



Betsy Henry, Ph.D.
Senior Managing Scientist

Professional Profile

Dr. Elizabeth (Betsy) Henry is a Senior Managing Scientist in Exponent's Environmental Sciences practice. She has more than 20 years of experience in planning and execution of projects involving data collection, management, analysis, synthesis, interpretation, and presentation of complex environmental systems. In addition, she has provided scientific consultation on development of overall strategy and negotiation with state and federal agencies on contaminated sediment sites.

With a broad background in the transport and fate of contaminants in the environment, Dr. Henry's specialty is in the transport, fate, and bioaccumulation of mercury in both terrestrial and aquatic systems. She has focused on assessment of mercury cycling and bioaccumulation in fresh and estuarine waters, mercury biogeochemistry in wetlands, mercury volatilization from contaminated soils, development of preliminary remediation goals for mercury in sediment and fish tissue for protection of wildlife and humans that consume fish, management options to control methylmercury formation, and residual risk analysis, including assessment of future concentrations of mercury in water and fish following remediation. Her experience includes management of investigations, risk assessment, and agency negotiations at some of the most prominent mercury sites in the country. She has worked closely with engineers during remedial design to understand and address risks associated with mercury contamination. She has published papers in the peer-reviewed literature, presented frequently on issues associated with mercury-contaminated sites, and maintains professional contacts within the mercury research community, a necessity given rapid developments in field.

Academic Credentials and Professional Honors

Ph.D., Engineering Sciences, Harvard University, 1992

B.S., Agronomy, Colorado State University (*highest distinction*), 1985

Phi Beta Kappa (honor society for liberal arts and sciences)

Gamma Sigma Delta (honor society for agriculture)

Publications

Menzie CA, Ziccardi LM, Lowney YW, Fairbrother A, Shock SS, Tsuji JS, Hamai D, Proctor D, Henry E, Su SH, Kierski MW, McArdle ME, Yost LJ. Importance of considering the framework principles in risk assessment for metals. *Environ Sci Technol* 2009; 43:8478–8482.

Todorova SG, Driscoll CT, Matthews DA, Effler SW, Hines ME, Henry EA. Evidence for regulation of monomethyl mercury by nitrate in a seasonally stratified, eutrophic lake. *Environ Sci Technol* 2009; 43:6572–6578.

Futornick K, Bigham G, Henry B. Mercury—A west coast perspective. *The Water Report*, Issue 31, September 15, 2006.

Futornick K, Bigham G, Henry B. Mercury—Global problem, local solution. Part II: Mercury in Oregon, where is it and how is it regulated? *Oregon Insider*, Issue 398, August 15, 2006.

Futornick K, Bigham G, McAteer J, Henry B. Mercury in a water environment. *The Water Report*, Issue 30, August 15, 2006.

Futornick K, Bigham G, Henry B. Mercury—Global problem, local solution. Part I: Sources, properties and chemistry. *Oregon Insider*, Issue 397, August 1, 2006.

Bigham G, Henry B, Bessinger B. Mercury. pp. 1–17. In: *Environmental Forensics: Contaminant Specific Guide*. Morrison RD and Murphy BL (eds), Academic Press, 2006.

Bigham G, Henry B, Bessinger B. Mercury—A tale of two toxins. *Natural Resources & Environment* 2005; 19:26–30.

Henry EA, Dodge-Murphy LJ, Bigham GN, Klein SM. Modeling the transport and fate of mercury in an urban lake (Onondaga Lake, NY). *Water Air Soil Pollut* 1995; 80:489–498.

Henry EA, Dodge-Murphy LJ, Bigham GN, Klein SM, Gilmour CC. Total mercury and methylmercury mass balance in an alkaline, hypereutrophic urban lake (Onondaga Lake, NY). *Water Air Soil Pollut* 1995; 80:509–518.

Jacobs LA, Klein SM, Henry EA. Mercury cycling in the water column of a seasonally anoxic urban lake (Onondaga Lake, NY). *Water Air Soil Pollut* 1995; 80:553–562.

Henry EA, Devereux R, Maki JS, Gilmour CC, Woese CR, Mandelco L, Schauder R, Rensen CC, Mitchell R. Characterization of a new thermophilic sulfate-reducing bacterium, *Thermodesulfobacterium yellowstonii* gen. nov. and sp. nov.: Its phylogenetic relationship to *Thermodesulfobacterium commune* and their origins deep within the bacterial domain. *Arch Microbiol* 1994; 161:62–69.

Gilmour CC, Henry EA, Mitchell R. Sulfate stimulation of mercury methylation in freshwater sediments. *Environ Sci Technol* 1992; 26:2281–2287.

Gilmour CC, Henry EA. Mercury methylation in aquatic systems affected by acid deposition. *Environ Pollut* 1991; 71:131–169.

Published Abstracts

Ghosh U, Kwon S, Gilmour C, Reidel G, Henry B, Menzie C, Brown S, Landis R. Remediation of Hg-contaminated sediments with activated carbon. 10th International Conference on Mercury as a Global Pollutant, Abstract TS16-O7, Halifax, Nova Scotia, July 24–29, 2011 (in press).

Henry B, Glaza E, Babcock D, Driscoll C, Todorova S, Effler S, Matthews D. Assessment of nitrate addition for control of methylmercury concentrations in Onondaga Lake. 10th International Conference on Mercury as a Global Pollutant, Abstract TG5-O4, Halifax, Nova Scotia, July 24–29, 2011 (in press).

Babcock D, Nolan J, Roth P, Kuhr K, Henry B, Matthews D. Deployment of soluble nitrate to minimize methylmercury release from anoxic lake sediment. Proceedings, 6th International Conference on Remediation of Contaminated Sediments, Abstract C-07, New Orleans, LA, February 7–10, 2011.

Glaser D, Henry B, Kelsall N, Murphy M, Brown S. Preliminary evaluation of mercury bioavailability in Berry's Creek, NJ. Proceedings, 6th International Conference on Remediation of Contaminated Sediments, Abstract A-30, New Orleans, LA, February 7–10, 2011.

Henry B, Gilmour C, Ghosh U, Kwon S, Menzie C, Brown S. Evaluation of sorbent amendments to mitigate methylmercury production and bioaccumulation in Berry's Creek, New Jersey. Proceedings, 6th International Conference on Remediation of Contaminated Sediments, Abstract C-15, New Orleans, LA, February 7–10, 2011.

Henry B, Murphy M, Reidy D, Glaser D, Todorova S, Driscoll C, Matthews D, Effler S. Decrease in mercury concentration in Onondaga Lake biota in recent years. Proceedings, 6th International Conference on Remediation of Contaminated Sediments, Abstract D-20, New Orleans, LA, February 7–10, 2011.

Babcock B, Henry B, Stivers C. Implementation of monitored natural recovery for Onondaga Lake. Proceedings, 5th International Conference on Remediation of Contaminated Sediments, Abstract J-33, Jacksonville, FL, February 2–5, 2009.

Henry B, Glaza E, Driscoll C, Effler S, Mathews D. Assessment of nitrate addition and oxygenation for control of methylmercury production in Onondaga Lake. Proceedings, 5th International Conference on Remediation of Contaminated Sediments, Abstract J-43, Jacksonville, FL, February 2–5, 2009.

Henry B, Becker S, Glaza E, Long E. Use of mean PEC quotients to prioritize sediment remediation in Onondaga Lake, NY. Proceedings, 4th International Conference on Remediation of Contaminated Sediments, Abstract A-013, Savannah, GA, January 22–25, 2007.

Stivers C, Henry B, Patmont C, Glaza E. Natural recovery assessment in Onondaga Lake profundal sediments. Proceedings, 4th International Conference on Remediation of Contaminated Sediments, Abstract A-024, Savannah, GA, January 22–25, 2007.

Henry B, Bigham G. Measurement of mercury concentrations in marsh drainages over a tidal cycle. 2007. Eos Trans. AGU, 88(52), Fall Meet. Suppl., Abstract B11B-0401.

Henry B, Bigham G. Overview of remediation decisions at mercury-contaminated sites. Proceedings, 8th International Conference on Mercury as a Global Pollutant, Abstract S-363. Madison, WI, 2006.

Henry B, Bigham G. Global perspective on mercury in the environment. Proceedings, 16th Annual International Conference on Contaminated Soils, Sediment & Water, University of Massachusetts, Amherst, MA, 2000.

Henry EA, Hansen L, Kuhnel V, Bland JA. Measurement of mercury flux across the soil surface to determine soil cleanup level for mercury. Proceedings, 15th Annual International Conference on Contaminated Soil and Water, Abstract No. 26, p. 151, University of Massachusetts, Amherst, MA, 1999.

Henry EA, Hansen L, Solc J, Kuhnel V, Bland JA. Field and laboratory measurement of mercury flux across the soil surface. Proceedings, 20th Annual Meeting of the Society of Environmental Toxicology and Chemistry, Abstract No. 333, p. 71, Philadelphia, PA, 1999.

Bigham GN, Henry EA, Dodge-Murphy LJ. Evaluation of various remediation options for Onondaga Lake. p. 156. In: Book of Abstracts of the Fourth International Conference on Mercury as a Global Pollutant, Congress Centre Hamburg, Germany, August 4–8, 1996. GKSS-Forschungszentrum Geesthacht, Germany and Oak Ridge National Laboratory, Oak Ridge, TN, 1996.

Henry EA, Dodge-Murphy LJ, Driscoll CT, Wang W. Evaluation of total mercury loading to Onondaga Lake via tributaries. p. 295. In: Book of Abstracts of the 4th International Conference on Mercury as a Global Pollutant. Congress Centre Hamburg, Germany, August 4–8, 1996. GKSS-Forschungszentrum Geesthacht, Germany and Oak Ridge National Laboratory, Oak Ridge, TN, 1996.

Henry EA, Jacobs LA, Klein SM, Bigham GN. Bulk sediment vs. pore water concentrations of total and methylmercury in an urban lake. Proceedings, 14th Annual Meeting of the Society of Environmental Toxicology and Chemistry, Abstract No. P785, p. 312, Houston, TX, 1993.

Bigham GN, Henry EA. Mercury in sediments—How clean is clean. Proceedings, Arsenic and Mercury—Workshop on Removal Recovery, Treatment, and Disposal, Alexandria, VA, August 17–20, 1992.

Gilmour CC, Henry EA. Why do sulfate-reducing bacteria methylate Hg?: Studies on SRB and Hg in pure culture 1. Methylation as a resistance mechanism. In: Abstracts of the International Conference on Mercury as a Global Pollutant, Monterey, CA, May 31–June 4, 1992.

Henry EA, Gilmour CC. Why do sulfate-reducing bacteria methylate Hg?: Studies on SRB and Hg in pure culture 2. Accumulation of Hg. In: Abstracts of the International Conference on Mercury as a Global Pollutant, Monterey, CA, May 31–June 4, 1992.

Henry EA, Gilmour CC, Mitchell R. Mercury resistance and transport in sulfate-reducing bacteria. In: Abstracts of the 91st General Meeting of the American Society for Microbiology, Abstract No. Q262, p. 320, Dallas, TX, 1991.

Project Experience

Provided technical support on mercury issues for the Berry's Creek Study Area, including methylation, bioaccumulation, risk, and *in situ* remedial approaches to control bioavailability.

Developed baseline and long-term monitoring program for the Ninemile Creek remedial design.

Served as guest editor for a special issue of *Ecological Applications* dedicated to research on mercury transport, fate, and bioaccumulation in Clear Lake, California.

Managed the supplemental field investigation, baseline ecological risk assessment, and feasibility study for the marsh portion (OU-3) of the Horseshoe Road Superfund Site in Sayreville, New Jersey. Investigation included measurements of contaminants in sediment and biota, as well as sediment toxicity/bioaccumulation tests to provide site-specific data for ecological risk assessment. Key contaminants included arsenic, mercury, and PCBs.

Managed investigation by Upstate Freshwater Institute and Syracuse University to study relationship between nutrient cycling and methylmercury formation in Onondaga Lake, New York. The study has implications for management options to control methylmercury formation in Onondaga Lake.

Managed issues of baseline monitoring, monitored natural recovery, and mercury cycling for the Onondaga Lake remedial design.

Provided technical support for the Onondaga Lake feasibility study, including 1) development of preliminary remediation goals for mercury in sediment and fish tissue for protection of wildlife and humans that consume fish, and 2) residual risk analysis, including assessment of future concentrations of mercury in water and fish following remediation. By involvement throughout the 13-year RI/FS process, provided historical and technical perspective as well as continuity in negotiating with state agency.

Managed the supplemental field investigation for the remedial investigation of Onondaga Lake, New York. The remedial investigation included a thorough analysis of mercury cycling in the lake based on mercury data in tributary and lake surface water, sediment, and sediment pore water.

Managed development of a mercury cycling and bioaccumulation model for Onondaga Lake, New York. The model was developed to identify and quantify the major processes controlling mercury behavior and to evaluate the effectiveness of various remedial alternatives. Key processes and quantities were characterized using specialized field and laboratory studies and based on literature reviews.

Provided technical support for the Geddes Brook/Ninemile Creek feasibility study, including development of preliminary remediation goals for mercury in sediment and fish tissue for protection of wildlife and humans that consume fish. Managed focused sediment toxicity investigation to identify site-specific threshold for mercury toxicity in Ninemile Creek.

Managed the remedial investigation and risk assessments for Geddes Brook/Ninemile Creek, New York. Evaluated the transport of mercury and other contaminants from a former mercury cell chlor-alkali plant site to Onondaga Lake, New York.

Managed a screening-level risk assessment for soil and groundwater at a former mercury cell chlor-alkali facility, LCP OU-2, in Solway, New York.

Managed the remedial investigation and risk assessments for the Ventron/Velsicol Superfund site in New Jersey (a landfill associated with a former mercury processing facility), where the primary contaminant is mercury in soil and groundwater. Also prepared a candidate technologies memorandum and review of mercury treatment technologies for the feasibility study.

Provided ongoing technical support for the Berry's Creek Study Area remedial investigation. Reviewed and commented on EPA's framework document for the remedial investigation and feasibility study of Berry's Creek in the Hackensack Meadowlands, New Jersey.

Managed a RCRA facility investigation of terrestrial areas and watershed adjacent to a mercury retorting facility in upstate New York. The project included soil, sediment, water, and biota sampling, as well as habitat quality assessment.

Designed and implemented a study to assess the inhalation risk potential for a proposed soil cleanup level for mercury at a former mercury retorting facility. The study involved field and laboratory measurements of mercury volatilization from soil and evaluation of volatilization models.

Wrote a review of mercury cycling and bioaccumulation in fresh and estuarine waters prepared to help guide future investigations for Alcoa. Summarized current and emerging regulatory status of mercury in sediment. Assisted in review of techniques and case studies of remediation of mercury-contaminated sediment.

Wrote a review of mercury chemistry, fate, toxicity, and wastewater treatment options for the American Petroleum Institute.

Provided deposition testimony on the effect of eutrophication on mercury bioaccumulation. Prepared expert report that included a literature summary and an evaluation of field data on the relationship between phosphorus concentration and methylmercury concentration. Assisted in developing deposition questions.

Participated in an expert panel for Alcoa to review data from an ongoing investigation of mercury-contaminated sediments at Lavaca Bay, Texas.

Participated in expert peer review of the Wastebed Leachate Minimization Program in Solvay, New York.

Participated in an expert workshop on the state of mercury modeling, sponsored by Dupont and the University of Delaware.

Presented talk on risk assessment issues related to mercury at a special workshop on Mercury Management in the Hudson Delaware Region sponsored by the Hudson-Delaware section of SETAC.

Chaired special session on the Bases for Remediation Decisions at Mercury-Contaminated Sites at the 8th International Conference on Mercury as a Global Pollutant, Madison, Wisconsin.

Chaired special session on Mercury in Contaminated Soils, Sediment, and Water at the 16th Annual International Conference on Contaminated Soils, Sediment & Water, Amherst, Massachusetts.

Participated in a field study of Quabbin Reservoir, Massachusetts, to investigate the stimulation of mercury methylation by acid deposition.

Investigated mercury geochemistry in aquatic systems using a thermodynamic equilibrium model. The objective of the work was to determine the probable mercury speciation and mineral solubility over a range of geochemical conditions using a geochemical computer code.

Optimized the toxicity characteristic leaching procedure, an EPA method used to assess leachability of waste.

Researched the role of sulfate-reducing bacteria in environmental mercury methylation while at Harvard University.

Professional Affiliations

- American Chemical Society

Testimony

Sugar Cane Growers v. South Florida Water Management District. No. 92-3038-3040.