

Melanie Edwards **Managing Statistician**

Professional Profile

Ms. Melanie Edwards is a Managing Statistician in Exponent's Health Sciences Center for Exposure Assessment and Dose Reconstruction. She has over 15 years experience as a statistician and data manager. She has been trained in applied and theoretical statistics as well as advanced calculus, partial differential equations, and linear programming. Ms. Edwards' focus is applying statistical analysis to environmental studies. She has particular expertise in applying appropriate statistical methods to industrial contaminant sources for environmental forensic projects. She is called upon frequently to provide understandable descriptions of statistical methods used by testifying experts, and suggestions for deposition questioning.

Ms. Edwards has provided statistical support on a wide range of projects including chemical fingerprint analyses, model fitting and predictions, comparisons with background and reference populations, probabilistic model development for quantification of uncertainties, and evaluation of toxicity test results. Methods used include regression, analysis of variance, non-linear models, factor analysis, principal component analysis, non-parametric methods, and sampling design and evaluation. She routinely provides insight on data presentation and interpretation of statistical analyses for experts from a variety of backgrounds, including environmental science, ecology, toxicology, and engineering. She is also familiar with NHANES and SEER data repositories as well as chemistry datasets representing background concentrations in soil and water. She has maintained all aspects of databases used for data validation, compilation, and storage, including transfer of data from multiple formats.

Academic Credentials and Professional Honors

M.S., Statistics, University of Wisconsin, Madison, 1998
B.S., Mathematical Science, University of Washington, Seattle, 1991

Publications

Connor, KT, Harris, MA, Edwards, MR, Budinsky, RA, Clark, GC, Chu, AC, Finley, BL, Rowlands, JC. AH receptor agonist activity in human blood measured with a cell-based bioassay: Evidence for naturally occurring AH receptor ligands in vivo. *Journal of Exposure Science and Environmental Epidemiology* 2008; 18:369–380.

Lowney YW, Wester RC, Schoof RA, Cushing CA, Edwards MR, Ruby MV. Percutaneous absorption of arsenic from soils as measured in the Rhesus Monkey. *Toxicological Sciences* 2007; 100(2):381–392.

Benton, L, Shields, WJ, Edwards, MR. Commentary on O'Connor and Sabrsula (2005): Background dioxins in house dusts. *Environmental Forensics* 2007; 6(3):283–287.

Tsuji JS, Williams PRD, Edwards MR, Allamneni KP, Kelsh MA, Paustenbach DJ, Sheehan PJ. Evaluation of mercury in urine as an indicator of exposure to low levels of mercury vapor. *Environ Health Perspect* 2003; 111(4):623–630.

Book Chapters

Shields WJ, Tondeur Y, Benton L, Edwards MR. Dioxins and furans. Chapter 14. In: *Environmental Forensics: Contaminant Specific Guide*. Morrison R, Murphy B (eds), Academic Press, San Diego, CA, 2006.

Presentations

Johns M, Atlas R, Edwards M. Weathering of MC252 oil in the water column of the Gulf of Mexico from May through September 2010 : Fluorometry, dissolved oxygen, and quantitative chemistry evaluation. Poster presentation at the Gulf Oil Spill SETAC focused topic meeting, Pensacola, FL, 2011.

Edwards M, Maier E, Reeder D, Gard N, Shock S. Assessment of plant communities exposed to fugitive dust along a mine transportation corridor in Alaska. Poster presentation at the Annual Joint Statistical Meeting, Salt Lake City, UT, 2007.

Benton L, Ginevan M, Edwards M. Chemical fingerprinting of dioxins using a similarity index. Poster presentation at the 16th Annual AEHS Meeting and West Cost Conference on Soils, Sediments and Water, San Diego, CA, 2006.

Kaetzel R., Edwards M, Lowney Y, Tsuji J. Patterns of urinary excretion of arsenic metabolites in a population with low arsenic exposure. Poster presentation at the 45th Annual SOT Meeting, San Diego, CA, 2006.

Ginevan M, Edwards M, Benton L. Statistical tools for the analysis of PCB and dioxin profile data. Platform presentation at the SETAC 26th Annual Meeting in North America, Baltimore, MD, 2005.

Pastorok R, Davis R, Salatas J, Edwards M. Identifying structural and functional indicators for habitat equivalency analysis (HEA) and restoration of submerged vegetation. Interactive platform presentation at the SETAC World Congress and 25th Annual Meeting in North America, Portland, OR, 2004.

Booth, P, Edwards M, Nielsen D. Spatial and temporal trends in PCBs in fish in response to natural recovery in sediments. Poster presentation at the SETAC World Congress and 25th Annual Meeting in North America, Portland, OR, 2004.

Project Experience

Used principal component analysis of dioxin and furan concentrations from multiple locations and sources to determine if historic releases from a wood treatment facility were the source of these compounds found in a nearby neighborhood in Mississippi. Used diagnostic ratio method to evaluate sources of PAHs. Assisted in preparation of expert report.

Generated upper tolerance limits for concentrations of PCB congeners, dioxin and furan congeners, and toxicity equivalents (TEQ) based on the NHANES complex survey study design. These values represent the upper range of background levels in blood samples from the U.S. population. Several age groups were evaluated separately.

Quantified temporal trends in concentrations measured in groundwater monitoring wells surrounding historical holding ponds used by an electric power generating facility.

Used profile comparisons and principal component analysis to evaluate dioxin and furan fingerprints in water, sediment, and fish tissue samples downstream and upstream of a former pesticide manufacturing facility.

Used simulation methods to evaluate sources of variability in fish tissue PCB concentrations and evaluate state of Michigan's current sample design for monitoring PCB and mercury concentrations in fish tissue throughout the state.

Developed probabilistic model to manage global waste stream volumes for a large petroleum company, including liquid and solid waste from sites ranging in size from local gas stations to major port loading facilities. Results from the model provided a baseline volume estimate prior to implementation of waste reduction practices and more detailed record keeping.

Evaluated the relationship between PCB congener concentrations and total PCB concentrations in sediment and several fish species from the Fox River, Wisconsin.

Evaluated and interpreted spatial and temporal trends in sediment PCB composition and concentration throughout a 25-mile stretch of river, in support of a NRDA for a Superfund site in Wisconsin.

Assisted with developing a sampling program for metals in fugitive dust in multiple tundra environments. Conducted statistical analyses to evaluate the contribution of metals in fugitive dust to changes observed in plant communities near the road and facility areas. Analyses included hypothesis testing, regression analyses, cluster analysis, principal component analysis, and non-parametric methods to quantify spatial trends in the vicinity of a mine, haul road, and port; compared concentrations between potentially impacted and reference locations; and summarized berry, caribou tissue, invertebrate, soil, sediment, and water chemical concentrations for ecological and human health risk assessment. Factor analysis highlighted habitat differences within the vegetation community. Cluster analysis quantified location similarities in the benthic invertebrate community.

Analyzed chemical endpoint data from surrogate species for human and wildlife receptors to quantify the relative uptake of metals from environmental media, following exposure via dermal or oral contact. Final analyses quantified the relative bioavailability of various treatments against a control. Additionally the sample design was evaluated with respect to the minimum detectable uptake.

Used a generalized linear model (with Poisson link function) and regression analyses to model dose-response relationships for response endpoints for mink. The endpoints evaluated were percent mortality and percent decline in fecundity. Calculated cumulative PCB dose probability curves and exceedance probabilities for percent decline in litter size.

Developed data assessment and quantification analysis to determine whether field collected fluorescence and dissolved oxygen measurements in the water column were associated with lab quantified benzene, ethylbenzene, toluene, xylene (BTEX) and polycyclic aromatic hydrocarbons (PAH) concentrations. Complications overcome included multiple instruments and data processing techniques. Designed the database and provided oversight for data compilation from multiple diverse sources encompassing three million sample records each with multiple measurements.

Calculated multiple benthic metrics (abundance, richness, diversity, and dominance) and assessed statistically significant differences between site stations and the reference area to support a weight-of-evidence approach to assessing biological effects, and to support the calculation of Apparent Effects Threshold values.

Compiled data from multiple studies of mercury in air and urine to assess common relationships using regression analysis. Adjustments of slopes and intercepts allowed for assessing similarity of sample design among studies. Confidence and prediction intervals were used to band the resulting relationships.

Developed regression analyses used to estimate concentration in worms from soil with confidence and prediction upper limits. Estimated worm concentrations were used in various scenarios for calculation of ecological risk to short-tailed shrew.

Used logistic regression to characterize the relationship between PAH concentration and average mortality of *Hyalella azteca*.

Analyzed mercury concentrations in homes using discriminant analysis to characterize and differentiate between different sources of mercury, including natural gas pressure regulators, thermometers, and other residential sources of mercury.

Evaluated temporal trends in landfill groundwater monitoring concentration data using summary statistics, boxplots, probability plots and distance weighted least squares regression. Standardized concentrations were used to equate the varying magnitude and variation of multiple chemicals.

Used regression analysis to evaluate the results of two analysis methods used to measure mercury concentration in sediment and soil. Results provided statistical support for using both methods, thereby increasing the quantity and precision of data used for site characterization.

Calculated the minimum number of samples necessary to meet statistical performance objectives of sampling plan in accordance with EPA guidance, including multiple levels of confidence, power, and minimum detectable differences.

Managed large environmental databases of chemistry, toxicity, and ecological data for multiple projects (Brunswick, Georgia; Saginaw River, Michigan; Onondaga Lake, New York; and Anaconda, Montana).

Professional Affiliations

- American Statistical Association

Deposition and Trial

Zina G. Bibb, et al. v. Monsanto Company, et al. Civil Action No. 04-C-465 in the Circuit Court of Putnam County, West Virginia. Testimony June 2011. Affidavits submitted in August and September 2011.