Chemistry) Instructor, University of California, Berkeley (Mechanical Engineering) Visiting Professor, Indiana University (Chemistry) Research Associate, Indiana University (Chemistry) Teaching and Research Assistant, University of California, Berkeley (Chemistry)

Recent Committees and Activities

Finance Committee Chair, The Combustion Institute
35th International Symposium on Combustion, Local Organizing Committee Member
External Advisor, LSU Superfund Program
California AB 127 Working Group
LBNL HSS Steering Committee
LBNL DOE 142.3 Implementation Plan Project Director
LBNL EHS Training Group Head
Idaho National Laboratory Review Committee for Laser Safety (2006)
LBNL Ergonomics Pilot Program Committee (2003-2005)
Scientific Peer Reviewer, California EPA

Multimedia Working Group, California EPA
DOE Laser Program Review Panel (2003)
Executive Board and Treasurer of the US Sections of the Combustion Institute
Executive Committee and Treasurer, Western States Section/Combustion Institute
International Congress on Toxic Combustion Byproducts: Executive Committee and Awards
Committee Chair
Organizing Committee, Quad Universities Superfund – EPA Conference
Publications Committee, The Combustion Institute
Organizing Committee, 2nd Joint Meeting of the U.S. Sections of the Combustion Institute
EPA Peer Review Panels Reviewer
Health Effects Institute Advisory Panel
Technical Advisor, California Institute for Energy Efficiency
Member: American Chemical Society, Sigma Xi, The Combustion Institute
Volunteer for various LBNL CSEE programs.

Service as Reviewer:

U.S. DOE
Environmental Science and Technology
Combustion Science and Technology
California EPA
International Journal of Chemical Kinetics
National Science Foundation
California Air Resources Board
Combustion and Flame
Applied Optics
U.S. EPA
Health Effects Institute
The Combustion Institute
Applied Spectroscopy
Universitywide Energy Research Group
California Energy Commission
California Institute for Energy Efficiency
Journal of Physical Chemistry

Service as Consultant:

ChevronTexaco
Texaco
Western Independent Refiners Association
UC Riverside
WESTAR
Aarons Air Services
Expert witness in legal proceedings
Green Science Policy Institute

Extramural Funding:

U.S. EPA
DOE
California Air Resources Board
NIEHS
UERG
Western States Petroleum Association

Awards

Dr. Donald Lucas and Dr. Catherine P. Koshland shared the Adel Sarofim Award in May, 2013, presented by the International Congress on Toxic Combustion Byproducts and their Health Effects.

Invited Talks (2003 – present):

Lucas, D. (2014). The complex role of chlorinated hydrocarbons in combustion. ACS National Meeting, Dallas, TX, Mar. 18, 2014.

Lucas, D (2011) Measuring combustion products: Plumbing parts to engineered nanoparticles. LSU Chemistry Dept., Baton Rouge, LA, Feb. 2, 2011.

Lucas, D (2011). Toxic combustion emissions: Measuring them and determining their health effects. East China University of Science & Technology (ECUST), June 2, 2011.

Lucas, D (2011) Combustion and health effects: Basic research to public policy. Chinese University of Hong Kong, Hong Kong, China, June 13, 2011.

Lucas, D (2011) Nanomaterials as environmental sensors. EPA Region 9, Sept. 21, 2011, San Francisco, CA

Lucas, D (2011) Nanomaterials as environmental sensors. SRP/EPA Region 9 seminar series. Oct. 3, 2011 (web presentation)

UC Riverside, Department of Mechanical Engineering, Riverside, CA Nov., 2009.

Renewable Energy Sources – New Fuels, New Issues. California Industrial Hygiene Council, San Diego, CA, Dec., 2008; San Francisco, CA, Dec., 2009

Berkeley Nanotechnology Forum, UC Berkeley, CA, April, 2008.

Environmental Health, Energy, and Transportation: Bringing Health to the Fuel Mixture. Institute of Medicine, The National Academies, Washington, DC, Dec., 2007.

Nanoparticles from Combustion Sources and their Toxicity. 38th Environmental Mutagen Society, Atlanta, Ga. Oct., 2007.

“Non-Burning Issues” of Combustion Fundamentals. 5th Meeting of the U.S. Sections of the Combustion Institute, San Diego, CA, Mar., 2007.

Moving Forward in Partnership to Protect Health. Superfund Basic Research Program, Berkeley, CA, May 5, 2006.

ERG100 Lectures, 2004, 2005, 2008 UC Berkeley

Excimer Laser Fragmentation Fluorescence Spectroscopy. Gordon Research Conference on Laser Diagnostics in Combustion, Oxford, England, August, 2003.

Patents

James JZ, Crosby, JS, Lucas D, Koshland CP. Localized Surface Plasmon Resonance Mercury Detection System and Methods. U.S. Application Nos. 61/585,542 and 61/587,546. January 10, 2013 (filed). The International Patent Application has been accorded serial number PCT/US2013/021066.

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2. J. R. Kanofsky, D. Lucas, and D. Gutman (1974). Direct Identification of the Reactive Channels with the Reactions of Oxygen Atoms and Hydroxyl Radicals with Acetylene and Methylacetylene. *J. Phys. Chem.* **78**, 311.
3. D. Lucas (1977). Fast Reactions, Free Radicals, and Molecular Complexes Studied by the Matrix Isolation Technique. Ph.D. Thesis, University of California, Berkeley.

4. L. J. Allamandola, D. Lucas, and G. C. Pimentel (1978). Synchronized Flash Photolysis and Pulse Deposition in Matrix Isolation Experiments. *Rev. Sci. Instrum.* **49** (7), 913.
5. D. Lucas and G. C. Pimentel (1979). Reaction Between NO and O₃ in Solid Nitrogen. *J. Phys. Chem.* **83** (18), 2311.
6. D. Lucas and G. E. Ewing (1981). Spontaneous Desorption of Vibrationally Excited Molecules Physically Adsorbed on Surfaces. *Chem. Phys.* **58**, 385.
7. D. Lucas and N. J. Brown (1982). Characterization of the Selective Reduction of NO by NH₃ Addition. *Combust. Flame* **47**, 219.
8. D. Lucas, L. J. Allamandola, and G. C. Pimentel (1982). Matrix Isolation Infrared Spectra of Hydrogen Halide and Halogen Complexes with Nitrosyl Halides. *Croat. Chem. Acta* **55**, 121.
9. D. Lucas, A. S. Newton, and N. J. Brown (1982). The Measurement of Ammonia in Lean Combustion Exhausts. *Combust. Sci. Technol.* **29**, 309.
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11. D. Lucas, R. Peterson, F. C. Hurlbut, and A. K. Oppenheim (1984). Effects of Transient Combustion on Molecular Beam Sampling. *J. Phys. Chem.* **88**, 4548.
12. N. J. Brown, E. Cuellar, and D. Lucas (1984). Measurement of Nitrogenous and Sulfurous Combustion Emissions. *Advanced Technologies in Synthetic Fuel Analysis*. Wright, C. W., Weimer, W. C., and Felix, W. D., eds. Tech. Inform. Center, Oak Ridge, TN.
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Exhibit J

Statement of Sharyle Patton

Commonweal Biomonitoring Resource Center
CBRC, 451 Mesa Road, PO Box 316, Bolinas, CA 94924
PH: 415.779-1010, FAX: 415 868.2230, www.commonweal.org

September 17, 2014

I, Sharyle Patton, am writing this statement in support of the Petition to the CPSC to regulate four categories of household products containing non-polymeric additive organohalogen flame retardants.

1. I am the director of the Commonweal Environmental Health Program in Bolinas, California, which takes a science-based approach to the challenge of reducing anthropogenic environmental contaminants. I also direct the Commonweal Biomonitoring Resource Center, and have worked with government agencies and community groups nationally and internationally to design and implement biomonitoring projects to inform improved chemicals regulation, focus chemicals research, and raise public awareness. Additionally, I am director of special projects for the Collaborative on Health and Environment (CHE), a Commonweal-sponsored network that seeks to raise the level of awareness about possible linkages between environmental threat and health outcomes. I was previously the northern co-chair of the International Persistent Organic Pollutants (POPs) Elimination Network, a network of over 350 international non-governmental organizations that worked successfully towards the UN Treaty on POPs, signed in May 2001. Please see my biographical sketch attached.

2. For the past 8 years, I have been involved with numerous biomonitoring studies, including a study in collaboration with the Center for Disease Control (CDC) and California Public Health Department to measure levels of perchlorate in humans, water and produce in Southern California, a study that measured levels of neurotoxicants in a group of individuals heading up national groups concerned with learning and developmental disabilities, and a methods development study in collaboration with the International Association of Firefighters that tested 35 firefighters in 15 states for levels of combustion bioproducts and flame retardants. I am currently a founding member of the Women Firefighter Biomonitoring Collaborative, (WFBC), a team of scientists and firefighter groups and advocacy groups which has been awarded a three year grant from the California Breast Cancer Research Foundation to assess women firefighters' exposure to chemicals linked to breast cancer, including carcinogens and endocrine disruptors such as combustion products and diesel exhaust, flame retardants, and perfluorinated chemicals. I am Co-chair of the Women Firefighter Biomonitoring Collaborative's communication, education, and policy team, and have recently co-written a paper discussing effecting biomonitoring study results communication¹.

3. Firefighters are exposed on the job, particularly during fire cleanup and overhaul, to organohalogen flame retardants contained in consumer products, and to their toxic

combustion products. The latter include dioxins and furans², which are likely contributors to the observed high levels of cancer (such as myeloma, lymphoma, and testicular and bladder cancers) in acting and retired firefighters³.

4. Several studies have found that firefighters have higher levels of organohalogen flame retardants and dioxins and furans than the average population. In collaboration with the University of California Irvine's Center for Occupational and Environmental Health and a Southern California fire department, Biomonitoring California carried out a study of environmental chemical exposures in 101 firefighters in Southern California in 2010-2011, known as the Firefighter Occupational Exposures (FOX) Project⁴. The study detected five PBDE (polybrominated diphenyl ether) congeners in over 90% of the study population, indicating widespread exposure. Two of these highly detected congeners, BDE-47 and BDE-99, are the most abundant congeners used in the commercial flame retardant mixture pentaBDE, which was added to foam inside upholstered furniture in California for many years. A 2013 study by Shaw *et al.*⁵ also measured the blood levels of several flame retardants, including the organohalogen flame retardants PBDEs, in 12 firefighters following a fire event. Study participants had elevated concentrations of PBDEs, particularly the PBDE-209 congener. The authors suggested that this high concentration of PBDE-209 may be due to inhalation of deca-BDE-containing particulate in smoke and dust that is released from burning consumer products such as televisions. Shaw *et al.*⁶ also found distinctive patterns of dioxin and furan congeners in the blood of these 12 firefighters, suggesting occupational exposure.

5. Since 2002, 56 percent of firefighters in the International Association of Fire Fighters Cancer and Occupational Disease Database who have died in the line of duty have died of occupation cancers (unpublished confidential data). This is the largest health-related issue facing the fire fighting profession. Firefighters have higher incidence of several forms of cancer, which may be at least in part related to their exposure to organohalogen flame retardants and their combustion products such as halogenated dioxins and furans⁷. A recent NIOSH study⁸, in collaboration with the National Cancer Institute and the Department of Public Health Sciences at the University of California at Davis, analyzed cancers and cancer deaths through 2009 among 29,993 firefighters from the Chicago, Philadelphia and San Francisco fire departments who were employed since 1950, and found higher rates of respiratory, digestive and urinary systems cancers compared to the general population. Bates *et al.*⁹ found that California firefighters are disproportionately susceptible to testicular cancer, melanoma, brain cancer, or esophageal cancer. Ma *et al.*¹⁰ found that Florida firefighters may get bladder, testicular, or thyroid cancer. Baris *et al.*¹¹ found that Philadelphia firefighters had increased mortality from colon cancer, kidney cancer, non-Hodgkin's lymphoma, or multiple myeloma. A 2006 study by Youakim¹² found firefighters with long-term service had an increased risk for colon cancer, kidney cancer, brain cancer, leukemia, and bladder

cancer. Kang *et al.*¹³ found increased incidence of colon and brain cancer in Massachusetts firefighters. LeMasters *et al.*¹⁴ reviewed 32 published studies and concluded that, overall, the risk of multiple myelomas, non-Hodgkin's lymphoma, testicular cancer, and prostate cancer for firefighters was notable. As firefighters are not required to regularly handle industrial chemicals, a probable reason for elevated incidences of such cancers is due to occupational exposure of firefighters to carcinogens such as certain organohalogen flame retardants, dioxins and furans, polycyclic aromatic hydrocarbons (PAHs) and others.

6. Firefighters save lives, but they are more likely to get sick or be killed on the job than the average Americans¹⁵. Organohalogen flame retardants and their combustion products are some of the potentially carcinogenic compounds that firefighters become exposed to on the job at higher levels than the general population. As such, deaths could potentially be avoided by banning, or at least restricting, the use of the entire class of organohalogen flame retardants in household products. Given that organohalogen flame retardants in furniture, mattresses, children's products and electronics casings as currently used do not stop fires, but increase the risk of cancer for firefighters, I see no justification for their use, and fully support the accompanying petition.

Yours sincerely,

Sharyle Patton



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Sharyle Patton is director of the Commonweal Biomonitoring Resource Center, a program that helps communities of concern learn more about the public health tool of biomonitoring. She also is director of Special Projects for the Collaborative on Health and Environment, a Commonweal-sponsored network that seeks to raise the level of awareness about possible linkages between environmental threat and health outcomes.

Patton was a co-founder and served as the Northern Co-Chair of the International Persistent Organic Pollutants (POPs) Network, a network of over 500 public-interest groups around the globe who are active in UN negotiations dealing with toxic chemical regulation. Working closely with governments, this network participated in creating the Stockholm Convention, a legally binding UN treaty that bans or severely restricts the use of POPs chemicals. The Convention entered into force in May 2004.

Patton serves as advisor for the California Health Tracking Program, a CDC-funded project to develop infrastructure and processes for tracking chemical hazards, pathways of exposure and health outcomes in California.

In 1995, 1996, and 1997, Patton was the public sector representative on the United States Delegation to the UN Commission on Sustainable Development. Patton was also a public sector representative on the United States Delegation to the UN Summit, Habitat II, as well as on the US Delegation to Rio Plus Five. Patton was active as an NGO representative at the UN summits on women's issues in Cairo and Beijing, supporting women's reproductive rights and the right of women to live in environments conducive to the highest possible standard of good health.

Patton currently serves on the Advisory Group for human milk monitoring, World Health Organization, and the steering group for the World Alliance for Breastfeeding Advocacy. Patton is also a board member of the Barbara Smith Fund and The Endocrine Disrupter Exchange (TEDX).

Exhibit K

Statement of Ruthann Rudel



I, Ruthann Rudel, am writing this statement to provide information relevant to the Petition to the CPSC to regulate four categories of household products containing non-polymeric additive organohalogen flame retardants.

1. I, Ruthann Rudel, am Director of Research at the Silent Spring Institute, and Adjunct Research Associate in the Brown University Department of Pathology and Laboratory Medicine. I have a B.A. in chemistry and neuroscience from Oberlin College, and an M.S. in environmental management and policy from Tufts University. I have served on the US National Toxicology Program Board of Scientific Counselors and the Regulatory Affairs and Legislative Assistance Committee of the Society of Toxicology, and have participated in numerous environmental regulatory reviews for the US EPA, Health Canada, Toxicology Excellence for Risk Assessment, and others. I have attached my CV and list of publications.

2. For almost 20 years, I have been co-leading Silent Spring Institute's exposure and toxicology research programs focusing on endocrine active chemicals and on the mechanisms by which chemicals may influence breast cancer risk. I also direct Silent Spring Institute's Household Exposure Study, which was described by Environmental Science & Technology as the "most comprehensive analysis to date" of exposures in homes. I have expanded the initial study to include indoor and outdoor air, house dust, urine, blood, and self-reported exposure data from 170 participants in California and Massachusetts, leading to over 30 highly-cited peer-reviewed exposure-related papers.

3. Our 2003 Household Exposure Study was the first to test US homes for the flame retardant PentaBDE (a commercial mixture of polybrominated diphenyl ethers (PBDE)), which was then used as flame retardant in furniture foam. We found that levels of PBDEs in US homes were ten times higher than in Europe. In 2006, we discovered that, due to unique furniture flammability standards, exposures to PentaBDE congeners (BDE 47, 99 and 100) were 4 to 10 times higher in California than in the rest of the US, and two orders of magnitude higher than in Germany and the UK. Californians also had nearly twice as high blood levels of PBDEs (sum of BDE-28, -47, -99, -100, -153, and -154 congeners) compared to other US residents¹. These results show that flammability standards influence exposures and risks².

5. In 2011, we tested again the same 16 California homes from the 2006 study, to understand exposure to a wider range of flame retardants. This time we screened for 49 flame retardants (organohalogens and organophosphates), chosen due to evidence for their widespread use and potential harmful health effects.

6. We found that the current levels of exposure to the organohalogen flame retardants are often above health based guidelines³. House dust concentrations of six chemicals, including the carcinogens TCEP (Tris (2-chloroethyl) phosphate) and TDCPP (chlorinated “Tris”), were higher than EPA health risk guidelines in at least one home, and levels in 13 of 16 homes exceeded at least one health guideline level. TCEP and TDCPP (both listed as carcinogens under California’s Proposition 65) were found at levels of up to 0.01% in dust, higher than previously reported in the US. Our study was also the first to detect TDBPP (brominated “Tris”) in house dust, in 75% of the homes studied.

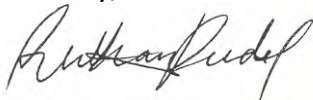
7. Our 2011 study also showed that exposure to flame retardants from house dust had changed since 2006, after the phase out of PentaBDE and OctaBDE. PentaBDE levels decreased in homes that added new furniture, electronics, and flooring. Similarly, households that reported purchasing new electronics had lower levels of TBBPA in 2011 compared to 2006. Instead, households that added new furniture and other flame retardant products between 2006 and 2011 had higher levels of tris(1-chloro-2-propyl) phosphate (TCPP), suggesting its use as PentaBDE replacement⁴.

8. Our 2003, 2006 and 2011 study results prove that, if added to consumer products in additive form (i.e. not chemically-bound to the material), organohalogen flame retardant chemicals migrate out of products and get into dust. This house dust is thought to be a major source of flame retardants in people’s bodies, especially in children⁵.

9. In particular, I wish to point out that our 2011 study indicated that banning individual flame retardants is ineffective because manufacturers tend to replace them with other chemicals with similar structures and hazards, including chemicals with uncharacterized toxicity. Some of the chemicals found in homes at the highest levels are carcinogenic, and are structurally similar to banned chemicals. Many of the chemicals detected in households show evidence of hormone disruption. The attached table from the Silent Spring study by Dodson et al. (2012)⁶ summarizes the known health concerns and the data gaps for some of the high production volume flame retardants we found in homes.

10. Based on these findings, my professional opinion is that, in order to reduce people’s exposure to hazardous chemicals in homes, it is best to use inherently non-flammable materials or smolder-resistant flammable materials. Continued use of non-polymeric additive organohalogen flame retardants would lead to continued exposure and may cause adverse health effects, particularly to vulnerable populations.

Sincerely,



Ruthann Rudel, MS
Director of Research, Silent Spring Institute

-
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Table SI4. Summary of flame retardant uses and health effects

Flame Retardant Class	Uses	Health Concerns ^a
Polybrominated diphenyl ethers (PBDEs)		
PentaBDE CAS 32534-81-9 <i>Includes congeners BDE 28, BDE 47, BDE 66, BDE 85, BDE 99, BDE 100, BDE 153, and BDE 154</i>	Additive flame retardant in polyurethane foams ⁷ Phased out in US in 2004 10-50 million pounds produced in 2002 in US	EPA Action Plan Chemical Dose-dependent decrease of T4, increased liver weight and P450 induction after 4 days of oral administration of DE-71 to 28 d.o. female rats. ⁸ Decrease of T4 and T3, increase of TSH, hypothyroid indicators, increased liver to body weight ratio, increased P450 induction, decrease in seminal vesicle and ventral prostate weights and delayed preputial separation in males, delayed vaginal opening in females; males more sensitive in this screening battery for EPA ED Screening Program using gavage of DE-71 on young Wistar rats ⁹ BDE-99: gestational exposure associated with hyperactivity and permanently impaired spermatogenesis in male rats ¹⁰ Decreased birth weight and birth length in humans associated with BDE 47, BDE 99, and BDE 100 levels in mothers' breast milk ¹¹ Children with higher concentrations of BDE 47, BDE 99, and BDE 100 in cord blood scored lower on tests of mental and physical development at 12-48 and 72 months ¹² In adult male sport fish consumers, serum levels of BDE 47, BDE 99, BDE 100, and BDE 153 were positively related to T4 and inversely related to T3 and TSH. Men over the 95 th percentile of PBDE levels were more likely to have thyroglobulin antibodies ¹³ Serum concentrations of BDE 28, BDE 47, BDE 99, BDE 100, and BDE 153 in pregnant women were inversely associated with TSH levels; no relationship was found with T4. ¹⁴ Serum levels of BDE 47, BDE 99, and BDE 100 were positively associated with T4 in pregnant women in their third trimester ¹⁵ Endocrine disruption through androgen, progesterone, estrogen, T4 receptor agonism and antagonism in vitro ¹⁶ Decreased attention, motor skills, and IQ in children associated with mothers' PBDE blood serum concentrations during pregnancy; decreased attention and IQ in children (age 7) associated with PBDE serum concentrations ¹⁷
OctaBDE CAS 32536-52-0 <i>Includes congeners BDE 183,</i>	Additive flame retardant in polymers for plastic housings and office equipment ⁷ Phased out in US in 2004	EPA Action Plan Chemical Dose-dependent decrease of T4, increased liver weight and P450 induction after 4 days of oral administration of DE-79 to 28 d.o. female rats ⁸

Flame Retardant Class	Uses	Health Concerns ^a
<i>BDE196, BDE 197, and BDE 203</i>	1-10 million pounds produced in 2002 in US	Neonatal mice gavaged BDE 203 resulted in increased CaMKII and synaptophysin in the hippocampus ¹⁸
DecaBDE CAS 1163-19-5 <i>Includes congener BDE 209</i>	Additive flame retardant in electrical and electronic equipment, textiles and fabric backings; accounts for 80% of total PBDE production ⁷ Volunteer phase-out in US by 2014 50-100 million pounds produced in 2006 in US	EPA Action Plan Chemical Impaired reproductive function to male mice exposed in utero ¹⁹ Neonatal exposure to mice effects neurobehavioral effects, including locomotion, rearing, and habituation activity; effects worsened with age. ²⁰ Neonatal exposure to mice effects sensorimotor responses and locomotor activity, and reduction of thyroxine levels ²¹ Decreased birth weight and birth length in humans associated with BDE 209 levels in mothers' breast milk ¹¹ Leukemia and liver, spleen, and thyroid tumors and cancers in oral high doses over 2 years to male rats ²²
Firemaster® 550 <i>2-ethylhexyl-2,3,4,5-tetrabromobenzoate (EH-TBB)</i> CAS 183658-27-7 <i>bis(2-ethylhexyl)-3,4,5,6-tetrabromophthalate (BEH-TBEP)</i> CAS 26040-51-7 <i>tri-phenyl phosphate (TPHP)</i> CAS 115-86-6	Replacement for PentaBDE in foams BEH-TBEP: 1-10 million pounds produced in 2006 in US TPHP: 10-50 million pounds produced in 2006 in US	FM® 550: DNA damage in liver tissue of fathead minnows after oral exposure. ²³ Increased thyroxine, body weight in offspring, early puberty in female offspring, difficulty in glucose regulation in female offspring and thickened walls in the left ventricle in male offspring. ²⁴ BEH-TBEP structurally similar to DEHP, a reproductive and developmental toxicant and listed carcinogen on CA's Proposition 65 List ^{25,26} Hypothyroidism, decrease T3, hepatotoxicity in pregnant rats, and increased multinucleated germ cells in fetal testis following two days of oral dosing of TBMEHP, a metabolite of TBPH ²⁷ TPHP: increased prolactin levels, reduced sperm concentration in men ²⁸ <i>Lack of cancer, and 2 generation reproductive, and developmental studies</i> ²⁹
hexabromocyclododecanes (HBCYDs) CAS: 3194-55-6 <i>Includes alpha, beta, and gamma-hexabromocyclododecane</i>	Additive flame retardant in thermoplastic (moldable) polymers and styrene resins ⁷ Used in building insulation, upholstery textiles and electrical equipment housing ³⁰ 10-50 million pounds produced in 2006 in US	EPA 2010 Action Plan to review potential reproductive, developmental and neurological effects ³¹ Listed as Substance of Very High Concern (SVHC) under REACH Hyperactive activity, reduced habituation, learning and memory impairment in neonatal mice with oral exposures ³² Non-monotonic dose response curve observed for TSH levels in adult mice and their offspring, decreased ovarian follicles in second generation female mice, decreases in the

Flame Retardant Class	Uses	Health Concerns ^a
		<p>viability index of F2 pups³³</p> <p>Thyroid hormone disruption in animals and in vitro models³⁴</p> <p>Endocrine disruption through androgen, progesterone, estrogen, T4 receptor agonism and antagonism in vitro¹⁶</p> <p>Dopamine and GABA uptake inhibition due to effects on membrane potential in rat brain cells³⁵</p>
tetrabromobisphenol A (TBBPA) CAS: 79-94-7	<p>Most widely used flame retardant; reactive in circuit boards; additive flame retardant in polymers⁷</p> <p>100-500 million pounds produced in 2006 in US</p>	<p>Endocrine disruption through T3, T4 agonism and estradiol inhibition in vitro.¹⁶ Strong T4 agonism.³⁶ CD25 inhibition in female mice.³⁷ Decreased T4, increased testis and pituitary weight in orally exposed rats, increased testis weight, testosterone, female gonadal weight in second generation³⁸</p> <p>Dopamine and GABA uptake inhibition due to effects on membrane potential in rat brain cells³⁵</p> <p><i>Lack of health studies</i></p>
Other brominated flame retardants (BFRs)		
tetrabromobisphenol A-bis(2,3-dibromopropylether) (TBBPA-BDBPE) CAS: 21850-44-2	<p>Additive flame retardant in plastics, including pipes, water barriers, kitchen hoods and electronics³⁹</p> <p>1-10 million pounds produced in 2006 in US</p>	<p>Endocrine disruption through T4 agonism and estradiol inhibition in vitro¹⁶</p> <p>Mutagenic in salmonella; structural similarities to TDBPP, a classified carcinogen⁴⁰</p> <p><i>Lack of health studies</i></p>
hexabromobenzene (HBB) CAS: 87-82-1	Additive flame retardant in paper, wood, textiles, electronic and plastics; not used in Europe ³⁹	<p>Disruption of heme formation in female rats following gavaged HBB over 28 days⁴¹</p> <p>Increased liver:body ratio and increased carboxylesterase in rats subchronically fed HBB⁴²</p> <p><i>Lack of health studies</i></p>
1,2-bis(2,4,6-tribromophenoxy)ethane (BTBPE) CAS: 37853-59-1	<p>Replacement for OctaBDE³⁹</p> <p>1-10 million pounds produced in 2006 in US</p>	<p>Its metabolite is a endocrine disruptor through androgen, progesterone, estrogen, T4 receptor agonism and antagonism in vitro¹⁶</p> <p>Behavioral, gastrointestinal, and respiratory changes, and dermatitis following high dose inhalation in rats. Dermal exposure to rabbits led to metabolic changes⁴³</p>

Flame Retardant Class	Uses	Health Concerns ^a
		<i>No chronic animal studies</i> ⁴³
decabromodiphenylethane (DBDPE) CAS: 84852-53-9	Alternative to DecaBDE ³⁹ 10-50 million pounds produced in 2006 in US	Reduced EROD activity in fish hepatocytes; acutely toxic to water fleas; reduced hatching rates of zebra fish eggs and increased mortality of hatched larvae ⁴⁴ Structurally similar to BDE 209 ³⁹ <i>Lack of health studies</i>
Halogenated organophosphate flame retardants (OPFRs)		
tris(2-chloroethyl)phosphate (TCEP) CAS: 115-96-8	Used in polyurethane foams, plastics, polyester resins, and textiles ^{45, 46} Banned from children's products in NY in 2011 ⁴⁷ Up to 1 million pounds produced in 2006 in US	Listed as carcinogen on CA's Proposition 65 List in 1992 Listed as Substance of Very High Concern (SVHC) and persistent, bioaccumulative, and toxic (PBT) as a reproductive toxicant under REACH ⁴⁸ Impaired memory in rats, cholinesterase inhibition in hen brains. ⁴⁹ Neurotoxicity due to altered cellular neurodifferentiation in vitro. ⁵⁰ Decreased cognitive function correlated with TCEP in house dust in boys and girls age 5-9 ⁴⁸
tris(1-chloro-2-propyl)phosphate (TCIPP) CAS: 13674-84-5	Used in polyurethane foams ⁴⁵ 10-50 million pounds produced in 2006 in US	Structurally similar to TCEP ⁵¹ <i>Lack of health studies</i>
tris(1,3-dichloro-isopropyl)phosphate (TDCIPP) CAS: 13674-87-8	Used in polyurethane foams, plastics, and textiles ^{45, 46} Removed from children's clothing in the late 1970s in the US ⁵² 10-50 million pounds produced in 2006 in US	Listed as carcinogen on CA's Proposition 65 List in 2011 Increased liver carcinomas and kidney, testicular, and brain tumors in male and female rats ⁴⁹ Associated with Sick Building Syndrome in men and women ⁵³ Endocrine disruption through decrease in thyroxine, increase in prolactin, and decrease in androgens in men ²⁸ Neurotoxicity due to altered cellular neurodifferentiation and inhibited DNA synthesis in vitro ⁵⁰
tris-(2,3-dibromopropyl)phosphate (TDBPP)	Used in polyurethane foams ⁴⁵ Banned in 1977 for use in children's clothing ⁵⁴	Listed as carcinogen on CA's Proposition 65 List in 1988; classified as IARC 2A carcinogen

Flame Retardant Class	Uses	Health Concerns ^a
CAS: 126-72-7		
Non-halogenated OPFRs		
tri-ethyl-phosphate (TEP)	Used for plasticizing properties and in antifoam agents and lacquers ^{45, 46}	Brain colinesterase inhibition and reduced righting reflex in rats following injection of TEP ⁵⁵
CAS: 78-40-0	1-10 million pounds produced in 2006 in US	<i>Lack of health studies</i>
tri-iso-butyl-phosphate (TIBP)	Used for plasticizing properties and in antifoam agents and lacquers ^{45, 46}	<i>Lack of health studies</i>
CAS: 126-71-6		
Tri-n-butyl-phosphate (TNBP)	Used for plasticizing properties and as lubricants in hydraulic fluids ⁴⁵	A dose-related increase in the incidence and severity of urinary bladder tumors was found in male and female rats receiving TnBP in the diet for 2 years ⁵⁶
CAS: 126-73-8	1-10 million pounds produced in 2006 in US	Associated with Sick Building Syndrome in men and women ⁵³ <i>Lack of health studies</i>
tri-(2-butoxyethyl)-phosphate (TBOEP)	Also used in floor wax, lacquers, and rubber and plastic stoppers ^{45, 46}	Decreased red cell acetylcholinesterase, ataxia, tremors, and increased liver weight in rats gavaged TBEP for 18 weeks ⁵⁷
CAS: 78-51-3	1-10 million pounds produced in 2006 in US	<i>Lack of health studies</i>
tri-(2-ethylhexyl)-phosphate (TEHP)	Used in clothing, as a plasticizer, and as a solvent ⁵⁸	Increase in lymphomas, liver, pituitary tumors in mice orally exposed to high doses of TEHP in diet for 2 years ⁵⁹
CAS: 78-42-2		<i>Lack of health studies</i>
tri-cresyl-phosphate (TMPP)	Used as flame retardant plasticizers and as lubricants in hydraulic fluid ⁴⁵	Reproductive and developmental toxicity due to dose-dependent increase in abnormal sperm morphology in male rats and increased pup mortality following in utero exposure ⁶⁰
CAS: 1330-78-5	1-10 million pounds produced in 2006 in US	Toxicity to central nervous system due to neuropathy of the sciatic nerve ⁶⁰ <i>Lack of health studies</i>
Dechlorane-plus (DDC-CO)	• Flame retardant in electronics ⁶¹	Increased liver weight, increased lung weight and macrophages in alveoli in rats, decreased liver and ovarian weight in rabbits ⁶²
CAS: 13560-89-9	1-10 million pounds produced in 2006 in US	Shares structural similarities with dieldrin, chlordane, heptachlor, endrin, and endosulfan ⁶³

Flame Retardant Class	Uses	Health Concerns^a
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^a From laboratory or animal studies unless otherwise indicated

Lack of health studies

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Sept 26, 2014

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EDUCATION

Oberlin College, B.A., Chemistry and Neuroscience (High Honors), 1986

Summer Research Fellowships, Rockefeller University, National Institute of Health, 1984-1986

Tufts University, Department of Civil Engineering, 1989-1991, M.S., Hazardous Materials Management, 1991

Harvard Extension School and New England Epidemiology Institute, 1993-1995, graduate courses in epidemiology, statistics

ACADEMIC APPOINTMENTS

Research Associate, Department of Pathology and Laboratory Medicine, The Warren Alpert Medical School of Brown University, 2007-present

PRIMARY CAREER APPOINTMENTS

Senior Research Assistant, Neuroscience Laboratories, Tufts University Medical School, Boston, MA, 1986-1989

Editor, World Information Systems, Cambridge, MA, 1989-1990

Environmental Toxicologist, Gradient Corporation, Cambridge, MA, 1990-1995

Director of Research, Senior Scientist, Toxicology and Environmental Health Risk Assessment, Silent Spring Institute, 1995-present (Silent Spring Institute is a nonprofit research organization dedicated to studying the environment and women's health.)

OTHER APPOINTMENTS

Ad hoc Manuscript Reviewer, *Environmental Science & Technology*, *Toxicological Sciences*, *Environmental Health Perspectives*, *Environmental Research*, and others, 1997-present

Invited Reviewer, Toxicology Excellence for Risk Assessment, Cincinnati, OH, 1998-present

Reviewer, US EPA/NIEHS STAR grants, 1999

Invited Reviewer, Cornell University Program on Breast Cancer and Environmental Risk Factors, 1999-2002

Advisor, Breast Cancer Fund, Breast Cancer Action, Massachusetts Breast Cancer Coalition, Massachusetts Alliance for a Healthy Tomorrow, California Breast Cancer Research Program, and others, 1999-present

Consultant, risk assessment reviewer, Health Canada, 1997-2009

Science Advisory Board Member, Massachusetts Toxics Use Reduction Act implementation, 2000-2001

Developer, Co-Chair, Society of Toxicology annual meeting symposium, *Breast Cancer: Issues in Screening and Testing of Potential Human Carcinogens*, 2001

Chair, Member, Society of Toxicology Regulatory Affairs and Legislative Assistance Committee, 2004-2006

Expert Panelist, California Breast Cancer and Chemicals Policy Project, 2009

Board of Scientific Counselors, US National Toxicology Program, 2009-2011

UNIVERSITY TEACHING ROLES

Guest lecturer at Tufts University, Harvard School of Public Health, and Suffolk University, 2005-present

PUBLICATIONS LIST

ORIGINAL PUBLICATIONS IN PEER-REVIEWED JOURNALS

1. Talamo, B.R., **R.A. Rudel**, K.S. Kosik, V.M. Lee, S. Neff, L. Adelman, and J.S. Kauer. 1989. Pathological changes in olfactory neurons in patients with Alzheimer's disease. *Nature* 337:736-739.
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22. Zota, A.R., A. Aschengrau, R.A. **Rudel**, and J.G. Brody. (2010) Self-reported chemicals exposure, beliefs about disease causation, and risk of breast cancer in the Cape Cod Breast Cancer and Environment Study: A case-control study. *Environmental Health*
23. **Rudel**, R.A., R.E. Dodson, L.J. Perovich, R. Morello-Frosch, D.E. Camann, M.M. Zuniga, A.Y. Yau, A.C. Just, and J.G. Brody. (2010) Endocrine disrupting compounds in paired indoor and outdoor air in two northern California communities. *Environmental Science and Technology*
24. Dunagan, S.C., R.E. Dodson, R.A. **Rudel**, and J.G. Brody. 2010. Toxics use reduction in the home: Lessons learned from household exposure studies. *Journal of Cleaner Production* 19(2011):438-444. doi:10.1016/j.jclepro.2010.06.012
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26. **Rudel**, R.A, J.M. Gray, C.L. Engel, T.W. Rawsthorne, R.E. Dodson, J.M. Ackerman, J. Rizzo, J.L. Nudelman, and J.G. Brody. 2011. Food packaging and bisphenol A and bis(2-ethylhexyl) phthalate exposure: Findings from a dietary intervention. *Environmental Health Perspectives* 119(7):914-920. doi:10.1289/ehp.1003170
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29. Brown, P., J.G. Brody, R. Morello-Frosch, J. Tovar, A.R. Zota, and R.A. **Rudel**. 2011. Measuring the success of community science: The Northern California Household Exposure Study. *Environmental Health Perspectives*. 120(3): 326-331. doi:10.1289/ehp.1103734
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31. Dodson, R.E., L.J. Perovich, A. Covaci, N. Van den Eede, A.C. Ionas, A.C. Dirtu, J.G. Brody, R.A. **Rudel**. 2012. After the PBDE phase-out: A broad suite of flame retardants in repeat house dust samples from California. *Environmental Science & Technology*. 46(24): 13056-13066.

32. Schaidler L.A., R.A. Rudel, J.M. Ackerman, S. Dunagan, and J.G. Brody. 2014. Pharmaceuticals, Perfluorosurfactants, and Other Organic Wastewater Compounds in Public Drinking Water Wells in a Shallow Sand and Gravel Aquifer. *Science of the Total Environment*, 468–469:384-393. doi: 10.1016/j.scitotenv.2013.08.067.
33. Ackerman JM, Dodson RE, Engel CL, Gray JM, **Rudel RA**. Temporal variability of urinary di(2-ethylhexyl) phthalate metabolites during a dietary intervention study. *J Expo Sci Environ Epidemiol*. 2014 Jan 22. doi: 10.1038/jes.2013.93.
34. **Rudel, R.A.**, J.M. Ackerman, K.R. Attfield, J.G. Brody. 2014. New exposure biomarkers as tools for breast cancer epidemiology, biomonitoring, and prevention: a systematic approach based on animal evidence. *Environmental Health Perspectives*. 122(9): 881-895. doi: 10.1289/ehp.1307455.

OTHER PEER-REVIEWED PUBLICATIONS

1. Brody, J.G., R.A. **Rudel**, N.I. Maxwell, and S.R. Swedis. 1996. Mapping out a search for environmental causes of breast cancer. *Public Health Reports* 3(6):495-507.
2. **Rudel R.A.** 1997. Predicting health effects of exposures to compounds with estrogenic activity: Methodological issues. *Environmental Health Perspectives* 105 (Suppl 3):655-663.
3. Brody, J.G., R.A. **Rudel**, S.J. Melly, and N.I. Maxwell. 1998. Endocrine disruptors and breast cancer. *Forum for Applied Research and Public Policy* 13(3):24-31.
4. Kriebel, D., J. Tickner, P. Epstein, J. Lemons, R. Levins, E.L. Loechler, M. Quinn, R.A. **Rudel**, R. Schettler, and M. Stoto. 2001. The precautionary principle in environmental science. *Environmental Health Perspectives* 109(9):871-875.
5. Brody, J.G., and R.A. **Rudel**. 2003. Environmental pollutants and breast cancer. *Environmental Health Perspectives* 111(8):1007-1019.
6. Brody, J.G., J. Tickner, and R.A. **Rudel**. 2005. Community-initiated breast cancer and environment studies and the precautionary principle. *Environmental Health Perspectives* 113(8):920-925.
7. Brody, J.G., R.A. **Rudel**, K.B. Michels, K.P. Moysich, L. Bernstein, K. R. Attfield, and S. Gray. 2007. Pollutants, diet, physical activity, body size, and breast cancer: Where do we stand in research to identify opportunities for prevention? *Cancer* 109(S12):2627-2634.
8. Brody, J.G., K.P. Moysich, O. Humblet, K.R. Attfield, G.P.. Beehler, and R.A. **Rudel**. 2007. Environmental pollutants and breast cancer: Epidemiologic studies. *Cancer* 109(S12):2667-2711.
9. Brody, J.G., and R.A. **Rudel**. 2008. Environmental pollutants and breast cancer: The evidence from animal and human studies. *Breast Diseases: A Year Book Quarterly* 19(1):17-19.
10. Brody, J.G., R.A. **Rudel**, M. Kavanaugh-Lynch. 2011. Testing Chemicals for Effects on Breast Development, Lactation, and Cancer. *Environmental Health Perspectives*, 119(8).
11. Adams, C., P. Brown, R. Morello-Frosch, J. G. Brody, R. **Rudel**, A. Zota, S. Dunagan, J. Tovar, and S. Patton. June 2011. Disentangling the exposure experience: the roles of

community experience: the roles of community context and report-back of environmental exposure data. *Journal of Health and Social Behavior*, 52(2): 180-196.

12. Osborne G, **Rudel** R, Schwarzman M. 2014. Evaluating chemical effects on mammary gland development: A critical need in disease prevention. *Reprod Toxicol*. doi: 10.1016/j.reprotox.2014.07.077
13. Brody JG, Dunagan SC, Morello-Frosch R, Brown P, Patton S, **Rudel RA**. 2014. Reporting individual results for biomonitoring and environmental exposures: lessons learned from environmental communication case studies. *Environ Health*. 13: 40. doi: 10.1186/1476-069X-13-40

BOOKS AND BOOK CHAPTERS

Rudel, R.A., and B.D. Beck. 1993. Risk assessment for indoor air: Evaluating risks to susceptible populations. In *NATO/CCMS Pilot Study on Indoor Air Quality: Methods of Risk Assessment for the Indoor Environment*. Ed. B. Seifert. Institute for Water, Soil, and Air Hygiene of the Federal Health Office, Berlin.

Beck, B.D., R.A. **Rudel**, and E.J. Calabrese. 1994. The use of toxicology in the regulatory processes. In *Principles and Methods of Toxicology, Third Edition*. Ed. A. Wallace Hayes. New York: Raven Press.

Beck, B.D., R.A. **Rudel**, G.C. Hook, and T.S. Bowers. 1995. Risk assessment. In *Metal Toxicology*, Eds. R. Goyer, C. Klaasen, and M. Waalkes. San Diego, CA: Academic Press.

Rudel, R.A. 2000. Polycyclic aromatic hydrocarbons, phthalates, and phenols. In *Indoor Air Quality Handbook*, Eds. J. Spengler, J. Samet, and J. McCarthy. New York: McGraw-Hill.

Beck, B.D., T.M. Slayton, E.J. Calabrese, L. Baldwin, and R.A. **Rudel**. 2001. The use of toxicology in the regulatory process. In *Principles and Methods of Toxicology*, Ed. A. Wallace Hayes. Philadelphia, PA: Taylor & Francis.

Brody, J.G., R. Morello-Frosch, P. Brown, R.A. **Rudel**, R.G. Altman, M. Frye, C.A. Osimo, C. Perez, and L.M. Seryak. 2008. Improving disclosure and consent: "Is it safe?": New ethics for reporting personal exposures to environmental chemicals. In *Perspectives in Medical Sociology, Fourth Edition*, Ed. Phil Brown. Long Grove, IL: Waveland Press, Inc.

Morello-Frosch, R., P. Brown, J.G. Brody, R.G. Altman, R.A. **Rudel**, A. Zota, and C. Perez. 2011. Experts, ethics, and environmental justice: Communicating and contesting results from personal exposure science. In *Technoscience and Environmental Justice: Expert Cultures in a Grassroots Movement*, eds. G. Ottinger and B.R. Cohen. Cambridge, MA: MIT Press.

Rudel RA, Rodgers KM, Just AC. 2014. Phthalates in Food Packaging, Consumer Products, and Indoor Environments. In: *Toxicants in Food Packaging and Household Plastics: Exposure and Health Risks to Consumers*. London:Springer.

OTHER NON-PEER-REVIEWED PUBLICATIONS

Letters

Rudel, R.A., J.G. Brody, and J.D. Spengler. 2001. Identification of selected hormonally active agents and animal mammary carcinogens in commercial and residential air and dust samples [Response]. *Journal of Air and Waste Management Association* 51:1388-90.

Rudel, R.A., and E. Newton. 2004. Letter to the Editor: Exposure assessment for decabromodiphenyl ether (decaBDE) is likely to underestimate general U.S. population exposure. *Journal of Children's Health* 2(2):171-173.

Zota, A.R., R.A. **Rudel**, R.A. Morello-Frosch and J.G. Brody. 2009. Response to comment on "Elevated house dust and serum concentrations of PBDEs in California: Unintended consequences of furniture flammability standards?" *Environmental Science & Technology* 43(7):2661-2662.

Brody, J.G., R. Morello-Frosch, P. Brown and R.A. **Rudel**. 2009. Letter to the Editor: Reporting individual results for environmental chemicals in breastmilk in a context that supports breastfeeding. *Breastfeeding Medicine* 4(2):121.

Schaider, L.A., R.A. **Rudel**, J.M. Ackerman, and J.G. Brody. (2010) Correspondence re: Using residential history and groundwater modeling to examine drinking water exposure and breast cancer by Lisa Gallagher et al., *Environmental Health Perspectives*, published online 1 September 2010.

Rudel, R.A, J.M. Ackerman, and R.E. Dodson. 2011. Dietary intervention and DEHP reduction: Rudel et al. respond. *Environmental Health Perspectives* 119:a380-a381. doi:10.1289/ehp.1103852R

Rudel, R.A. and L.J. Perovich. 2012. Accurate risk-based chemical screening relies on robust exposure estimates. *Toxicological Sciences*, doi:10.1093/toxsci/kfs143.

PUBLICATIONS SUBMITTED

Dodson, R.E., Van den Eede, N, Covaci, A, Perovich,LJ, Brody, JG., **Rudel, RA.** (Under review) Urinary biomonitoring of phosphate flame retardants: Levels in California adults and recommendations for future studies

INVITED PRESENTATIONS

1. **Rudel, R.A.** 1995. Modeling *in vivo* estrogenic potency. Invited talk. Workshop on hormones, hormone metabolism, and breast cancer. National Cancer Institute's National Action Plan on Breast Cancer, September, New Orleans, LA.
2. **Rudel, R.A.** 2001. Residential exposure to EDCs in the context of a breast cancer study. e.hormone 2001, October 18-20, Tulane University, New Orleans, LA.
3. Brody, JG, RA **Rudel**. 2002. Environmental pollutants and breast cancer: using GIS and environmental sampling in the Cape Cod Breast Cancer and Environment Study. Presented at the

National Institute of Environmental Health Sciences (NIEHS), June 10, 2002, Research Triangle Park, North Carolina.

4. **Rudel**, R.A. 2002. Household exposure to hormonally active agents and animal mammary carcinogens in indoor air, dust, and residents' urine on Cape Cod, MA. Invited talk sponsored by the EPA conference Risk Management for Endocrine Disrupting Compounds, January, Cincinnati, OH.
5. **Rudel**, R.A. 2003. Air, dust, and urinary markers of phthalates. NIEHS Workshop on Human Health Effects of Phthalate Exposure. March 26-27, Research Triangle Park, NC.
6. Brody, JG, RA **Rudel**. 2005. Community-initiated breast cancer and environment studies and the Precautionary Principle. Presented to the Collaborative on Health and the Environment Cancer Working Group, June 1.
7. Brody, JG, RA **Rudel**. 2007. Endocrine disruptors and breast cancer: The Cape Cod Study and beyond. Presented at the Superfund Basic Research Program Seminar, Brown University, April 20, Providence, Rhode Island.
8. Brody, JG, RA **Rudel**. 2007. Breast cancer and the environment: Science review with Silent Spring Institute. Presented to the Collaborative on Health and the Environment Partnership Call, June 19.
9. **Rudel**, RA. 2009. Key issues and data needs for considering mammary gland effects in chemical risk assessment. Presented at the Mammary Gland Evaluation and Risk Assessment Workshop, November 16-17, Oakland, CA.
10. Brody, J.G., R. Morello-Frosch, P. Brown, R.A. **Rudel**, S. Dunagan. Is It Safe? Reporting Personal Exposures When Health Effects are Uncertain. Presented at the Keystone Science Lecture Series sponsored by the NIEHS Division of Extramural Research and Training (DERT), December 1, 2009, Research Triangle Park, North Carolina.
11. **Rudel**, R.A. 2010. Toxicology Can Advance Breast Cancer Prevention by Informing Chemicals Policies and Epidemiologic Study Design. Institute of Medicine Committee on Breast Cancer and the Environment. July 7, 2010, San Francisco, CA
12. **Rudel**, RA., R. Dodson. 2011. SVOCs in indoor air, dust, and personal care products. Presented at the SVOCs in the Indoor Environment: Mechanistic Insights to Support Sustainable Product Design, Safe Use and Improved Public Health Workshop sponsored by the Indoor Air Institute, January 5-7, 2011, EPA, Research Triangle Park, North Carolina.
13. **Rudel**, RA. 2011. "Is It Safe?": New Ethics for Reporting Personal Exposures to Environmental Chemicals. Presented at the Biomonitoring California Workshop: Understanding and Interpreting Biomonitoring Results, March 17, 2011, Oakland, California.
14. Brody, J.G., **R. Rudel**. Household Cancer Hazards Interview. Julie and Ruthann interviewed with Dr. Lynn Goldman on NPR's On Point (Tom Ashbrook) regarding the Product Testing Study, March 13, 2012.

15. **Rudel, R.A.** 2013. Chemicals and Breast Cancer: Building on National Initiatives for Chemical Safety Screening. Presented at Chemical Testing in the 21st Century: Opportunities and Challenges, January 24, 2013, Environmental Defense Fund, Washington DC.
16. **Rudel, R.A.** 2013. Chemicals Testing Workgroup Panel. California Breast Cancer Research Program's "From Research to Action: Two Decades of Change" symposium, May 17-18, 2013, Costa Mesa, CA.
17. **Rudel, R.A.** 2013. How are the critical relationships between chemical bioavailability, activity, and adversity established within an AOP in a way that protects the most sensitive subpopulations? Panel speaker at Adverse Outcome Pathways: From Research to Regulation. September 3-4, 2014, Bethesda, MD.
18. **Rudel, R.A.** Toxicology for Breast Cancer Prevention. Risk Assessment Specialty Section (RASS) and Mixtures Specialty Section (MSS) Webinar. September 10, 2014.

SELECTED ABSTRACTS

1. **Rudel, R.A.**, and B.D. Beck. 1993. Risk assessment for indoor air: Evaluating risks to susceptible populations. *Methods of Risk Assessment for Indoor Environment*. B. Seifert, ed. NATO/CCMS Pilot Study of Indoor Air Quality and European Collaborative Action. "Indoor Air Quality and its Impact on Man (Formerly Cost Project613)." Report on a joint workshop, held October 15-17, 1991 in Kloster Banz, Federal Republic of Germany.
2. **Rudel, R.A.**, and B.D. Beck. 1994. Variability in international criteria for chemical toxicity: Comparison of the methods and criteria developed by the U.S. EPA, the WHO, and the RIVM. Presented at the Society for Risk Analysis Annual Meeting, December, Baltimore, MD.
3. Melly, S.J., S.R. Swedis, R.A. **Rudel**, Y.T. Joyce, and J.G. Brody. 1996. Environmental factors in breast cancer: Enhancing an ecological epidemiology study through the use of a geographic information system. Joint Annual Meeting of the Society for Risk Analysis and the International Society for Exposure Assessment. New Orleans, LA.
4. Melly, S.J., R.A. **Rudel**, A.M. Soto, C. Sonnenschein, M. Fernandez, and J.G. Brody. 1996. Potential exposure to estrogenic chemicals via drinking water from a vulnerable aquifer: Pairing chemical analysis with a bioassay. Joint Annual Meeting of the Society for Risk Analysis and the International Society for Exposure Assessment. New Orleans, LA.
5. Brody, J.G., A. Aschengrau, and R.A. **Rudel**. 1997. Occupational history module of the breast cancer core questionnaire. American Public Health Association Annual Meeting. Indianapolis, IN.
6. **Rudel, R.A.** 1998. Estrogenic components in wastewater, septage, and groundwater: A comparison between chemical analysis and results from an MCF-7 cell proliferation bioassay. Presented at the NIEHS/EPA Endocrine Disruptor Grantees Annual Meeting, October, Research Triangle Park, NC.

7. **Rudel, R.A.**, A.M. Soto, C. Sonnenschein, M. Luizzi, B. Weill, S.J. Melly, P.W. Geno, and J.G. Brody. 1998. Estrogenic components in wastewater, septage, and groundwater: A comparison between chemical analysis and results from an MCF-7 cell proliferation bioassay. NIEHS/US EPA Endocrine Disruptor Investigators Meeting. Research Triangle Park, NC.
8. Camann, D.E., J.S. Colt, S.L. Teitelbaum, R.A. **Rudel**, R.M. Hart, and M.D. Gammon. 2000. Pesticide and PAH distributions in house dust from seven areas of USA. Society of Environmental Toxicology and Chemistry 21st Annual Meeting, Nashville, TN.
9. **Rudel, R.A.**, D. Camann, P.W. Geno, N. Ho, M. Ortiz, A. Yau, J.D. Spengler, J. Vallarino, and J.G. Brody. 2000. Identification of animal mammary carcinogens and hormonally active chemicals in residential air and dust samples. International Society for Exposure Analysis Meeting. Monterey, CA.
10. Brody, JG, SJ Melly, RA **Rudel**, NI Maxwell. 2000. GIS exposure assessment for pesticides and drinking water in the Cape Cod Breast Cancer and Environment Study. Annual Conference of International Society for Environmental Epidemiology (ISEE)/International Society of Exposure Analysis (ISEA). *Epidemiology* 11(4):S102.
11. **Rudel, R.A.** and B. Davis. 2001. Breast cancer: Issues in screening and testing of potential human carcinogens. Symposium for 2001 Society of Toxicology Annual Meeting, March 29, San Francisco, CA.
12. O'Leary, ES, CH Swartz, JG Brody, RA **Rudel**. 2001. GIS in exposure assessment for pesticides in the Cape Cod Breast Cancer and Environment Study and the Long Island Breast Cancer Study Project. Presented at the American Public Health Association Meeting. October 24, Atlanta, Georgia.
13. **Rudel, RA**, D Barr, JG Brody. 2001. Characterizing exposure to a wide range of chemicals of interest for breast cancer research: Indoor air and dust and urinary measure for pesticides, endocrine disruptors, and animal mammary carcinogens. Presented at the American Public Health Association Meeting, October 24, Atlanta, Georgia.
14. **Rudel, RA**, JG Brody, D Camann, A Yau, JD Spengler, J Vallarino. 2001. Characterization of residential exposures to a wide range of endocrine-active compounds in the context of a breast cancer epidemiologic study. Presented at e.hormone 2001: The Cutting Edge of Endocrine Disruptor Research, Tulane University. October 20, New Orleans, Louisiana.
15. **Rudel, RA**. 2002. Residential indoor air and dust measurements of phthalates and other EDCs. Effective Risk Management of Endocrine Disrupting Chemicals, U.S. Environmental Protection Agency. January 29–30, Cincinnati, Ohio.
16. Brody, JG, RA **Rudel**. 2002. Environmental pollutants and breast cancer: using GIS and environmental sampling in the Cape Cod Breast Cancer and Environment Study. Presented at National Institute's Environmental Health Sciences meeting. June 10, Research Triangle Park, North Carolina.

17. Brody, JG, CH Swartz, T Kennedy, RA **Rudel**. 2002. Historical pesticide exposure assessment using a geographic information system and self-report in a breast cancer study. Annual Conference of International Society for Environmental Epidemiology (ISEE)/International Society of Exposure Analysis (ISEA). *Epidemiology* 13(4):S209.
18. **Rudel**, RA, CH Swartz, JG Brody, DM Camann, A Yau, M Zuniga, JD Spengler. 2002. Residential indoor air and dust measures for pesticides, alkylphenols, phthalates, and other endocrine disruptors. Annual Conference of International Society for Environmental Epidemiology (ISEE)/International Society of Exposure Analysis (ISEA). *Epidemiology* 13(4):S198.
19. Brody, JG, R Polk, AM Menting, CH Swartz, RA **Rudel**. 2002. Beyond “I don’t know”: responsible and effective strategies to communicate results of exposure assessment for endocrine disruptors to study participants and communities in a breast cancer study. Annual Conference of International Society for Environmental Epidemiology (ISEE)/ International Society of Exposure Analysis (ISEA). *Epidemiology* 13(4):S253.
20. Swartz, CH, RA **Rudel**, JR Kachajian, JG Brody. 2002. Indicators of wastewater and land use impacts on public drinking water: Historical reconstruction of exposure on Cape Cod, MA. Annual Conference of International Society for Environmental Epidemiology (ISEE)/ International Society of Exposure Analysis (ISEA). *Epidemiology* 13(4):S191.
21. **Rudel**, R.A. 2003. Phthalates in indoor air, housedust, and urine. Invited talk. NIEHS Workshop on Human Health Effects of Phthalate Exposure. March 26-27, 2003, Research Triangle Park, NC.
22. McKelvey, W, RA **Rudel**, V Cortessis, JG Brody. 2003. Is there an association between cryptorchidism or hypospadias in a son and a mother’s risk of breast cancer? Presented at the 36th Annual Meeting of the Society for Epidemiologic Research; June 11–14, Atlanta, Georgia. *American Journal of Epidemiology* 157(suppl 11): S39.
23. Brody, JG, RA **Rudel**, R Morello-Frosch, P Brown, A Napolis, RG Altman, C Osimo, C Perez, L Seryak, A Just. 2006 Environmental justice and breast cancer advocacy: Household exposure to endocrine disrupting compounds. 134th Annual Meeting of the American Public Health Association, November, Boston, Massachusetts.
24. Attfield, K, T Kennedy, A Just, S Gray, R **Rudel**, JG Brody. 2006. Developing computer mapping tools for public access to environmental health information. 134th Annual Meeting of the American Public Health Association, November, Boston, Massachusetts.
25. Morello-Frosch, R, JG Brody, M Frye, P Brown, RG Altman, RA **Rudel**, C Perez. 2006. Right-to-know, the right-to-act, and the right not-to-know: Ethical and scientific dilemmas of reporting data in biomonitoring and environmental exposure studies. 134th Annual Meeting of the American Public Health Association, November, Boston, Massachusetts.
26. Standley, LJ, RA **Rudel**, CH Swartz, KR Attfield, JG Brody. 2006. Contamination of surface ponds on Cape Cod, MA, by EDCs and pharmaceuticals from septic-contaminated groundwater. North

American Meeting of the Society for Environmental Toxicology and Chemistry, November, Montreal, Canada.

27. Zota, AR, RA **Rudel**, RA Morello-Frosch, DE Camann, JG Brody. 2007. Regional variation in levels of indoor polybrominated diphenyl ethers may reflect differences in fire safety regulations for consumer products. 17th Annual Conference of the International Society of Exposure Analysis. Research Triangle Park, North Carolina.
28. Zota, AR, RA **Rudel**, RA Morello-Frosch, JG Brody. 2008. Elevated house dust and serum concentrations of PBDEs in California: Unintended consequences of furniture flammability standards? ISEE-ISES Joint Annual Conference on Exposure and Health in a Global Environment. Pasadena, California.
29. Morello-Frosch, RA, AR Zota, RA **Rudel**, C Perez, J Tovar, P Brown, R Dodson, JG Brody. 2008. Community-based participatory exposure assessment in an environmental justice community: preliminary results and communication. ISEE-ISES Joint Annual Conference on Exposure and Health in a Global Environment. Pasadena, California.
30. **Rudel** RA, RE Dodson, E Newton, AR Zota, JG Brody. 2008. Correlations between urinary phthalate metabolites and phthalates, estrogenic compounds 4-Butyl phenol, and some pesticides in home indoor air and house dust. ISEE-ISES Joint Annual Conference on Exposure and Health in a Global Environment. Pasadena, California.
31. Dodson RE, RA **Rudel**, E Newton, JG Brody. 2008. Urinary Pesticide Concentrations and Their Relationship to Air and Dust Concentrations and Household Predictors. ISEE-ISES Joint Annual Conference on Exposure and Health in a Global Environment. Pasadena, California.
32. Dodson RE, LJ Standley, JG Brody, RA **Rudel**. 2008. Development of an Evidence-based Intervention Study to Reduce Exposures to Contaminants in Consumer Products. ISEE-ISES Joint Annual Conference on Exposure and Health in a Global Environment. Pasadena, California.
33. Brody JG, RG Altman, R Morello-Frosch, P Brown, C Adams, RA **Rudel**. 2008. Reporting Individual-level Exposure Measurements to Participants in Intervention Studies for Emerging Contaminants. ISEE-ISES Joint Annual Conference on Exposure and Health in a Global Environment. Pasadena, California.
34. Dodson RE, KR Attfield, RA **Rudel**. 2009. Green buildings and indoor air quality: Lessons learned from household exposure studies. Healthy Buildings 2009 Conference and Exhibition. Syracuse, New York.
35. Zota AR, G Adamkiewicz, JD Spengler, R Morello-Frosch, JG Brody, RA **Rudel**. 2009. Cumulative Exposures to Thyroid Hormone Disrupting Compounds (PCBs and PBDEs) in Residential House Dust. Annual Conference of the International Society of Exposure Science (ISES). Minneapolis, Minnesota.

36. Dodson RE, JG Brody, RA **Rudel**. 2009. Endocrine Disrupting Compounds in Paired Residential Indoor and Outdoor Air Samples from Two Northern California Communities: Comparisons and Relationships. Annual Conference of the International Society of Exposure Science (ISES). Minneapolis, Minnesota.
37. **Rudel**, RA. 2009. Residential exposures to endocrine disrupting compounds from consumer products and building materials: recent findings and future directions. Annual Conference of the International Society of Exposure Science (ISES). Minneapolis, Minnesota.
38. Chan E, S Dairkee, S Janssen, J Latimer, RA **Rudel**, M Schwarzman, A Wlassowsky, L Zeise, DE Johnson. 2009. Chemical Exposure and Breast Cancer: identifying compounds of concern. Society of Toxicology Annual Meeting. March 5-12, 2010. Salt Lake City, UT.
39. Schaidler LA, JM Ackerman, SC Dunagan, JG Brody, RA **Rudel**. 2010. Organic Wastewater Compounds in Drinking Water Wells Impacted by Septic Systems. Annual North America Meeting of the Society of Environmental Toxicology and Chemistry (SETAC). Portland, Oregon.
40. **Rudel** RA, SY Euling, SL Makris, SE Fenton. Mammary Gland Development as a Sensitive Indicator of Early Life Exposures: Recommendations from an Interdisciplinary Workshop. Society of Toxicology Annual Meeting, Salt Lake City, UT March 2010.
41. Dodson, R.E., J.G. Brody, R.A. **Rudel**. Household Exposures in an Urban Environmental Justice Community. Urban Environmental Pollution Conference 2010. Boston, Massachusetts.
42. Dodson, R.E., L.J. Perovich, M. Nishioka, J.D. Spengler, J. Vallarino, R.A. **Rudel**. Long-term integrated sampling of SVOCs in indoor air: Measurement of emerging compounds using novel active and passive sampling methods. International Society of Exposure Science/International Society of Environmental Epidemiology (ISES/ISEE) 2010. Seoul, South Korea.
43. Dodson, R.E., R.A. **Rudel**, L.J. Perovich, D.E. Camann, J.G. Brody. Partitioning theory applied to paired indoor air and house dust SVOC measurements: Implications for residential exposure measurements in epidemiology studies. ISES/ISEE 2010. Seoul, South Korea.
44. Adamkiewicz, G, R Dodson, A Zota, L Perovich, J Brody, R **Rudel**, J Spengler. 2010. Semi-volatile Organic Compounds Distributions in Residential Dust Samples From 5 US Communities: Key Lessons for Improving Residential Exposure Assessment. Joint Conference of International Society of Exposure Science & International Society for Environmental Epidemiology. Seoul, Korea. *Epidemiology*. 22(1):S160-S161, January 2011. doi: 10.1097/01.ede.0000392166.33641.22.
45. Dodson, R.E., M.G. Nishioka, L.J. Standley, L.J. Perovich, J.G. Brody, R.A. **Rudel**. Chemical analysis of household and personal care products for endocrine disrupting compounds and other chemicals of emerging concern. ISES/ISEE 2010. Seoul, South Korea.
46. **Rudel** RA, Ackerman JA, Euling S, Makris S, Fenton S. 2010. Chemical Perturbation of Mammary Gland Development and Function: current initiatives to strengthen mammary gland assessment in

guideline studies and risk assessment. Society of Toxicology Annual Meeting 2011. March 6-10, 2011. Washington, D.C.

47. Schaider, L.A., R.A. **Rudel**, J.M. Ackerman, S.C. Dunagan, J.G. Brody. 2011. Pharmaceuticals, Perfluorinated Compounds and Other Organic Wastewater Compounds in Private Drinking Water Wells on Cape Cod, Massachusetts. 32nd Annual Meeting of the Society of Environmental Toxicology and Chemistry (SETAC) North America. November 13-17, 2011, Boston, Massachusetts.
48. Dodson, R., M. Nishioka, L. Standley, L. Perovich, J. Brody, R. **Rudel**. 2011. What Do We Know About What Is in Personal Care Products?. 32nd Annual Meeting of the Society of Environmental Toxicology and Chemistry (SETAC) North America. November 13-17, 2011, Boston, Massachusetts.
49. Dodson, R., L. Perovich, J. Brody, R. **Rudel**. 2011. Relationship Between House Dust and Indoor Air Concentrations: Applying Partitioning Theory to Empirical Data. 32nd Annual Meeting of the Society of Environmental Toxicology and Chemistry (SETAC) North America. November 13-17, 2011, Boston, Massachusetts.
50. **Rudel** RA, J. Ackerman, K. Attfield, R. Dodson, JG Brody. New exposure biomarkers for breast cancer epidemiology. ISES 2012. Seattle, WA.
51. Dodson R.E., K. Rodgers, A. Covaci, N. Van den Eede, A. Ionas, A. Dirtu, L. Perovich, J. Brody, R. **Rudel**. 2012. Health Risks from Flame Retardants in California House Dust. Environment and Health-Bridging South, North, East and West Conference of ISEE, ISES, and ISIAQ. August 19-23, 2013, Basel, Switzerland.
52. **Rudel** RA, JA Ackerman, C Vulpe. 2013. *In Vitro* Predictive Toxicology for Breast Cancer. Society of Toxicology Annual Meeting 2013. March 10-14, 2013. San Antonio, Texas.
53. Van den Eede N, RE Dodson, RA **Rudel**, LJ Perovich, H Neels, A Covaci. Urinary Concentration of Phosphate Flame Retardants and Plasticiser Metabolites and Relationships with Indoor Dust Levels. Brominated Flame Retardants Conference. 2013.
54. Pan, S., C. Yuan, A. Tagmount, R. **Rudel**, C. Vulpe, D. Leitman. 2013. Cross-Talk Between HER2 Agonists and Xenoestrogens Lead to a Synergistic Proliferation of Breast Cancer Cells. California Breast Cancer Research Symposium. May 17-18, 2013, Costa Mesa, California.
55. Dodson, RE, KM Rodgers, A Covaci, N Van den Eede, AC Ionas, AC Dirtu, LJ Perovich, JG Brody, RA **Rudel**. 2013. Health Risks From Flame Retardants In California Homes. Sixth International Symposium On Flame Retardants. April 7-10, 2013, San Francisco, California.
56. **Rudel**, R., J. Ackerman, C. Vulpe. 2013. Chemical Screening to Identify Potential Breast Carcinogens Using Human Breast Cell Cultures: Genotoxicity. California Breast Cancer Research Symposium. May 17-18, 2013, Costa Mesa, California.

57. Zarate, O, J Brody, P Brown, L Sweeney, M Ramirez-Andreotta R. **Rudel**. 2013. "Open Data" Practices for Environmental Health Studies. Environmental Health Disparities and Environmental Justice Meeting. July 29-31, 2013, Research Triangle Park, North Carolina.
58. Dodson, RE, RA **Rudel**. 2013. Indoor exposure to SVOCs from consumer products and building materials: Empirical data validates air-dust partitioning models and informs measurement strategies. 2013 Conference of the International Society of Environmental Epidemiology (ISEE), the International Society of Exposure Science (ISES), and the International Society of Indoor Air Quality and Climate (ISIAQ). August 19–23, 2013, Basel, Switzerland.
59. Dodson, RE, K Rodgers, A Covaci, N Van den Eede, A Ionas, A Dirtu, L Perovich, J Brody, RA **Rudel**. 2013. Health Risks of Flame Retardants in California House Dust. 2013 Conference of the International Society of Environmental Epidemiology (ISEE), the International Society of Exposure Science (ISES), and the International Society of Indoor Air Quality and Climate (ISIAQ). August 19–23, 2013, Basel, Switzerland.
60. Ackerman J., R **Rudel**, C. Vulpe. 2014. High-Content Screening of Genotoxicity in Breast and Liver Cells. FutureTox II: In Vitro Data and In Silico Models for Predictive Toxicology. January 16-17, 2014, Chapel Hill, North Carolina

GRANTS

1. California Breast Cancer Research Program Women Firefighters Biomonitoring Collaborative	2013 - 2016	\$833,945
2. National Institutes of Health: 1R01ES021726-01 Data Sharing and Privacy Protection in Digital-Age Environmental Health Studies	2012 - 2017	\$1,785,672
3. US Department of Housing and Urban Development: MAHH000512 (PI) Impact of Green Renovations on asthma and IEQ in public housing: The role of phthalates, glycol ethers, flame retardants, perfluorinated compounds and PCBs	2012 - 2015	\$699,786
4. California Breast Cancer Research Program Chemicals and Breast Cancer: Building on National Initiatives for Chemical Safety Screening	2011 - 2014	\$256,194
5. Avon Foundation Methods and resources for cohort studies of breast cancer and environmental chemicals;	2011 - 2014	\$175,000
6. American Chemistry Council Interpretation of Biomonitoring Data from a Dietary Intervention Study	2011 – 2012	\$120,000
7. Mount Desert Island Biological Laboratory Exposure Ontology and HES data on the Web	2010 – 2011	
8. Avon Foundation (Co-I)	2010 - 2011	\$150,000

Methods and resources for cohort studies of breast cancer and environmental chemicals;
Massachusetts Health and Environment Information System

9.	National Institute of Environmental Health Sciences: 1R01ES017514-01A1	2009 - 2014	\$2,830,157
	Ethical and Legal Challenges in Communicating Individual Biomonitoring and Personal Exposure Results to Study Participants: Guidance for Researchers and Institutional Review Boards (5 years)		
10.	MA Environmental Trust (Co-I)	2009-2010	\$45,000
	Emerging Contaminants in Public and Private Drinking Water Wells		
11.	Centers for Disease Control: 1R01EH000632-01 (Co-I)	2009 - 2010	\$333,000
	Women's Health and the Environment: Breast Cancer Prevention Research		
1.	Passport Foundation/Breast Cancer Fund (Co-I)	2009 – 2010	\$10,000
	BPA Migration and Consumption in a Pilot Sample of US Families		
13.	Brown University/NIEHS (Co-I)	2009 – 2010	\$10,000
	Brominated Flame Retardants		
14.	Avon Foundation (Co-I)	2009 - 2010	\$200,000
	Methods and resources for cohort studies of breast cancer and environmental chemicals; Massachusetts Health and Environment Information System		
15.	Barnstable Assembly of Delegates (Co-I)	2009 – 2010	\$24,000
	EDC's in Public Drinking Water on Cape Cod		
16.	New York Community Trust (Co-I)	2009 - 2010	\$75,000
	Pollution at Home: Exposures in a Fence-line Environmental Justice Community		
17.	California Breast Cancer Research Program (PI)	2009	\$25,000
	Conference on the Effects of Chemicals on Mammary Glands		
18.	National Institute of Environmental Health Sciences (PI)	2009	\$32,000
	Conference on the Effects of Chemicals on Mammary Glands		
19.	US Environmental Protection Agency (PI)	2009	\$17,354
	Conference on the Effects of Chemicals on Mammary Glands		
20.	NSF/University of California – Berkeley: SES-0822724 (Co-I)	2008 - 2011	\$94,395.66
	Toxic Ignorance and the New Right-to-Know: The Implications of Biomonitoring for Regulatory Science		
21.	Centers for Disease Control: 1H75EH000377-01 (Co-I)	2008 - 2009	\$118,886

Women's Health and the Environment: Breast Cancer Prevention Research

22. National Institute of Environmental Health Sciences: 3R25ES013258-04S2 (Co-I) 2008 - 2009 Linking Breast Cancer Advocacy and Environmental Justice Supplement 2		\$139,805
23. Avon Foundation (Co-I) Breast Cancer and Environmental Chemicals	2008 - 2009	\$175,000
24. Commonwealth of Massachusetts Breast Cancer Prevention Research: Household Exposure	2008 - 2009	\$20,000
25. New York Community Trust (Co-I) California Household Exposure Study Data Analysis	2007 - 2008	\$75,000
26. Commonwealth of Massachusetts Breast Cancer and the Environment on Cape Cod	2007 - 2008	\$107,500
27. Commonwealth of Massachusetts (UMASS Lowell) (Co-I) Breast Cancer Prevention Research: Household Exposure	2007 - 2008	\$175,000
28. MA Environmental Trust (Co-I) EDC's in Ponds on Cape Cod (FY2008 grant)	2007 - 2008	\$25,000
29. Avon Foundation (Co-I) Breast Cancer and Environmental Chemicals	2007 - 2008	\$175,000
30. HES Goldman (Co-I) Exposure Reduction for Endocrine Disruptors in Homes	2006 - 2009	\$400,000
31. Department of Defense (Co-I) Nanotech Method to Identify EDC's in Septic Waste	2006 - 2008	\$93,108
32. Babylon Breast Cancer Coalition (Co-I) EDC's in Cape Cod Groundwater and Drinking Water	2006 - 2007	\$7,500
33. MA Environmental Trust (Co-I) Groundwater and Drinking Water	2006 - 2007	\$25,000
34. Hurricane Voices (Co-I) Household Exposure Study	2006 - 2007	\$45,000
35. Jane's Trust Environmental Factors in Breast Cancer	2006 - 2007	\$100,000
36. Avon Foundation (Co-I)	2006 - 2007	\$100,000

Breast Cancer and Environmental Chemicals

37. Commonwealth of Massachusetts Cape Cod Household Exposure Study	2006 - 2007	\$107,500
38. National Science Foundation: SES-0450837 (Co-I) "Research Right-to-Know": Ethics and Values in Communicating Environmental Health Study Results to Individuals and Communities	2005 - 2008	\$299,999
39. Beldon Fund Environmental factors and women's health	2005 - 2007	\$150,000
40. Centers for Disease Control: R01DP000218-01 (Co-I) Impact of Environmental Pollutants on Breast Cancer and Women's Health	2005 - 2006	\$347,200
41. Avon Foundation Environmental factors and breast cancer	2005 - 2006	\$75,000
42. MA Department of Public Health (Co-I) Cape Household Exposure Study follow-up	2005 - 2006	\$107,500
43. MA Environmental Trust (Co-I) Groundwater and Drinking Water	2005 - 2006	\$25,000
44. National Institute of Environmental Health Sciences: 1R25ES013258 (Co-I) Linking Breast Cancer Advocacy and Env. Justice (4 yrs)	2004 - 2008	\$932,104
45. Susan G. Komen for the Cure (Co-I) Breast Cancer and the Environment Science Review	2004 - 2008	\$611,273
46. Agua Fund (Co-I) EDCs in Cape Cod Groundwater and Drinking Water	2004 - 2006	\$25,000
47. National Cancer Institute: 5R03CA103478-2 Risk Factors for Ductal Carcinoma In Situ (DCIS)	2004 - 2006	\$140,000
48. National Library of Medicine: 1G08LM008415 Public Access to Environmental Health Information	2004 - 2006	\$130,199
49. Hurricane Voices (Co-I) Household Exposure Study of EDCs	2004 - 2005	\$60,000
50. Avon Foundation Environmental factors and breast cancer	2004 - 2005	\$50,000

51. MA Environmental Trust (FY05 grant) (Co-I) Groundwater and Drinking Water	2004 - 2005	\$25,000
52. Heinz Endowments Environmental factors and breast cancer	2004 - 2004	\$50,000
53. Jane's Trust Environmental factors and women's health	2003 - 2004	\$281,980
54. Beldon Fund Environmental factors and women's health	2003	\$75,000
55. MA Environmental Trust 2003 grant – Wells (Co-I) EDCs in Cape Cod Water	2003	\$25,000
56. MA Environmental Trust 2002 grant (Co-I) EDCs in Cape Cod Water	2002	\$25,000
57. Susan G. Komen Breast Cancer Foundation Cape Cod Breast Cancer and Environment Study data analysis	2001 - 2002	\$160,000
58. Anonymous foundation Environmental factors and women's health	2000-2005	\$606,072
59. Tides Foundation (Co-I) EDCs in Cape Cod Groundwater and Drinking Water	2000 - 2001	\$115,000
60. Jessie B. Cox Charitable Trust Environmental factors and women's health	1998-2002	\$194,000
61. Dolphin Trust (Soil, Atlas, Wells, and Septic) (Co-I) EDCs in Cape Cod Groundwater and Drinking Water	1998 - 2001	\$86,700
62. Komen Massachusetts Affiliate Outreach and education	1996 - 2003	\$312,000
63. Massachusetts Department of Public Health (Co-I) Cape Cod Breast Cancer and Environment Study	1994 - 2003	\$7,300,000

Exhibit L

Statement of Ted Schettler



October 14, 2014

I, Ted Schettler, am writing this statement in support of the Petition to the CPSC to regulate four categories of household products containing non-polymeric additive organohalogen flame retardants.

1. I, Ted Schettler MD, MPH am a physician and the Science Director of the Science and Environmental Health Network. I also serve as Science Director of the Collaborative on Health and Environment (CHE) and am a science advisor to the Health Care Without Harm (HCWH) campaign. I have a medical degree from Case Western Reserve University and a Masters in Public Health from Harvard University. I am co-author of "Generations at Risk: Reproductive Health and the Environment"; "In Harm's Way: Toxic Threats to Child Development"; and "Environmental Threats to Healthy Aging." I am also the author of "The Ecology of Breast Cancer: The Promise of Prevention and the Hope for Healing". I have published a number of articles in peer-reviewed scientific journals. I served on the U. S. Environmental Protection Agency's (EPA) Endocrine Disruptor Screening and Testing Advisory Committee (EDSTAC) and the National Academy of Sciences' committee on defining concerns associated with products of animal biotechnology.

2. In collaboration with organizations in the US and internationally, I have addressed many aspects of the relationship between environmental exposures and human health. I am an active contributor to HCWH's international campaign on improving the environmental performance of healthcare institutions. HCWH has had great success in helping to reduce the emissions of dioxin and mercury from health care institutional materials management practices, and we are working to reduce the use of organohalogen flame retardants in materials and products purchased by those institutions.

3. Organohalogen flame retardants are of considerable concern because of their persistence, toxicity, tendency of many to bioaccumulate, and long-range transport. Many of these chemicals have been incorporated into consumer products and are being released from them into indoor and outdoor environments, resulting in exposures to humans and wildlife.¹ In general, halogenated organic molecules (i) are more resistant to metabolic break down, (ii) cross biologic membranes more readily, and (iii) gain access to cells and tissues more readily than non-halogenated compounds. Because of this, virtually all halogenated flame retardants have adverse impacts when they interact with cells and

tissues of living organisms. Virtually all organohalogen flame retardants studied for their toxic properties have health effects at varying levels of exposure, including adverse impacts on brain development in children,² adverse impacts on reproduction,³ endocrine disruption,⁴ immune suppression,^{5,6} and/or cancer.

4. Widespread human and wildlife exposures to flame retardants are well documented. Humans are exposed to organohalogen flame retardants mainly through inhalation or ingestion of dust particles containing these chemicals⁷ and ingestion of food that has been contaminated with these chemicals⁸. Fetuses are exposed to these chemicals by transplacental transport, and infants are also exposed through ingestion of contaminated breast milk.

5. As a physician, I am particularly concerned about the health effects of organohalogen flame retardants on developing children. In 2010, in invited testimony before the U.S. Senate Committee on Environment and Public Works⁹, I described windows of vulnerability and unique susceptibility to hazardous environmental exposures during *in utero* development, infancy, and childhood. Those exposures may result in adverse health outcomes with lifelong consequences. For example, ample scientific evidence confirms the unique susceptibility of the developing brain to chemical exposures that can disrupt one or more of a number of biologic processes that must proceed in an orderly fashion as brain architecture and chemistry are established throughout pregnancy, infancy, and childhood.¹⁰ Studies have shown that exposure to polybrominated diphenyl ethers during critical windows of brain development can result in adverse impacts on multiple measures of brain function in childhood, including impaired learning and memory.^{11,12} As replacement organohalogen flame retardants are slowly tested, their toxicity, too, becomes increasingly clear.

6. This combination of circumstances – biologically active compounds, increased resistance to biologic degradation, ready access to biologic tissues, and widespread exposure – justifies evaluation of organohalogen flame retardants as a class and replacement with safer alternatives.

Yours sincerely,



Ted Schettler, MD MPH

¹ Lorber M. Exposure of Americans to polybrominated diphenyl ethers. *J Expo Sci Environ Epidemiol*. 2008 Jan;18(1):2-19.

² Herbstman JB, Sjödin A, Kurzon M, Lederman SA, Jones RS, Rauh V, Needham LL, Tang D, Niedzwiecki M, Wang RY, Perera F. Prenatal exposure to PBDEs and neurodevelopment. *Environ Health Perspect*. 2010 May;118(5):712-9. doi: 10.1289/ehp.0901340.

³ Birnbaum LS, Staskal DF. Brominated flame retardants: cause for concern? *Environ Health Perspect*. 2004 Jan;112(1):9-17.

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- ⁴ Legler J, Brouwer A. Are brominated flame retardants endocrine disruptors? *Environ Int.* 2003 Sep;29(6):879-85.
- ⁵ Darnerud PO, Eriksen GS, Jóhannesson T, Larsen PB, Viluksela M. Polybrominated diphenyl ethers: occurrence, dietary exposure, and toxicology. *Environ Health Perspect.* 2001 Mar;109 Suppl 1:49-68.
- ⁶ Birnbaum LS, Staskal DF. Brominated flame retardants: cause for concern? *Environ Health Perspect.* 2004 Jan;112(1):9-17.
- ⁷ Lorber M. Exposure of Americans to polybrominated diphenyl ethers. *J Expo Sci Environ Epidemiol.* 2008 Jan;18(1):2-19.
- ⁸ Schecter A, Harris TR, Shah N, Musumba A, Pöpke O. Brominated flame retardants in US food. *Mol Nutr Food Res.* 2008 Feb;52(2):266-72.
- ⁹ Hearing on EPA's Efforts to Protect Children's Health. Testimony of Ted Schettler MD, MPH. March 17, 2010
http://www.epw.senate.gov/public/index.cfm?FuseAction=Files.View&FileStore_id=b1cf9367-64b7-4884-b06a-2719e2709f2c
- ¹⁰ Ibid
- ¹¹ Eriksson P, Jakobsson E, Fredriksson A. Brominated flame retardants: a novel class of developmental neurotoxicants in our environment? *Environ Health Perspect.* 2001 Sep;109(9):903-8.
- ¹² Viberg H, Fredriksson A, Jakobsson E, Orn U, Eriksson P. Neurobehavioral derangements in adult mice receiving decabrominated diphenyl ether (PBDE 209) during a defined period of neonatal brain development. *Toxicol Sci.* 2003 Nov;76(1):112-20. Epub 2003 Aug 12.

CURRICULUM VITAE

Theodore H. Schettler, M.D., M.P.H.

Education:

Carleton College - B.A., 1963

University of Minnesota

Case-Western Reserve University - M.D., 1968

Internship - Internal Medicine - University Hospitals - Cleveland, Ohio

Harvard School of Public Health - MPH, 1994

Occupational and environmental health

Clinical Medical Practice:

1969-71 - U.S. Navy / 3rd Marine Division - Viet Nam, Okinawa, Japan, San Francisco

1971-79 - Emergency Medicine - Dept. of Emergency Medicine; Windham
Community Memorial Hospital; Willimantic, Ct.

1979-90 - Chief of Emergency Services; Penobscot Bay Medical Center; Rockland, Me.
Established and directed the department of emergency medicine.
Provided both clinical and administrative services as department director

1987-93 - Medical Director; Health Connections – an occupational health program
established in 1987 as a subsidiary of its parent corporation, Northeast Health.

1994 – June, 2006 – Dept. of Internal Medicine; Boston Medical Center. Staff physician -
East Boston Neighborhood Health Center; E. Boston, MA

Non-clinical positions:

1999 – present - Science director, Science and Environmental Health Network

2008—present—Science director. Collaborative on Health and Environment

Science advisor—Health Care Without Harm

Physicians For Social Responsibility (PSR)

- Steering Committee - Greater Boston PSR (co-chair, 2000, 2001)

- Environment Committee - National PSR (1995, 1996)

2000- 2006—Co-Chair - Committee on Human Health and the Environment - New
England

Administrative:

1979-89 - Medical Director - Mid-Coast Emergency Medical Services, Inc.
1979-90 - Chief of Emergency Services - Penobscot Bay Medical Center (PBMC)
1982-85 - Secretary of Medical Staff (PBMC)
1986 - Vice President of Medical Staff (PBMC)
1986 - Chairman, Credentials and Peer Review Committee (PBMC)
1982-86 - Member, Executive Committee of Medical Staff (PBMC)

Boards and committees:

1987-90 - Member, Medical Staff Development Plan Committee (PBMC)

1989-90 - Member, Board of Trustees, Northeast Health

1989 - Member of Subcommittee on Emergency Medicine - Maine Medical Mutual Insurance Co. - charged with developing standards for medical management of selected clinical conditions in emergency medicine

1995 -96 - Member of the Federal Facility Environmental Restoration Dialogue Committee - (US EPA)

1996-1998 - Endocrine Disruptor Screening and Testing Advisory Committee (US EPA)

1997 - 2003 - Special committee on occupational and environmental health. Massachusetts Medical Society; member and consultant

1997-2000 – Advisory Board – Women's Cancer Resource Center; Minneapolis, MN

1999-2000 - Board of Directors – Clean Water Action; Boston, MA

1999-2000 - Member – Environmental Leadership Committee – American Hospital Association and US EPA

2001- 2003: Professional Advisory Board – Learning Disabilities Association of America

2001 – National Academy of Sciences Sub-Committee on Defining Science-based Concerns Associated with Animal Biotechnology

2001, 2002, 2003 – Endocrine Disruptor Methods Validation Subcommittee (US EPA)

2008-present—Science Advisory Board; Environmental Health Initiative; American Association of Intellectual and Developmental Disabilities (formerly American Association for the Mentally Retarded)

2009-2013—Board of directors. Pesticide Action Network North America

2010-present—Science Advisory Panel. The Breast Cancer Fund.

2012-present—Advisory council; California Breast Cancer Research Program

2014—Science advisory board. Women’s Voices for the Earth

Select Publications

Schettler, T.H. Reverberations of Militarism: Toxic Contamination, the Environment, and Health. *Medicine and Global Survival*, 2(1), 7-18, (1995).

Co-author: *An Environmental and Health Impact Report on Known and Potentially Contaminated Sites at Former U.S. Military Bases in the Philippines*. 1995.

Schettler T, Solomon G, Burns P, Valenti M. Generations at Risk: How Environmental Toxins May Affect Reproductive Health in Massachusetts. August, 1996.

Schettler T, Solomon G, Valenti M, Huddle A. Generations at Risk: Reproductive Health and the Environment. MIT Press, Cambridge, MA, (June 1999).

Schettler T. Manganese in gasoline: A case study of the need for precautionary action. In: *Protecting Public Health and the Environment: Implementing the Precautionary Principle*. Ed: Raffensperger C, Tickner J. Island Press Washington DC. July, 1999.

Schettler T, Stein J, Reich F, Valenti M. In Harm's Way: Toxic Threats to Child Development. Greater Boston Physicians for Social Responsibility; May, 2000.

Raffensperger C, Schettler T, Myers N. Precaution: A Belief, Regulatory System, and Overarching Principle. *Intl J Occ Env Health* 6(4): Oct-Dec, 2000.

Solomon G, Schettler T. Environment and Health: 6. Endocrine disruption and potential human health implications. *Can Med Assoc J* 163(11):1471-6, 2000.

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Schettler T. Human Health and the Environment: Lessons from the children. San Francisco Medicine 74(3):9-11, 2001.

Kriebel D, Tickner J, Epstein P, Lemmons J, Levins R, Loechler E, Quinn M, Rudel R, Schettler T, Stoto M. The precautionary principle in environmental science. Environ Health Perspect 109:871-876, 2001.

Schettler T. Toxic threats to neurologic development of children. Environ Health Perspect 109, (Suppl 6); 2001.

Schettler T, Barrett K, Raffensperger C. The Precautionary Principle. In: Life Support: The environment and human health. Ed: McCally M. Cambridge MA: MIT Press, 2002.

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DiGangi J, Schettler T, Cobbing M, Rossi M. Aggregate exposures to phthalates in humans. Health Care Without Harm. July, 2002. www.noharm.org

Schettler T. Sewage Sludge—Looking Upstream: the Precautionary Principle. New Solutions 12(4):355-358, 2002.

Schettler T. Human rights: Necessary? Sufficient? Diversionary? Int J Occup Environ Health. 9:69-73, 2003.

Schettler T. The Precautionary Principle. Journal of Endocrine Disruption (Japanese). Vol. 3, 2003-2004

Schettler T. Corn and corn-derived products: Sources of endocrine disruptors. Environ Health Perspect 111(13): A691, 2003.

Schettler T. The Ethics of Environmentally Responsible Health Care; Pierce J, Jameton A. Book Review. Environ Health Perspect 112(8):A382, 2004.

Mekdeci B, Schettler T. Birth defects and the environment. <http://www.protectingourhealth.org/newscience/birthdefects/2004-0501birthdefectspreview.htm> Accessed July, 2004.

Schettler T. Endometriosis. <http://www.protectingourhealth.org/newscience/endometriosis/2003-04peerreviewendometreosis.htm> Accessed July, 2004.

Schettler T. Infertility and related reproductive disorders.
<http://www.protectingourhealth.org/newscience/infertility/2003-04peerreviewinfertility.htm>
Accessed July, 2004.

Schettler T. Developmental disabilities-impairment of children's brain development and function: the role of environmental factors.
<http://www.protectingourhealth.org/newscience/learning/2003-02peerreviewlearningbehavior.htm> Accessed July, 2004.

Schettler T. Autism: Do environmental factors play a role in causation?
<http://www.protectingourhealth.org/newscience/learning/autismpeerreview.htm> Accessed July, 2004.

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<http://www.protectingourhealth.org/newscience/cardiovascular/2005-0601cardiopeerreview.htm>
Accessed July, 2005.

Schettler T. Human exposure to phthalates from consumer products. *International Journal of Andrology* 2006 29(1):134-9; discussion 181-5.

Schettler T. Toward an ecological view: complex systems, health, and disease. *San Francisco Medicine*. 79(1):12-16, 2006.

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Weuve J, Sanchez B, Calafat A, Schettler T, Green R, Hu H, Hauser R. Exposure to phthalates in neonatal intensive care unit infants: urinary concentrations of monoesters and oxidative metabolites. *Environ Health Perspect* 114(9): 1424-31, 2006.

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Building related health effects: What do we know? Presented at Institute of Medicine roundtable on Green Healthcare Institutions. Subsequently published, in part in "Green Healthcare Institutions Health, Environment, and Economics", Institute of Medicine, June, 2007.

Schettler T. Adding fluoride to drinking water: A good idea? Rachel's Democracy and Health News. #918. Aug, 2007.

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Heilig S, Schettler T. Genetically Modified Food: Fantastic or “Frankenfood: the labeling debate. San Francisco Medicine. July, 2013.

Schettler T. The Ecology of Breast Cancer: The Promise of Prevention and the Hope for Healing. Nov., 2013. Available at: <http://sehn.org/new-release-the-ecology-of-breast-cancer-the-promise-of-prevention-and-the-hope-for-healing/>

Schettler T. The Ecology of Breast Cancer. SEHN Networker. 18/5, Autumn, 2013.

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Schettler T. New insights into chronic stress, obesity, and metabolic syndrome: Further support for an ecological model of health and an integrated approach to care. CHE and SEHN blog. May, 2014.

Schettler T. Another victory for cleaner air. CHE and SEHN blog. May 21, 2014.

Honors and Awards

1968—Alpha Omega Alpha - Case-Western Reserve University

1990—Presidential Leadership Award - 1990 - Mid-Coast Emergency Services Council, Inc.

1998—Broad Street Pump Award - 1998 - Physicians for Social Responsibility

2000 - Will Solimene Award for Excellence in Medical Writing, American Medical Writers Association

2009—Science hero award. The Breast Cancer Fund.

2011—Environmental Health Hero Award; CleanMed

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thscv

Exhibit M

Statement of Roland Weber

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Schwäbisch Gmünd, den

24.09.2014

To Whom It May Concern:

I, Roland Weber, am writing this statement in support of the Petition to the CPSC to regulate four categories of household products containing non-polymeric additive organohalogen flame retardants.

1. I am an independent consultant working mainly for UN Organizations for the implementation of the Stockholm Convention on global elimination of persistent organic pollutants (POPs). I am also a visiting Professor at Tsinghua University, China. I received my Masters in Chemistry (1993) and my Ph.D. (1996) from the University of Tuebingen, Germany. My Ph.D. thesis was entitled "Synthesis, Analysis, Toxicology and Occurrence of fluorinated and chlorinated-fluorinated Dioxins, Dibenzofurans and Biphenyls". Since then I have carried out research, and since 2003 also consulting, in the field of dioxins/furans and other unintentionally and intentionally produced POPs. I have attached a copy of my curriculum vitae and a list of my scientific publications on halogenated dioxins, furans and other unintentionally formed POPs.

2. Polyhalogenated dibenzo-p-dioxins und dibenzofurans (dioxins and furans) are structurally-similar groups of chemicals containing benzene rings and halogens (chlorine or bromine). They have no industrial use, but are unintentional by-products of incomplete combustion and of various industrial processes, including the manufacture of some chemicals.

3. Dioxins and furans are likely human carcinogens and have been linked - at very low doses - to a wide range of other adverse health effects, including immune suppression, enzyme induction, thyroid hormone and vitamin A perturbations, antiestrogenicity, teratogenicity, and neurobehavioral deficits (US EPA, Van den Berg et al. 2013, WHO 1998). Additionally, they are highly persistent and bioaccumulative. They all have similar structures and a common mechanism of action, which accounts for their similar biological effects. The harmful effects of chlorinated dioxins and furans have been recognized by the Stockholm Convention, which recommends reducing and/or eliminating the unintentional releases of these chemicals. Brominated dioxins and furans are not currently regulated by any international authority, but have similar toxicities to their chlorinated counterparts (Van den Berg et al. 2013).

4. Dioxins and furans are unintentional byproducts of the production of halogenated aromatic compounds (i.e. compounds containing halogens and benzene rings), a group that includes many of the commonly used organohalogen flame retardants. As a result, they occur as impurities in commercial organohalogen flame retardants. For instance, brominated dioxins and furans have been found as contaminants in commercial brominated flame retardants, such as polybrominated diphenyl ethers (PBDEs),

decabromobiphenyl, 1,2-bis(tribromophenoxy)ethane, tetrabromobisphenol A (TBBPA), and bromophenols (WHO 1998, Ren et al. 2011).

5. Levels of dioxin and furan contamination in some organohalogen flame retardants increase during a product's life span, suggesting that dioxins and furans can form during the normal use of products containing these organohalogen flame retardants. For instance, additive organohalogenated flame retardant decaBDE in plastics such as those used in TV casings have been shown to form brominated furans when exposed to sunlight during normal use (Kajiwara et al. 2008). Similarly, polybrominated dibenzofurans (PBDFs) can be formed in treated textiles (Kajiwara et al. 2013). Thus, normal usage of household products containing organohalogen flame retardants that are dioxin precursors is potentially a major source of dioxins and furans found in indoor air and dust (Suzuki et al. 2010; Tue et al. 2013).

6. House and office dust originating from normal wear and tear of common household products such as polyurethane foam, TV sets, computers and other electronic and electrical equipment or textiles containing organohalogen flame retardants that are dioxin precursors is a source of direct human exposure to polybrominated dibenzodioxins (PBDDs) and PBDFs (Brorstrom-Lunden et al. 2010; Suzuki et al. 2010; Tue et al. 2013). Levels measured in Japanese house dust were sufficient to contribute to a major share of daily dioxin toxic equivalencies (TEQ)-exposure for toddlers (Suzuki et al. 2007).

7. All chlorinated and brominated aromatic compounds (i.e. compounds containing benzene rings) are dioxin/furan precursors

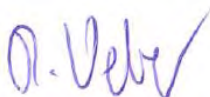
under thermal treatments below 850°C, which includes accidental household fires (Weber & Kuch 2003, Weber 2007). Furthermore, any chlorine/bromine present in consumer products during their low temperature combustion can lead to the formation of dioxin and furans (McKay 2002, Ikeguchi & Tanaka 2001; Weber et al. 2002, Weber & Kuch 2003). Thus, the presence of any organohalogen flame retardants in consumer products during accidental household fires can lead to the formation of dioxins and furans (Weber & Kuch 2003). This increases the risk of harm to humans, particularly to firefighters who are exposed to these chemicals on the job.

8. In summary, dioxins and furans (i) have been found as impurities in organohalogen flame retardants in consumer products, (ii) can form from certain aromatic organohalogen flame retardants during the normal use of household products containing them, and (iii) can form from all organohalogen flame retardants when products containing them burn during household fires. The EPA, the WHO and Stockholm Convention have determined that some of these dioxins and furans present serious health risks.

9. Therefore, my professional opinion is that the use of organohalogen flame retardant chemicals in the four categories of household products covered by this petition should be stopped, as the human health risks associated with dioxin and furan impurities or their unintentional formation due to organohalogen flame retardants are severe. I am happy to answer any questions, and provide further documentation as needed.

Yours sincerely,

Roland E. Weber, Ph.D.



International Consultant for Persistent Organic Pollutants

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- Zennegg M., Xiezhong Y., Hung W. M., Weber R. (2009) Fingerprints of chlorinated, brominated and mixed halogenated dioxins at two e-waste recycling sites in Guiyu/China. *Organohalogen Compd.* 71, 2263-2267.

Curriculum Vitae Dr. Roland E. Weber

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Key expertise and interests

- Persistent Organic Pollutants (POPs) including newly listed POPs under the Stockholm Convention and related national implementation plans.
- Research and research strategies on chlorinated, brominated and fluorinated POPs/PTS
- Inventories and action plans for PCDD/PCDF (Dioxins) and other unintentionally produced POPs (Stockholm Convention implementation).
- Best Available Technologies (BAT) and Best Environmental Practice (BEP) for reduction of PCDD/PCDF and other unintentionally produced Persistent Organic Pollutants (UPOPs).
- Chemicals and Sustainable Production & Consumption. Substitution of critical chemicals.
- Destruction of POPs (combustion and non-combustion technologies) and formation of Dioxins (PCDD/PCDF) and other pollutants.
- POPs contaminated sites (Editor POPs contaminated site series in ESPR)

Education:

03/1994 - 03/1996 PhD, Thesis "Synthesis, Analysis, Toxicology and Occurrence of fluorinated and chlorinated-fluorinated Dioxins, Dibenzofurans and Biphenyls" (University Tübingen; Institute of Organic Chemistry, Supervisor Prof. Dr. H. Hagenmaier)
10/1993 - 05/1996 Study of "Public law for scientists and engineers" at the University of Hagen. (Equivalent to bachelor degree)
10/1988 - 01/1994 Master (diploma) in chemistry (University of Tübingen/Germany)

Employment career:

Since 01/2003 Independent international consultant (POPs Environmental Consulting)
Since 01/2010 Visiting Professor; Department of Environmental Engineering, POPs Center, Tsinghua University, China (Stockholm Convention Center)
Since 07/2006 Visiting Professor at the MTM Research Center, University Örebro/Sweden
05/97-12/2002 Employee in IHI Co. Ltd. (Yokohama, Japan, www.ihico.jp/index-e.html) (Management dioxin laboratory, R & D Dioxin reduction and POPs destruction)
03/96-04/1997 Post doc at the University Tübingen (Formation mechanisms of PCDD/PCDF)

Consultancies for governmental bodies and UN organisations:

Since 08/2013	Publication “Alternatives to POPs chemicals” (for SC Secretariat)
Since 03/2013	Member of the SwitchMed Expert Group for “Switching to more sustainable consumption and production in the Mediterranean” (for CP/RAC Spain)
Since 02/2013	IPOP Project Dioxin reduction from open burning in the Philippines (for World Bank; Subcontract to Witteveenbos)
Since 11/2012	Updating SC National Implementation Plans (Mongolia, Turkey, Philippines, Indonesia, Sudan, Tanzania) (for UNIDO)
Since 10/2012	R&D project “Environmental contamination of Dioxin and PCB and interlink to food contamination” (for German Environmental Ministry/ Agency)
Since 09/2011	Consultancy on international chemical management (for GIZ)
04/2012 – 04/2013	Monitoring of new listed POPs in articles and products. Support for the Basel and Stockholm Convention Centre China (for BRS Conv. Secretariat and GIZ)
12/2011 – 07/2012	Pilot country workshops for updating Stockholm Convention NIPs for newly listed POPs (Algeria, China, India, Nigeria, Serbia) (for SC Secretariat)
12/2011-12/2012	Consultancy for updating the SC Dioxin Toolkit (for SC Secretariat)
07/2011-08/2012	Lead author/co-author of Guidelines for supporting the implementation of newly listed POPs in the Stockholm Convention (for UNITAR & UNIDO)
07/2011-03/2012	Developing chemical criteria for Ecolabel and Green Public Procurement (For the European Commission Joint Research Center IPTS Seville)
07/2011-10/2011	FSP development for POPs management in Egypt (for WB; with Tauw)
05/2011-12/2011	1 st pilot project on inventory of newly listed POPs Nigeria (for SC Secretariat)
04/2011-01/2013	Dioxin/Furan inventory and NIP development Zimbabwe (for UNEP)
11/2010	Invited expert at POPs Reviewing Committee meeting (for SC Secretariat)
01/2010-10/2010	Technical paper on PBDEs newly listed in the Convention (for SC Secretariat with Alan Watson; UNEP/POPS/POPRC.6-2, UNEP/POPS/POPRC.6/INF/6)
09/2010	Summary report on the questionnaire survey on new POPs PBDE and PFOS from parties and observers (for Stockholm Convention Secretariat & POPRC)
03/2009-04/2011	Hazardous chemical/waste management Egypt (EU Twinning project, for GIZ)
03/2009 – 06/2011	Dioxin/Furan inventory and NIP development Suriname (for UNDP)
10/2009-12/2009	Integrating Pollution Prev. and Control and Stockholm Convention (UNIDO)
02/2009	Refining of National Implementation Plan for UPOPs Serbia (for UNEP)
09/2008 – 03/2009	EU Life project on hazardous waste management Turkey (for GTZ)
10/2008	Refining of National Implementation Plan for UPOPs Montenegro (for UNEP)
2007/2008	Dioxin/Furan Inventory Turkey; support finalising the NIP (for UNIDO)
2007/2008	Dioxin/Furan Inventory Vietnam; BAT/BEP project development for UPOPs reduction Vietnam (MSP for UNIDO)
08/2005 - 02/2006	Stockholm Convention BAT/BEP and NIP consultancy Sudan (for UNDP)
Since 2004	Dioxin/Furan Inventories and NIP support for Montenegro, Serbia, Sudan, Suriname, Turkey, Uganda, Vietnam & Zimbabwe (Stockholm Convention consultancy UNDP, UNEP, UNIDO for respective environmental ministries).
2003	Minimisation strategies for PCDD/PCDF emission from waste incineration. Chemical Risk Assessment (Risk Management Handbook, AIST, Japan)
2002	Regulations and status of hospital waste management in Germany (For Japan Waste Management Experts; Co-operation with German Env. Agency (UBA))
1997-1998	Evaluation historical input of PCDD/F in Japan (Prof. Sakai, NIES, Japan)

Research and Research Cooperations:

- Since 2011 (ongoing) Formation of dioxin-like compounds from Chlorpyrifos (Osaka University).
- Since 2009 (ongoing) PBDE, other BFRs and PBDD/F in E-waste (cooperation Basel Convention Center Nigeria; Fraunhofer Institute Germany; Umea University/Sweden).
- Since 2005 (ongoing) Research/documentation of global POPs contaminated sites (selected partners)
- 2000-2012 Historical PCDD/F inputs and their source implication in Queensland, Australia (National Centre for Environmental Toxicology, Queensland, Australia).
- 2008/2009 Assessment of chlorinated and brominated Dioxin pollution of an e-waste village in Guiyu/China (with Prof. Ming Wong, Baptist University, Honkong).
- 2007/2008 Assessment of PFOS/PFOA sources for contamination of a German river system and drinking water reservoir (BUND, Germany).
- 2004-2007 Research on PCDD/PCDF formation in thermal processes in dependence on inorganic matrices (Czech Academy of Science, Prague, Czech Republic).
- 2002 – 2003 Forest fires as a potential PCDD/F source in Queensland, Australia (National Research Centre for Environmental Toxicology, Queensland, Australia).
- 1997-1999 Evaluation historical input of PCDD/F in Japan (Kyoto University; Japan).
- 1993-1996 Evaluation of the relevance of fluorinated and fluorinated-chlorinated dibenzodioxins and dibenzofurans in technical processes and assessment of their toxicity (with Institute of Toxicology, Univ. Tübingen; Prof. Schrenk).
- 1993-1994 Development of the trace analysis for fluorinated Dioxin and Furans.

Further Activities in the international community of POPs/PTS research

- Member of the UNEP PCDD/PCDF Toolkit group (since 2006) and now BAT/BEP (since 2012).
- Chair of the session “Remediation Methods and Control Techniques” DIOXIN 2004.
- Chair of session “Contaminated sites – cases, remediation, risk and policy” & related at DIOXIN Conference Series 2006 - 2013 (26th to 33th International Symposium on Halogenated POPs).
- International advisory board ISWA final sink Conference (2013); ISWA World 2016
- Editor Board Environmental Science Pollution Research (ESPR)
- Member of the ISO Group analysis brominated flame retardants (ISO/TC 146/SC 6/WG 22)
- Member VDI (Community of German Engineers) development analytical standard for POPs.
- Reviewer for scientific journals: ES&T, ESPR, Chemosphere, Environmental Pollution, Environmental International, Hazardous Materials, Waste Management and others.

Experience in industry and co-operation with industry (including R&D):

- Since 2004 Consulting on long term monitoring of PCDD/PCDF and other UPOPs with AMESA System (Environnement SA, Germany)
- 2004/2005 Consulting on destruction of POPs (Prantner GmbH Verfahrenstechnik, Reutlingen, Germany) <http://www.prantner.de/index.html>
- 1997-2006 BAT/BEP strategies for municipal waste incinerators and hazardous waste incinerators in respect to PCDD/PCDF and other UPOPs emission reduction (IHI Co., Ltd. Yokohama and Tokyo, Japan) <http://www.ihico.jp/en/index.html>
- 1999-2003 Research & development work on formation and destruction of POPs (PCB, PCDD/F, PCP, PCBz) in technical processes (IHI Co., Ltd. Yokohama, Japan).

1998-2002	Development and improvement of catalytic filters (REMEDIA) for PCDD/PCDF destruction (W.L. Gore & Associates, Inc., Elkton, USA)
2001-2003	Formation of brominated and brominated-chlorinated PXDD/PXDF in thermal processes. (IHI Co., Ltd. Yokohama, Japan)
1999-2002	Research and development of catalytic destruction of PCDD/PCDF and PCB on fly ashes (Hitachi Zoosen, Osaka & IHI Co. Ltd..Tokyo Japan,).
1997-2005	BAT implementation in approx. 20 municipal waste incinerators and hazardous waste incinerators reduction of PCDD/PCDF emission (IHI Co., Ltd. Yokohama and Tokyo, Japan).
1999 - 2003	Research and development on reduction and destruction of POPs in technical processes (IHI Co., Ltd. Yokohama, Japan).
1997-2003	Establishment/management of a dioxin research laboratory (IHI Co., Ltd.)
1996-1999	Formation mechanisms of PCDD/PCDF in thermal and industrial processes (IHI Co., Ltd. Yokohama/Japan, University Tübingen/Germany).
1995-1996	Evaluation of potential release of fluorinated and chlorinated-fluorinated PXDD/PXDF from Aluminium industry (facilities in Germany and Norway).

Civil society activities

Ambassador of the International HCH & Pesticides Association (IHPA) (www.ihpa.info).

Member of the International Panel on Chemical Pollution (IPCP) (<http://www.ipcp.ch>)

Board member of the NGO “SOL” (People for Solidarity, Ecology & Lifestyles)

(www.nachhaltig.at) member of the Norther Alliance .

Board member of the NGOs Aufbruch (Germany) for “sustainable lifestyle” (www.anders-besser-leben.de), awarded UNESCO project UN Decade for “Education for Sustainable Development”.

Guidelines/Guidances and reports for UN agencies and POP Reviewing Committee

1. Stockholm Convention (2013) Guidance on Sampling, Screening and Analysis of Persistent Organic Pollutants in Products and Articles; Draft; (Lead Author)
2. Stockholm Convention (2012) Guidelines on Best Available Techniques and Best Environmental Practice for the Recycling and Disposal of Articles containing Polybrominated Diphenyl Ethers (PBDEs) under the Stockholm Convention on POPs (Lead author)
3. Stockholm Convention (2012) Guidance for strengthening regulatory framework/voluntary agreements for monitoring of products/articles that may contain new POPs (Lead author).
4. Stockholm Convention (2012) Guidance for the Inventory of commercial Pentabromodiphenyl ether (c-PentaBDE), commercial Octabromodiphenyl ether (c-OctaBDE) and Hexabromobiphenyls (HBB) under the Stockholm Convention on Persistent Organic Pollutants (co-author)
5. UNEP (2010) Technical review of the implications of recycling commercial penta and octabromodiphenyl ethers. Stockholm Convention document for 6th POP Reviewing Committee meeting (UNEP/POPS/POPRC.6/2) Geneva 11-15. October 2010.
6. UNEP (2010) Supporting Document for Technical review of the implications of recycling commercial penta and octabromodiphenyl ethers. Stockholm Convention document 6th POP Reviewing Committee meeting (UNEP/POPS/POPRC.6/INF/6) Geneva 11-15. Oct. 2010.
7. UNEP (2010) Debromination of brominated flame retardants. Stockholm Convention document for 6th POP Reviewing Committee meeting (UNEP/POPS/POPRC.6/INF/20) Geneva 11-15. October 2010
8. UNEP (2010) Additional consideration of new persistent organic pollutants: pentachlorobenzene. Stockholm Convention document for 6th POP Reviewing Committee meeting (UNEP/POPS/POPRC.6/INF/21) Geneva 11-15. October 2010.

Selected Publications (from ca. 140 reviewed papers):

In Book

1. R. Weber. Minimisation strategies for PCDD/PCDF emission in waste incineration. Chemical Risk Assessment Handbook, Asakura publisher, 2003 (In Japanese).

Review Articles and editorials

2. Weber R, Aliyeva G, Vijgen J. (2013) The need for an integrated approach to the global challenge of POPs management. *Environ Sci Pollut Res Int*. DOI 10.1007/s11356-012-1247-8
<http://link.springer.com/article/10.1007%2Fs11356-012-1247-8?LI=true>
3. R. Weber, A. Watson, M. Forter, F. Oliaei. (2011) Persistent Organic Pollutants and Landfills - A Review of Past Experiences and Future Challenges. *Waste Management & Research* 29 (1) 107-121
4. J. Vijgen, P.C. Abhilash, Y-F Li, R. Lal, M. Forter, J. Torres, N. Singh, M. Yunus, C. Tian, A. Schäffer, R. Weber* (2011) HCH as new Stockholm Convention POPs – a global perspective on the management of Lindane and its waste isomers. *Env Sci Pollut Res*. DOI: 10.1007/s11356-010-0417-9.
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