

**Invitation for Comments on the “Short List” Candidates for the  
Clean Air Scientific Advisory Committee (CASAC) Lead Review Panel**

**EPA Science Advisory Board (SAB) Staff Office**

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The EPA Science Advisory Board (SAB) Staff Office is forming the **Clean Air Scientific Advisory Committee (CASAC) Lead Review Panel** (Panel). Nominations for technical experts to supplement the existing statutory CASAC membership were requested in the *Federal Register* (70 FR 53010) on September 6, 2005. Information on the CASAC, the Panel, and the nomination process appear in the above-referenced *Federal Register* notice and on the SAB Web site at: [http://www.epa.gov/sab/panels/casac\\_lead\\_review\\_panel.htm](http://www.epa.gov/sab/panels/casac_lead_review_panel.htm). Per the *Federal Register* notice, the SAB Staff Office requested nominees who are nationally-recognized experts in one or more of the following disciplines:

(a) **Chemistry, environmental sources, transport and deposition of lead.** Includes expertise in: (1) inorganic and organometallic chemistry of lead; (2) methods of measuring environmental sources and source strengths from smelters, coal combustion plants, vehicles (historic and modern) and natural sources; (3) atmospheric transport, including methods of detecting transported lead (*e.g.*, isotope analysis) in the gas phase, liquid phase, particle phase (both primary and resuspended); and (4) deposition of lead, including measurement of deposition rate as a function of surface properties.

(b) **Multimedia routes of human exposure to lead.** Includes knowledge of measurement methods (*e.g.*, air sampling methodology) and observed environmental concentrations for multimedia human exposure pathways via inhalation and ingestion (relevant concentrations for various sources: soil, dust, drinking water, food, as well as others such as lead-based paint, pica for paint or soil, *etc.*).

(c) **Modeling of multimedia human exposure uptake/absorption of lead to predict internal biokinetic distribution (blood/bone lead burdens):**

(1) **Lead exposure pathway assessment.** Expertise in the physical and chemical properties of lead and the biogeochemical processes involved in the pathways involved in human exposure to lead. These pathways include:

- (i) air (both direct inhalation and deposition to surfaces likely to be contacted by humans);
- (ii) drinking water (from typical sources including municipal systems, bottled water, public drinking fountains, and private wells);
- (iii) food (including market sources, home gardens and recreational and subsistence fishing/hunting); and
- (iv) soil/dust ingestion.

(2) **Lead uptake/absorption.** Expertise in the processes of uptake or absorption of lead in the digestive tract and lungs, including knowledge of digestive processes that affect the form of lead thus making it more (or less) available for absorption. Experience on the fate of inhaled particles is also desirable, including olfactory uptake.

(3) Internal biokinetic distribution and physiological effects of lead. Expertise on the physiological processes that determine the distribution of absorbed lead among the various organs and tissues of the human body. This would include expertise on the mechanisms of transport within the human body, the organs and tissues that accumulate significant amounts of lead, the concentrations at the organ/tissue level that might impair physiological processes, and the residence times (or other measures of potential impact) of lead in these tissues and organs. Expertise on the various mechanisms and routes of elimination and the mechanisms of this elimination is desirable.

(4) Tissue concentrations of lead. Includes expertise on measurement methods and observed concentrations for various biological tissues, including blood, teeth, and bone lead concentrations and lead levels in soft tissues such as brain, kidney, *etc.*

(5) Human growth and activity patterns. Expertise on growth patterns and typical human activity patterns from prenatal to elderly, including recreational, occupational, leisurely, and household activities. This would include knowledge of published data and of modeling applications.

(6) Exposure assessment modeling. Expertise and experience in measuring human population exposure to lead and/or in modeling human exposure to ambient and indoor pollutants. Expertise in relating indicators of human exposure to potential health outcomes and quantification of risk related to adverse health outcomes.

(d) Lead-induced health effects. Experience in epidemiologic/clinical evaluation and/or evaluation in laboratory animals or in *in vitro* test systems of lead-induced effects on:

- (1) neurological development and other neurological endpoints;
- (2) cardiovascular function;
- (3) immune system function;
- (4) heme synthesis;
- (5) genotoxic effects; and
- (6) carcinogenicity.

(e) Risk assessment and uncertainty characterization. Expertise in human health risk assessment for lead or other pollutants causing non-cancer and cancer health effects, including Bayesian statistical approaches and biostatistics. Expertise in designing uncertainty characterization frameworks for complex multi-media health assessments involving use of PBPK models, empirical data, microenvironmental exposure modeling and concentration-response functions drawing on both toxicological and epidemiological data. Specific areas of expertise should include probabilistic methods and Bayesian techniques.

(f) Evaluation of environmental effects of lead on terrestrial and aquatic ecosystems. Includes expertise and/or knowledge of most current methods and state-of-the-science for assessing: modes of action of lead in plants, animals, and microorganisms; exposure of aquatic and terrestrial organisms to lead in various forms and from various sources; bioavailability of lead and factors which modify the lead uptake by aquatic and terrestrial ecosystems; ecosystem responses at a range of spatial and temporal scales; lead sources, fate, transport, and mobility using stable isotopes; and critical loads for lead in aquatic and terrestrial ecosystems.

(g) **Evaluation of economic effects of lead.** Experience in evaluating economic effects of lead on consumptive-use ecological entities such as agriculture, commercial forests, aquaculture, shell fisheries, and commercial fisheries; and ability to monetize non-consumptive-use ecological entities such as recreation, aesthetics, biodiversity, and other ecological goods and services that are not typically assigned a monetary value.

**The SAB Staff Office has reviewed the nominations and identified 19 candidates to serve on the CASAC Lead Review Panel.** Brief biographical sketches (“biosketches”) on these candidates are provided below. *We hereby invite comments from members of the public for relevant information or other documentation that the SAB Staff Office should consider in the selection of this Panel.* In addition, the biosketches for the members of the chartered CASAC may be viewed at the following URL: [http://www.epa.gov/sab/pdf/casac\\_bios\\_2006.pdf](http://www.epa.gov/sab/pdf/casac_bios_2006.pdf).

Any information furnished by the public in response to this Web site posting will be combined with information already provided by the candidates, and gathered independently by the SAB Staff Office. Prior to final selection of this Panel, the combined information will be reviewed and evaluated for any possible financial conflict of interest or a possible appearance of a lack of impartiality. The information will also be used to ensure appropriate balance and breadth of expertise needed to address the charge to the panel. The SAB Staff Office Director will make the final decision concerning who will serve on the CASAC Lead Review Panel.

Please e-mail your comments no later than **January 9, 2006** to Mr. Fred Butterfield, CASAC Designated Federal Officer (DFO), at: [butterfield.fred@epa.gov](mailto:butterfield.fred@epa.gov).

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## CASAC LEAD REVIEW PANEL CANDIDATE BIOSKETCHES

### **Dr. Joshua Cohen**

Dr. Joshua T. Cohen is a Senior Research Associate at the Center for Risk Analysis, Department of Health Policy and Management, School of Public Health, Harvard University. In that capacity, Dr. Cohen: develops and conducts analyses, authors manuscripts and reports, develops health economic models and environmental risk assessments, provides expertise in Monte Carlo simulation, and is a guest lecturer on the use and design of simulation models in continuing education and graduate student courses. Prior to his current position at Harvard, Dr. Cohen was a Senior Associate at Gradient Corporation from 1994-1999.

Dr. Cohen earned his Master’s Degree in Applied Mathematics from Harvard University in 1990. He earned his Ph.D. in Decision Sciences from Harvard in 1994. Dr. Cohen’s particular areas of expertise relative to the SAB CASAC Lead Review Panel include lead exposure modeling, risk assessment and uncertainty characterization, and evaluation of economic effects of lead. Dr. Cohen has published on several modeling issues relevant to the Review Panel, including several peer-reviewed articles on lead exposure modeling. In 2001, Dr. Cohen co-authored an article on trends in childhood blood lead levels, and another article on the development of a stochastic physiologically-based pharmacokinetic model for lead. In 1998, he published an article on blood lead slope factor models for adults. In 1995, he published an

article on the use of Monte Carlo simulation techniques to predict population blood lead levels. Since 2004, Dr. Cohen has served as a member of the National Academies of Sciences Committee on EPA's Exposure and Human Health Reassessment of TCDD and Related Compounds.

### **Dr. Deborah Cory-Slechta**

Dr. Deborah Cory-Slechta received her Ph.D. degree from the University of Minnesota in 1977 and worked as a junior staff fellow of the National Center for Toxicological Research (NCTR) beginning in 1979. She was appointed to the faculty of the University of Rochester Medical School in 1982 and rose through the ranks. In 1998, Dr. Cory-Slechta was appointed Chair of the Department of Environmental Medicine and Director of the National Institute of Environmental Health Sciences (NIEHS) Environmental Health Sciences Center at the University of Rochester. From July 2000- July 2002, she was the Dean for Research and Director of the Aab Institute for Biomedical Sciences, a newly established post at the University and as such, became the first female dean in the history of the Medical School.

Dr. Cory-Slechta has served on numerous national research review and advisory panels, including committees of the National Institutes of Health (NIH), the NIEHS, the Food and Drug Administration (FDA), NCTR, the U.S. Environmental Protection Agency (EPA), the National Academy of Sciences (NAS), the Institute of Medicine (IOM), and the Agency for Toxic Substances and Disease Registry (ATSDR), Centers for Disease Control (CDC). In addition, Dr. Cory-Slechta has served on the editorial boards of several journals, including: *Neurotoxicology*, *Toxicology*, *Toxicological Sciences*, *Fundamental and Applied Toxicology*, *Neurotoxicology and Teratology*, and *American Journal of Mental Retardation*. She has held the elected positions of President of the Neurotoxicology Specialty Section of the Society of Toxicology, President of the Behavioral Toxicology Society, and been named a Fellow of the American Psychological Association (APA).

Dr. Cory-Slechta's research has focused largely on environmental neurotoxicants as risk factors for behavioral disorders and neurodegenerative disease. Specifically, this has included work on the impact of lead on learning and attention and associated neurochemical mechanisms, and, more recently on the role of pesticides as risk factors for Parkinson's disease. Currently she has also begun to examine mixtures of neurotoxic chemicals and risk modifiers for effects of neurotoxicants as well. These research efforts have resulted in over 100 papers and book chapters to date.

### **Dr. Kenny Crump**

Dr. Kenny Crump, a principal at Environ International Corporation, is a mathematician who specializes in the assessment of human risk from exposure to toxic chemicals. Dr. Crump received a B.S. degree in Electrical Engineering from Louisiana Tech University (1961), an M.A. in mathematics from the University of Denver (1963), and a Ph.D. in mathematics from Montana State University (1968).

Dr. Crump has specialized in development of quantitative methodology for risk assessment, including the "linearized multistage model" used in cancer risk assessment and

"benchmark method" for use with non-cancer outcomes. He has applied these and other methods to many different types of chemical exposures. He is an author of over 100 research articles on these and other subjects that have appeared in the scientific peer-reviewed literature.

Dr. Crump is a Fellow of the American Statistical Association and of the Society for Risk Analysis. Among his awards are the Distinguished Achievement Medal, Section on Statistics and the Environment, American Statistical Association, and the Society for Risk Analysis Distinguished Achievement Award. He has served on the science advisory boards of the U.S. Environmental Protection Agency (EPA), the Mickey Leland National Urban Air Toxics Research Center, the National Center for Toxicological Research, and the National Institute of Environmental Health Sciences (NIEHS). Dr. Crump is presently serving on the science advisory board of the National Toxicology Program. He has also served on committees of the National Academies of Science (NAS), on advisory panels of the Royal Society of Canada, the Province of Ontario and the State of California, and as an advisor to the Food and Agriculture Organization of the United Nations/World Health Organization (FAO/WHO) Joint Expert Committee on Food Additives (JECFA).

During the past two years, Dr. Crump's major sources of funding have been with regard to the health risk posed by perchlorate in the environment, funded by various industry groups, including Kerr Magee Corporation; evaluation of a biologically motivated model for assessing risk from exposure to formaldehyde, funded by the U.S. EPA; and statistical issues related to evaluation of data on the degree of protection afforded by respirators in occupational environments, funded by the Occupational Safety & Health Administration (OSHA).

#### **Dr. A. Russell Flegal**

Dr. Flegal is a Professor of the Department of Environmental Toxicology at the University of California, Santa Cruz (UCSC). He is also the Regional Director for the university's California Alliance for Minority Participation in Science, Engineering and Mathematics (CAMP) that is funded by the National Science Foundation (NSF). Dr. Flegal received his B.A. in Zoology from the University of California, Santa Barbara in 1968; his M.S. in Marine Biology from Moss Landing Marine Laboratories (MLML) in 1976; and his Ph.D. in Oceanography, with minors in Nuclear Chemistry and Statistics, from Oregon State University in 1979. He was then a Research Fellow in Geochemistry at the California Institute of Technology (Caltech) in 1980, and remained affiliated with Caltech as a Visiting Scientist until 1992. Dr. Flegal has also been affiliated with the Swiss Federal Institute of Technology, Université de Aix-en-Provence III, and CNRS European Center for Research in Environmental Geochemistry. His research is focused on the biogeochemical cycling and toxicity of lead and other inorganic contaminants. He has published over 140 articles in peer-reviewed, scientific journals, texts, and encyclopedias on those subjects.

Dr. Flegal has been a member of numerous scientific committees, including those of the US EPA Office of Water's for revision of sampling and analytical protocols for trace element measurements in water, National Research Council's Committee on Measuring Lead in Critical Populations, University of California Blue Ribbon Panel on Chromium (VI), and UNESCO Intergovernmental Oceanographic Commission's Group of Experts on Standards, Techniques and Intercalibration for the Global Investigation of Pollution in the Marine Environment. He is

an Associate Editor of Environmental Research, and a reviewer for several other scientific journals. In 2005, Dr. Flegal was selected as an Invited Lecturer for the Gaspar de Portola Catalonian Program in Spain, and he was elected as a Fellow of the American Association for the Advancement of Science (AAAS).

Dr. Flegal's research program has been primarily supported by the National Institutes of Health, National Science Foundation, National Oceanographic & Atmospheric Administration, Department of Defense, California State Water Resources Control Board, San Francisco Estuarine Institute, University of California Toxic Substances Research & Teaching Program, and University of California Water Resources Program. In addition, his laboratory has conducted analyses for contaminants, primarily lead, in consumer products related to the California Safe Drinking Water and Toxic Enforcement Act of 1986, that have been funded by the California Attorney General's Office, California County District Attorney's Offices, and non-governmental organizations over the past decade. Within the preceding two years, Dr. Flegal he has received funding from: (1) the NSF for the CAMP program; (2) Department of Defense (DoD) for a study of groundwater contamination; (3) California State Water Resources Control Board for a study chronicling mercury contamination in San Francisco Bay sediments; (4) San Francisco Estuarine Institute for studies of biogeochemical cycling of contaminants in San Francisco Bay; (5) University of California Toxic Substances Research & Teaching Program for studies of coastal toxicology; (6) University of California Water Resources Program for studies of water contamination; (7) University of California-France Fund for an international investigation of atmospheric lead contamination; (8) University of California Office of the President for studies using the Advanced Light Source; (9) UC MEXUS-CONACyT for a study of lead contamination in Mexico; and (10) fort studies of lead contamination of consumer products for the California Attorney General's Office, Napa County District Attorney's Office, American Environmental Safety Institute, and the law firm of Bushnell, Caplan & Fielding.

### **Dr. Bruce Fowler**

Dr. Bruce A. Fowler, Fellow A.T.S., received a B.S. degree in Fisheries (Marine Biology) from the University of Washington in 1968 and a Ph.D. in Pathology from the University of Oregon Medical School in 1972. He was a staff scientist at the National Institute of Environmental Health Sciences from 1972 until 1987, when he became Director of the University of Maryland System-wide Program in Toxicology and Professor of Pathology at the University of Maryland School of Medicine. In 2001, Dr. Fowler became Professor and Director of the Laboratory of Cellular and Molecular Toxicology in the Department of Epidemiology at the University of Maryland School of Medicine. From 2002-2003 he was a Senior Research Advisor to the Agency for Toxic Substances and Diseases Registry (ATSDR) in the Division of Toxicology. Dr. Fowler was appointed as the Assistant Director for Science in the Division of Toxicology and to the Senior Biomedical Research Service (PHS) at ATSDR in November 2003.

Dr. Fowler, who is an internationally recognized expert on the toxicology of metals has served on a number of State, National and International Committees in his areas of expertise. These include the Maryland Governor's Council on Toxic Substances (Chair), National Academy of Sciences/National Research Council (NAS/NRC) Committees on Toxicology, Toxicology Information Committee, Committee on Women in Science and Engineering,

Measuring Lead in Critical Populations (Chair), Biological Markers of Urinary Toxicology, Committee on the Evaluation of Augmenting Potable Water Supplies with Reclaimed Water, and the Subcommittee on Arsenic in Drinking Water of the Committee on Toxicology. He has also served as a temporary advisor to the World Health Organization (WHO) and the International Agency for Research Against Cancer (IARC). Dr Fowler has been honored as a Fellow of the Japanese Society for the Promotion of Science (1990), as a Fulbright Scholar and a Swedish Medical Research Council Visiting Professor at the Karolinska Institute, Stockholm, Sweden (1994-995), and was elected as a Fellow of the Academy of Toxicological Sciences (2000).

Dr Fowler was selected as Colgate-Palmolive Visiting Professor of In Vitro Toxicology at the University of Washington in 1998. He served as Chairman of the Scientific Committee on the Toxicology of Metals under the International Commission on Occupational Health (ICOH) 1996-2002, as a consultant to the U.S. EPA Science Advisory Board (SAB) and a member of the Fulbright Scholarship review committee for Scandinavia (1999-, Chair, 2000-2001). Dr Fowler has been a member of the AAAS Recruitment and Screening Committee for the Court-Appointed Scientific Experts (CASE) Demonstration Project since 2000. He is currently a member of the SAB Metals Risk Assessment Framework Panel. Dr Fowler is also a current member of the Council of the Society of Toxicology (2005-2007) and the SAB *Ad Hoc* All-Ages Lead Model (AALM) Review Panel.

Dr. Fowler is the author of over 200 research papers and book chapters dealing with molecular mechanisms of metal toxicity and biomarkers for early detection of metal-induced cell injury. He has been the editor or co-editor of 5 books or monographs on metal toxicology and mechanisms of chemical-induced cell injury. Dr Fowler's current research is focused on the toxicology of chemical mixtures involving metals, particularly in relation to semiconductors, lead, cadmium, arsenic mixtures and the role(s) of lead-binding proteins in mediating the toxicity of this ubiquitous metal to the kidney and brain. He serves on the editorial boards of a number of scientific journals in toxicology and environmental health. Dr. Fowler has previously received peer-reviewed research funding from the EPA STAR Grant Program and the National Institutes of Health.

### **Dr. Andrew Friedland**

Dr. Andrew J. Friedland is Professor and Chair of the Environmental Studies Program at Dartmouth College. He has B.A.s in Biology and Environmental Studies (double major) (1981) and a Ph.D. in Geology (1985), all from the University of Pennsylvania. Dr. Friedland's research has focused on understanding the effects of atmospheric deposition of pollutants on elemental cycling processes in high-elevation forests of New England and the Northeastern United States. He has examined the processes and behavior of trace elements such as lead, copper, zinc, nickel and cadmium and major elements such as nitrogen and calcium on vegetation, soils and water. Dr. Friedland's research on the lead has documented the changes in lead concentrations and amounts in forests of the Northeast over the past 25 years. In a number of related projects, he has described the decline of red spruce in the mountains of New England and has examined water relations in conifers during winter. More recently, Dr. Friedland has begun to explore the role of individual action and personal choice in relation to energy consumption and environmental impact. He has published 50 peer-reviewed articles on these topics and many more conference proceedings and other papers. Dr. Friedland has written one

book, co-authored with biology professor Carol Folt, *Writing Successful Science Proposals* (Yale University Press, 2000).

Dr. Friedland has taught introductory and advanced environmental science courses as well as soil science, forest biogeochemistry and an interdisciplinary course on science and literature. He was a member of the Citizens Advisory Panel of the Strategy for Vermont's Third Century, an environmental risk assessment program conducted by the State of Vermont and the U.S. Environmental Protection Agency (EPA). From 1995-1998, Dr. Friedland chaired the College Board Advanced Placement Environmental Science development committee. This committee designed the first Advanced Placement course in environmental science that was offered nationwide for the first time in 1998. Approximately 25,000 students took the most recent AP Environmental Science exam earlier in 2002. Dr. Friedland is a member of the Soil Science Society of America, the Ecological Society of America, and the American Association for the Advancement of Science. He is currently on the editorial board of the *Journal of Sustainable Forestry* and was a member of the editorial board of *Science of the Total Environment* from 1995 through 2002. In 2002 and 2003, Dr. Friedland was a member of the Metals Review Assessment Plan Review Panel of the EPA Scientific Advisory Board. In 2004 and 2005, he was a member of the Metals Risk Assessment Framework Review Panel of the EPA Science Advisory Board.

Dr. Friedland has received funding from the National Science Foundation (NSF), the U.S. Forest Service, EPA, and private foundations. In the last two years, he has received funding for a project entitled "Determining Calcium, Lead and Organic Matter Changes in Forest Floors Across the Northern Forest" from the Northeast States Research Cooperative of the USDA Forest Service; and, for a project entitled "The Sustainable New England Landscape: Integrating Interdisciplinary Environmental Studies from the Undergraduate to the Post-Doctoral Level," from The Henry Luce Foundation, New York, NY.

### **Dr. Robert Goyer [M.D.]**

Dr Robert Goyer is a Clinical Pathologist with special interests in pediatric pathology, toxicology and research in health effects of toxic metals. After serving in the U.S. Navy at the end of World War II, Dr. Goyer graduated from the College of the Holy Cross (B.S., 1950) and the St. Louis University School of Medicine (1955). He interned at St. Francis Hospital in Hartford Connecticut and completed a residency in Pathology at the St. Louis University Hospitals.

Dr. Goyer held a National Foundation Research Fellowship and was a postdoctoral research fellow in the Medical Unit of University College Hospital Medical School, London, England. Professional appointments included Director of Laboratories at the Cardinal Glennon Hospital for Children in St. Louis; Professor of Pathology at the University of North Carolina at Chapel Hill; and Deputy Director of the National Institute of Environmental Health Sciences (NIEHS) at Research Triangle Park NC. He also served two terms as Professor and Chairman of the Department of Pathology at the University of Western Ontario, London, Canada.

Dr. Goyer has published over 175 research papers, reviews and book chapters on toxicity of metals and interactions of toxic metals with nutritionally-essential metals. He has co-edited

three books on the toxicology of metals. Dr. Goyer is an internationally-recognized expert in health effects of toxic and nutritionally-essential metals, and has served on number of committees for U.S. and international health agencies, including: the National Institutes of Health (NIH), the Environmental Protection Agency (EPA), the National Research Council (NRC) of the National Academy of Sciences (NAS), and the World Health Organization (WHO) International Programme for Chemical Safety. Dr Goyer was recognized at an International Conference on Metal-Binding proteins in 1998 “for his outstanding lifetime contribution to the understanding of the actions and effects of metals on living organisms.” In 2001, he was recognized by the NAS “for extraordinary service to the National Academies as advisor to the nation in matters of science, engineering and health.” Dr. Goyer was also awarded the 2003 Merit Award from Society of Toxicology for “in recognition of a distinguished career in toxicology.” Dr. Goyer is retired as Professor Emeritus of Pathology, University of Western Ontario, Canada, but continues to contribute to various national and international agencies on matters of environmental health and toxicology. He currently resides in Chapel Hill, NC. Dr. Goyer receives no outside contract or grant support funding.

### **Mr. Sean Hays**

Mr. Sean Hays is the President and founder of Summit Toxicology, a toxicology and risk assessment consulting firm. Mr. Hays received his B.S. in Biomedical Engineering from Texas A&M University in 1989, a M.S. in Physiology from the University of Vermont in 1992, and a M.S. in Chemical Engineering from Colorado State University in 1997. Mr. Hays specializes in conducting exposure assessments, deriving acceptable exposure limits (*i.e.*, reference doses and reference concentrations, cancer slope factors, permissible exposure limits, and minimal risk levels), developing pharmacokinetic (PK) and physiologically based pharmacokinetic (PBPK) models, and in developing methods for interpreting biomonitoring data in a health risk context.

Mr. Hays has developed PBPK models for a wide range of chemicals and metals (including collaborating with Dr. Ellen O’Flaherty to develop a PBPK model for chromium), and has specialized in developing models for pregnancy and the developing child. He has over nine years of experience performing pharmacokinetic modeling of lead in humans and in using the O’Flaherty lead PBPK and IEUBK models to assess potential health risks for a wide range of potential exposure scenarios. Mr. Hays has used the lead PBPK model to set site-specific clean-up goals for numerous lead impacted properties, to model the potential for elevated blood lead levels among children exposed to elevated levels of lead in school drinking water supplies, and for modeling the likely changes in blood lead levels among astronauts who experience rapid and substantial bone loss while on extended space travel. Mr. Hays has experience using U.S. EPA’s IEUBK model for risk assessment purposes and has performed detailed analyses to evaluate the scientific differences between the various lead pharmacokinetic models and to evaluate in which risk assessment scenarios each lead model is scientifically valid for predicting changes in blood lead levels.

Mr. Hays is a member of the Society of Toxicology, the International Society of Regulatory Toxicology and Pharmacology, the American Conference of Governmental Industrial Hygienists, the International Society of Exposure Analysis, and the Society of Risk Analysis. He is currently serving as the Vice President-Elect of the Biological Modeling Section of the Society of Toxicology. Mr. Hays currently serves as a member of the U.S. Environmental Protection

Agency's (EPA) Science Advisory Board (SAB) *Ad Hoc* All-Ages Lead Model (AALM) Review Panel. Over the past two years, Mr. Hays has received funding related to lead from Wyle Laboratories (a subcontractor to NASA) to develop a lead PBPK to predict the potential impact that extended periods of exposure to microgravity would have on the blood lead levels of astronauts. He has also received funding from a large school district in the Pacific Northwest to help model the likely blood lead levels of children who had been exposed to elevated levels of lead in their school drinking water. In Mr. Hays' other consulting efforts, he has received funding from the U.S. EPA to develop PBPK models, from private industry to develop PBPK models and exposure and risk assessments for a variety of chemicals and to develop methods for interpreting biomonitoring data.

### **Dr. Philip K. Hopke**

Dr. Philip K. Hopke is the Bayard D. Clarkson Distinguished Professor and the Director of the Center for Air Resources Engineering and Science at Clarkson University. In October 1997, he was appointed by the Administrator of the U.S. Environmental Protection Agency (EPA) as a member of the Clean Air Scientific Advisory Committee (CASAC), which is administratively located at EPA under the Science Advisory Board (SAB). Dr. Hopke is the immediate past Chair of the CASAC and the CASAC Ambient Air Monitoring and Methods (AAMM) Subcommittee. In addition, he serves as an SAB Board Member. Professor Hopke was the President of the American Association for Aerosol Research from 2003 to 2003, and was a member of the National Research Council's Congressionally-mandated Committee on Research Priorities for Airborne Particulate Matter and the Committee on Air Quality Management in the United States. He has previously served on five other NRC committees.

Professor Hopke received his B.S. in Chemistry from Trinity College (Hartford) and his M.A. and Ph.D. degrees in chemistry from Princeton University. After a post-doctoral appointment at M.I.T., he spent four years as an assistant professor at the State University College at Fredonia, NY. Dr. Hopke then joined the University of Illinois at Urbana-Champaign, and subsequently came to Clarkson in 1989 as the Robert A. Plane Professor with a principal appointment in the Department of Chemistry. He has served as Dean of the Graduate School, Chair of the Department of Chemistry, and Head of the Division of Chemical and Physical Sciences before he moved his principal appointment to the Department of Chemical Engineering in 2000. In 2002, he became the Bayard D. Clarkson Distinguished Professor and Director of the Center for Air Resources Engineering and Science.

Dr. Hopke's recent and current grant and other contract support includes consulting on scientific and technical matters related to: particulate matter, particle monitoring, semi-volatile pollutants, vapor nucleation, EPA Supersites, sources of PCBs, regional air quality monitoring, and computational fluid dynamic modeling in humans for the Federal government (EPA and the National Institute for Occupational Safety and Health [NIOSH]), state and regional agencies (LADCO, NYSERDA, NJDEP, Cal ARB, Delaware DNREC), U.S. Department of Energy (DOE), International Atomic Energy Agency (IAEA), the Electric Power Research Institute (EPRI), and the National Science Foundation (NSF).

### **Dr. Thomas La Point**

Dr. Thomas La Point directs the Institute of Applied Sciences at the University of North Texas and is a Professor in the Department of Biological Sciences. He received his B.S. in Zoology and Physiology (1971) from the University of Wyoming; his M.S. in Population Biology (1975) from the University of Houston, TX; and his Ph.D. in Aquatic Biology (1980) from the Department of Biological Sciences at Idaho State University. Dr. La Point's primary research and teaching interests include contaminant effects on freshwater aquatic communities, specifically how metals and organic contaminants affect benthic population dynamics and freshwater fisheries. He has published on ecosystem measures, contaminant bioaccumulation, and sub-lethal effects on aquatic populations.

Dr. La Point has served on several U.S. Environmental Protection Agency (EPA) Science Advisory panels concerned with pesticides and ecological risk and has worked as a consultant on Superfund issues at large sites. He is presently serving on a National Academy of Science (NRC) Committee on Superfund Site Assessment and Remediation in the Coeur d'Alene River Basin. Dr. La Point is presently serving as Chair of a Water Environment Research Foundation subcommittee on whole-effluent testing as an indicator of aquatic health. In addition, he has served on several NSF, USEPA and USGS panels to review proposals submitted for funding. Dr. La Point is on the editorial board for *Chemosphere and Environmental Toxicology and Pharmacology* and has served as Editor of the Society of Environmental Toxicology and Chemistry (SETAC) Special Publication Series.

### **Dr. Bruce Lanphear**

Dr. Bruce P. Lanphear, M.D., M.P.H., is the Sloan Professor of Children's Environmental Health and the Director of the Cincinnati Children's Environmental Health Center at Cincinnati Children's Hospital Medical Center and the University of Cincinnati. He received a B.A. in Biology (1985) and his Doctor of Medicine degree (1986) from the University of Missouri at Kansas City. Following his transitional internship at the University of Arkansas for Medical Sciences, Little Rock, AK, he attended the Tulane School of Public Health & Tropical Medicine, which he received his Masters in Public Health & Tropical Medicine (1988).

Dr. Lanphear is currently the principal investigator (PI) for a five-year Children's Environmental Health Center study funded by the National Institute of Environmental Health Sciences (NIEHS) and the U.S. Environmental Protection Agency (EPA) to examine fetal and early childhood exposures to prevalent environmental neurotoxins, including lead, alcohol, environmental tobacco smoke, pesticides mercury and PCBs, and to evaluate their impact on children's behaviors, learning disabilities and asthma. He is also conducting a trial to test the safety and efficacy of housing repairs to reduce childhood lead exposure and residential injuries in 400 children followed from birth. Dr. Lanphear has conducted numerous epidemiologic studies of lead-contaminated house dust and residential soil, and has directed studies to identify standardized dust-sampling methods for lead-contaminated house dust and indoor allergens. In addition, he was the principal investigator of two randomized trials to test the effect of dust control on children's blood lead levels and of a U.S. Department of Housing and Urban Development (HUD)-funded study to develop screening criteria to identify residential lead hazards.

From 1998 to 2001, Dr. Lanphear served as a member of the Science and Research Work Group of EPA's Office of Children's Health Protection Advisory Committee. From 2001 to 2003, he was a member of the Expert Panel on Children's Health and the Environment for the North American Commission for Environmental Cooperation; and in May 2003 he served as a member of the "Herculaneum Health Study Workshop" sponsored by the Agency for Toxic Substance Diseases Registry (ATSDR). In 2003-2004, Dr. Lanphear was a Panel Member for "Lead Poisoning in Pregnant Women," at the Center for Children's Health and the Environment (CCHE) of the Mount Sinai School of Medicine, New York, NY. Most recently, in 2004, he was a member of the committee on "Ethical Consideration for Research on Housing-Related Health-Hazards involving Children" sponsored by the National Research Council (NRC) and the Institute of Medicine (IOM) of the National Academy of Sciences (NAS).

Dr. Lanphear's sources of recent grant or other contract support include: (1) PI, "A Randomized Trial to Reduce ETS in Children with Asthma," National Heart, Lung and Blood Institute (NHLBI), National Institutes of Health (NIH); (2) PI (Subcontract), "A Longitudinal Study of Lead Exposure and Dental Caries," National Institute of Dental and Craniofacial Research (NIDCR), NIH; and (3) Co-Investigator (CI), "ADHD Phenotype Network: Animal Model to Clinical Trial," National Institute of Neurological Disorders and Stroke (NINDS). His sources of current grant or other contract support include: (1) PI, "Prevalent Neurotoxicants in Children," NIEHS & EPA; (2) PI, supplement to "Prevalent Neurotoxicants in Children," NIEHS; (3) PI, "Linkage of ADHD and Lead Exposure," Springfield, OH Department of Health; (4) CI, "Explorations of ETS Exposure on Child Behavior and Sleep," NIEHS; (5) CI, "Childhood Asthma in an Era of Genomics: Will the Generalist's Role be Recast?," Robert Wood Johnson Generalist Physician Faculty Scholars Program; (6) CI, "MRI as a Biomarker of Manganese Exposure," NIEHS; (7) CI, "Childhood Residential Injury and Caregiver Supervision," National Institute for Child Health and Human Development (NICHD); (8) CI, "Development of a Standardized Housing Assessment for Asthma," HUD; and (9) PI, "National Research Service Award – Fellowship Training in Primary Care Research," U.S. Department of Health and Human Services (HHS).

### **Dr. Samuel Luoma**

Dr. Samuel N. Luoma is a Senior Research Hydrologist with the U.S. Geological Survey (USGS). He received his Ph.D. in Zoology from the University of Hawaii in 1974. He has been with USGS since 1975, and also served as the first Lead Scientist for the CALFED Bay-Delta program between August 2000 and November 2003. Dr. Luoma's research interests are in the fate and effects of contaminants, primarily metals and metalloids, in aquatic ecosystems. He has worked on contaminant bioavailability to invertebrates from diet and water, biomonitoring, sediment contamination, processes affecting metal fate and form, and both organism-level and community-level effects of metals. Dr. Luoma has additional interests the linkages between science and policy, and communication of environmental risks, especially in the arena of water management. He has advised and contributed in a number of different forums on the implications of various advances in metals science to managing those contaminants in the environment. A general contribution was bringing science and scientists into a prominent role in managing California water, as the first Lead Scientists for the CALFED program.

Dr. Luoma's more specific advisory functions include the Canadian NRC Committee on Biologically Available Metals in Sediments (1988), the *ad hoc*, four-person committee that designed USGS National Water Quality Assessment; National Science & Engineering Research Council, Canada, Strategic Grant Selection Panel for Environmental Quality (1991-93), U.S. Environmental Protection Agency (EPA) Science Advisory Board (SAB) Subcommittees on Sediment Quality Criteria (1992, 1995, 1999), and the EPA SAB panel reviewing the Metal Framework (2004). He chaired the Science Advisory Group for the Interagency Ecological Program, San Francisco Bay/Delta and was Chair of the Science Advisory Committee, for Water Resources Division USGS Senior Staff (1994 – 1998). Dr. Luoma was on the Science Advisory Committee for the EPA Center of Excellence (Center for Environmental Health Research), UC Davis (1998-2002). He participated in a series of four SETAC & EPA Workshops on Re-evaluation of the State the Science for Water Quality Criteria development & hazard assessment for metals (1994, 1996, 1998, and 2003). In 2002-03, Dr. Luoma was on the National Academy of Sciences (NAS), NRC committee on Bioavailability of Contaminants from soils and sediments. In 2004, he was a Fulbright Distinguished Scholar in London at the Natural History Museum and is currently working on a book on managing metal contamination in aquatic environments as a follow-up to that appointment. In 2006 he will sit on a British Fulbright Commission selection committee for new students and scholars.

Dr. Luoma's sources of funding include City of Palo Alto for San Francisco Bay monitoring, State of California (CALFED Bay-Delta Program) for work with selenium and mercury, USEPA Superfund Program for work monitoring the Clark Fork River in Montana, and USEPA Region 9 for work on evaluating alternative site-specific criteria for selenium in California.

### **Dr. William Manton**

Dr. William Manton is a professor of geoscience at the University of Texas at Dallas. He received his B.Sc., Geology and Physics (Hons.) (1959), M.Sc. (1963), and Ph.D. from the University of the Witwatersrand, Johannesburg, South Africa. Although his undergraduate degree was in geology and physics and his doctorate in isotope geochemistry, he has for the past thirty years been involved with research in the problem of lead in the environment as it pertains to human health.

Dr. Manton has published on the contribution of gasoline lead to blood, lead poisoning from bullets, lead content of blood serum, the uptake of lead by children, the mobilization of bone lead in pregnancy and lactation, and most recently the origin of lead in the U.S. diet. He was an advisor to Health Canada in their work on lead in non-human primate pregnancy. Dr. Manton has not and is not serving on any advisory committees and has held no office in professional societies.

### **Dr. Paul Mushak**

Dr. Paul Mushak is a principal in PB Associates, Durham, N.C., a consulting partnership in toxicology and health risk assessment. He specializes in the exposure and health risk assessment of elements such as lead, arsenic, cadmium and mercury. Dr. Mushak holds a Ph.D. in metal chemistry and biochemistry (1970), University of Florida (UF)-Gainesville, FL with

extensive training in metal toxicology at the UF School of Medicine. His post-doctoral training was in nutrient and toxic metal enzymology, Department of Molecular Biophysics and Biochemistry, Yale University. Dr. Mushak was formerly a full-time member of the faculty at the University of North Carolina-Chapel Hill School of Medicine, Department of Pathology (1971-1985) and adjunct full professor in that department (1986 through 1993).

Dr. Mushak currently has an affiliation with the Albert Einstein College of Medicine as an unsalaried visiting professor in the Department of Pediatrics. Research interests include measurement and predictive modeling of toxic metal exposure biomarkers in humans and the factors affecting them. He has authored or coauthored about 175 papers, book chapters, conference abstracts. Dr. Mushak was a principal coauthor of many expert consensus documents for Federal, National Academy of Sciences, and international health agencies. He has served on numerous peer-review panels, and chaired two peer review panels for U.S. EPA reports to Congress on mercury emissions. Dr. Mushak has testified on several occasions before the U.S. Congress regarding childhood lead exposures. He has been qualified in a number of Federal and state courts as an expert in the toxicology and health risk assessment of lead and other metals.

Dr. Mushak currently serves as a member of the EPA Science Advisory Board (SAB) *Ad Hoc* All-Ages Lead Model (AALM) Review Panel, and has served on a number of SAB panels in the past, including two panels dealing with peer evaluation of EPA's Integrated Exposure-Uptake Biokinetic Model for use in assessing lead exposures around point source lead emissions and Superfund sites and a panel evaluating risk posed by chromated copper arsenate-treated lumber to young children. Dr. Mushak has no outside contract or grant support related to the IEUBK or All-Ages Lead Model.

### **Dr. Herbert Needleman**

Dr. Herbert L. Needleman is Professor of Psychiatry and Pediatrics at the University of Pittsburgh School of Medicine. Trained in psychiatry at Temple University Health Sciences Center, he received his B.A. in Natural Sciences from Muhlenberg College in 1948 and his M.D. degree from the University of Pennsylvania in 1952. He was attending physician at the Children's Hospital of Philadelphia and associate professor of psychiatry at Harvard Medical School.

Dr. Needleman has been studying the effects of lead at low doses on children's brains and development for 30 years. He developed a new method of measuring a child's body burden of lead through the analysis of teeth and mounted the first large-scale study of intelligence and behavior in children who had no symptoms lead toxicity other than high lead in their teeth, a study that served as a model for others around the world. This dentine lead assay for lead showed that lead at doses too low to bring children to medical attention was associated with IQ loss, behavioral aberration, language deficits and disturbed classroom behavior.

Dr. Needleman followed these children into young adulthood and showed that their deficits persisted and were expressed in school failure and reading disabilities. He designed the first forward study of lead exposure in the uterus, and showed that it was associated with cognitive deficits later in life. Dr. Needleman's studies have demonstrated that lead exposure is associated with increased aggression, disturbed attention and delinquent behavior. He conducted

the first case control of delinquents, and demonstrated that they have elevated bone lead levels, and that this finding is associated with an odds ratio of four (4) for delinquency. These studies led to programs and regulations to eliminate childhood lead poisoning. Dr. Needleman also examined the effects of lead during pregnancy on infant development and relationship between early lead exposure and delinquency. For his work on lead toxicity, Dr. Needleman has been honored by the Dana Foundation, the Heinz Family Fund, and has been elected to the Institute of Medicine (IOM) of the National Academy of Sciences (NAS). He is not currently serving on other related advisory committees;

Dr. Needleman served as a consultant to the U.S. Environmental Protection Agency (EPA) regarding the air quality criteria documents for lead in 1977, 1978, and 1982. In addition, he has consulted with the U.S. Centers for Disease Control and Prevention (CDC), the U.S. Department of Housing and Urban Development (HUD), and State and local governments. Dr. Needleman has written extensively on the effects of lead, and lectured on the subject at universities around the world.

### **Dr. Michael Newman**

Dr. Michael Newman is Professor of Marine Science at the College of William and Mary, Virginia Institute of Marine Science. He received degrees in zoology from the University of Connecticut (B.A., 1974; M.S., 1978) and environmental sciences from Rutgers University (M.S., 1980; Ph.D., 1981). After his postdoctoral studies, Dr. Newman was a research ecologist at the University of Georgia's Savannah River Ecology laboratory. He now holds a Professor of Marine Science position at the College of William and Mary's School of Marine Science after ending a three-year term as Dean of Graduate Studies of the School of Marine Science.

Dr. Newman's research emphasizes quantitative methods in ecotoxicology with topics of interest ranging from chemical measurement statistics to QSAR-like models for predicting metal ion effects to contaminant effects on population genetics to methods of predicting community level effects. He has authored approximately 100 publications on these topics including four books, *Quantitative Methods in Aquatic Ecotoxicology*, *Fundamentals of Ecotoxicology*, *Population Ecotoxicology*, and *Community Ecotoxicology*. He also edited several books, *Metal Ecotoxicology*, *Hierarchical Ecotoxicology*, *Risk Assessment: Logic and Measurement*, *Coastal and Estuarine Risk Assessment*, and *Risk Assessment with Time-to-Event Models*.

Dr. Newman is active in advisory service. He served on Organisation for Economic Co-operation and Development (OECD), U.S. Environmental Protection Agency (EPA), U.S. Department of Energy (DOE), National Academy of Sciences (NAS), and state environmental regulatory and risk assessment committees and panels. Dr. Newman was one of two U.S. members of an OECD team charged with assessing statistical methods for analyzing toxicity data. Work with DOE involved complex-wide consideration of data quality objectives for risk assessment activities, and various site-specific advisory services to the Savannah River and Hanford sites. He has been a member of numerous EPA teams including the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) ECOFRAM working group, two FIFRA science advisory panels, the Chesapeake Bay Office science advisory board, a Food Quality Protection Act (FQPA) scientific review board, and a joint U.S. EPA-Israeli Water Agency working group. Dr. Newman has reviewed numerous risk assessment documents for EPA and was a consultant

to the NAS (Everglades Ecosystem Assessment). He continues to work actively with various Virginia Department of Environmental Quality (DEQ) teams and panels.

### **Dr. Michael Rabinowitz**

Dr. Michael Rabinowitz is a geochemist with over 20 years of experience with lead. He holds an S.B. in Physics (1968) from the Massachusetts Institute of Technology; an M.S. in Planetary Sciences (1970) from the University of California, Los Angeles; and a Ph.D. in Geochemistry (1975) from UCLA. From 1974-1975, he was a NIEHS Post-Doctoral Fellow in Nephrology at the UCLA-Wadsworth VA Hospital. His current positions are: Clinical Instructor in Neurology, Harvard Medical School, Boston; Library Reader, Marine Biological Laboratory, Woods Hole; and Assistant Dockmaster, Herreshoff Maritime Museum.

Dr. Rabinowitz conducted several pioneering research projects on the environmental sources and pathways of lead contamination and the movement of lead within human body compartments by feeding stable isotope tracers to adult human volunteers in a metabolic balance ward. He is familiar with paint, rock, soil, vegetation, air, water, and tissue sampling in urban, rural and remote settings. Dr. Rabinowitz has established several clean-room laboratories for trace lead determinations in Massachusetts and Taiwan. He has experience with statistical analysis and data interpretation, including work on sources of lead to children and lead's effects on child development, and he is familiar with the factors which influence environmental uptake and absorption of lead. Dr. Rabinowitz has studied the history of the American lead paint industry, visited most of the production sites and analyzed available soil, metal, and paint samples to document this anthropogenic flow of lead.

Dr. Rabinowitz currently serves as a member of the U.S. Environmental Protection Agency's (EPA) Science Advisory Board (SAB) *Ad Hoc* All-Ages Lead Model (AALM) Review Panel. He participated in an EPA workshop on modeling lead exposure and bioavailability in 1998 and a more recent review of an uptake and distribution model (so-called LEAD5). His sources of recent grant and/or contract support include Westat, Syracuse Research Corporation, Battelle, and the Eagle Picher Personal Settlement Injury Trust.

### **Dr. Joel Schwartz**

Dr. Joel Schwartz is a Professor in the Departments of Epidemiology and Environmental Health at the Harvard School of Public Health, and in the Department of Medicine at Harvard Medical School. He is also a faculty member in the Environmental Biostatistics Program at the School of Public Health. Dr. Schwartz received his B.A. (1969) and Ph.D. (1980) from Brandeis University. He is a member of the International Society for Environmental Epidemiology, and the American Thoracic Society (ATS).

Dr. Schwartz served as a member of the Center for Disease Control's Committee on Preventing Childhood Lead Poisoning from 1994 to 2002, and as a member of two National Research Council Committees (Committee on Assessing Lead Exposure in Critical Populations, Committee on Environmental Epidemiology). Dr. Schwartz was a recipient of a John D. and Catherine T. MacArthur Fellowship, and a World Congress Award from the International Union of Environmental Protection Associations. His expertise is in epidemiology, biostatistics, and

cost benefit analysis. Dr. Schwartz's major subject matters include air pollution and lead. His research has involved cross-sectional, time-series, cohort and panel studies of the acute and chronic health effects of air pollution, including both respiratory and cardiovascular endpoints, and he has a particular interest in questions of susceptibility.

In the last two years, Dr. Schwartz received funding from the National Institutes for Health (NIH) for environmental biostatistics, for studies of aeroallergen exposure and asthma, for studies of lead, for a study of the association between particulate air pollution and heart attacks, and for a study of socioeconomic gradients in breast cancer. He has received funding from EPA as the PI for Epidemiology of the Harvard PM Research Center, and from the Health Effects Institute (HEI) for the APHENA project, which aims to combine North American and European time series analyses of air pollution, morbidity, and mortality. Dr. Schwartz currently serves as a member of the EPA Science Advisory Board (SAB) *Ad Hoc* All-Ages Lead Model (AALM) Review Panel.

### **Dr. Ian von Lindern**

Dr. Ian von Lindern is Chairman and CEO of TerraGraphics. He received his B.S. in Chemical Engineering (1971) from Carnegie-Mellon University, Pittsburgh, PA; and his M.S. in Biometeorology and Atmospheric Studies (1973) and Ph.D. in Environmental Science and Engineering (1980) from Yale University, New Haven, CT.

Dr. von Lindern has 30 years of environmental engineering and science experience in Idaho. He has directed over 30 major environmental investigations, involving solvent contamination of groundwater in the Southwest, an abandoned petroleum refinery, secondary smelters and battery processors, landfills, uranium mill tailings, and several major lead sites including: Dallas, TX; the Niagara and Riverdale Projects in Toronto, Canada; the Marjol Battery Site in Throop, PA; ASARCO/Tacoma, WA; East Helena and Butte/Anaconda in MT; Anzon Industries in Philadelphia, PA and the Rudnaya Pristan-Dalnégorsk Mining District, Russian Far East. Through TerraGraphics, Dr. von Lindern has worked continually for Idaho Department of Environmental Quality on various projects since the company's inception in 1984. He has been the lead Risk Assessor for the Bunker Hill Superfund Site in north Idaho, communicating associated risk issues at many public meetings in the community. In the last few years, Dr. von Lindern directed and completed the Union Pacific Railroad "Rails-to-Trails Risk Assessment;" the exhaustive Five-Year Review of the Populated Areas of the BHSS; the Human Health Risk Assessment for the Basin; and several other technical tasks.

Dr. von Lindern has served as a U.S. EPA Science Advisory Board (SAB) Member on four occasions: (1) the Review Subcommittee for Urban Soil Lead Abatement Demonstration Project, 1993; (2) the Subcommittee Assessing the Consistency of Lead Health Regulations in U.S. EPA Programs, Special Report to the Administrator, 1992; (3) the Review Subcommittee Assessing the Use of the Biokinetic Model for Lead Absorption in Children at RCRA/CERCLA Sites, 1988; and (4) currently, the *Ad Hoc* All-Ages Lead Model (AALM) Review Panel. He also served on the EPA Clean Air Scientific Advisory Committee (CASAC) Subcommittee on Exposure Assessment Methodology, 1988; and was a member of EPA Criteria Assessment Committee for Lead in the Ambient Air from 1975-1986.