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# Patrick Sheehan, Ph.D.
**Principal**

## Professional Profile

Dr. Patrick Sheehan is a toxicologist, ecologist, and risk assessor with more than 30 years experience conducting human health and ecological risk assessments. Dr. Sheehan has been recognized as an expert in exposure and risk assessment. He has managed and conducted human health and ecological risk assessments at contaminated sites, industrial and commercial facilities and for consumer products, evaluating chemicals released to air, surface water, groundwater, soils, hands, and food items. He specialized in assessing and quantifying potential historical, current or future exposures to chemicals in the environment, workplace and home, and associated health risks. He has designed and directed studies to simulate and reconstruct historical exposures in occupational and residential settings to benzene and other volatile chemicals in solvents, asbestos in adhesives and roofing products and lead in various consumer products. He has also evaluated potential future chemical exposures associated with new facilities or combustion sources and new products. Dr. Sheehan has also designed and directed wildlife population assessments, aquatic toxicity tests, toxicity identification evaluations, risk allocation evaluations, human and probabilistic uncertainty analyses. Dr. Sheehan frequently interacts with local, state, and federal regulatory agencies and has testified as an expert before government panels and in legal proceedings on toxicology, exposure and human health and wildlife risks.

## Academic Credentials and Professional Honors

Ph.D., Toxicology/Ecology, University of California, Davis, 1980
M.S., Ecology, University of California, Davis, 1975
B.S., Mechanical Engineering, University of Santa Clara, 1968

**Publications**

Sheehan P, Mowat F, Weidling R, Floyd M. Simulation test to assess occupational exposure to airborne asbestos from artificially weathered asphalt-based roofing products. Ann Occup Hyg 2010; 54:880–892.

Sheehan P, Bogen K, Hicks J, Goswami E, Brorby G, Lau E. Benzene inhalation by parts washers: New estimates based on measures of occupational exposure to solvent coaromatics. Risk Anal 2010; 30(8):1249–1267.

Richter RO, Finley BL, Paustenbach DJ, Williams PDR, Sheehan PJ. An evaluation of short-term exposures of brake mechanics to asbestos during automotive and truck brake cleaning and machining activities. J Exp Sci Environ Epidemiol 2009; 19:458-474.

Martin R, Malzahn D, Hicks J, Sheehan P. Energy-saving thermal insulation—Industrial hygiene and occupational health considerations. Indust Heating 2008; 75:54-57.

Brorby GP, Sheehan PJ, Berman DW, Greene JF, Holm SE. Re-creation of historical chrysotile-containing joint compounds. Inhalation Toxicol 2008; 20:1043–1053.

Sheehan P, Malzahn D, Goswami E, Mandel JH. Simulation of benzene exposure during use of a mineral spirits solvent to clean elevator bearing housings. Hum Ecol Risk Assess 2008; 14(2):421–432.

Finley BL, Richter RO, Mowat FS, Mlynarek S, Paustenbach DJ, Warmerdam JL, Sheehan PJ. Cumulative asbestos exposure for U.S. automobile mechanics involved in brake repair (circa 1950s–2000). J Exp Sci Environ Epidemiol 2007; 17:644-655.

Mowat F, Weidling R, Sheehan P. Simulation tests to assess occupational exposure to airborne asbestos from asphalt-based roofing products. Ann Occup Hyg 2007; 51(5):451–462.

Sheehan PJ, Warmerdam JM, Ogle S, Humphrey DN, Patenaude SM. Evaluating the risk to aquatic ecosystems posed by leachate from tire shred fill in roads using toxicity tests, toxicity identification evaluations, and groundwater modeling. Environ Toxicol Chem 2006; 25(2):400–411.

Williams PRD, Benton L, Sheehan P. The risk of MTBE relative to other VOCs in public drinking water in California. Risk Anal 2004; 24(3):621-634.

Paustenbach D, Lu E, Finley B, Brorby G, Sheehan P. Environmental and occupational health hazards associated with the presence of asbestos in brake linings and pads (1900 to present): A state-of-the-art review. J Toxicol Environ Health, Part B, 2003; 7:33–110.

Paustenbach D, Richter R, Finley B, Sheehan P. An evaluation of the historical exposures of mechanics to asbestos in brake dust. Appl Occ Environ Hyg 2003; 18:786–804.

Tsuji J, Williams P, Edwards M, Allamneni K, Kelsh M, Paustenbach D, Sheehan P. Evaluation of mercury in urine as an indicator of exposure to low levels of mercury vapors. Environ Health Perspect 2003; 111(4):623630.

Williams P, Cushing C, Sheehan P. Data available for evaluating the risks and benefits of MTBE and ethanol as alternative fuel oxygenates. Risk Anal2003; 23(5):1085−1115.

Williams P, Benton L. Sheehan P. MTBE in California's drinking water: A comparison of groundwater versus surface water sources. Environ Foren 2003; 4:175−189.

Williams P, Benton L, Warmerdam J, Sheehan P. Comparative risk analysis of six volatile organic compounds in California drinking water. Environ Sci Technol 2002; 36:4721−4728.

Williams PRD, Sheehan PJ. Overview of MTBE and TBA exposures and human health risks in the U.S. Contam Soil Sed Water, 2002; July/August 93−103.

Williams PRD, Sheehan PJ. A better perspective on the incidence and implications of MTBE in California's drinking water. Contam Soil SedWater, MTBE special issue 2001; 23-27.

Williams PRD, Scott PK, Sheehan PJ, Paustenbach DJ. A probabilistic assessment of household exposures to MTBE from drinking water. Hum Ecol Risk Assess 2000; (5):827−849.

Fuchsman PC, Barber TR, Sheehan PJ. Sediment toxicity evaluation: Spiked sediments tests with *Leptocheirus plumulosus*, *Hyalella azteca*, and *Chironomus tentans*. Arch Environ Toxicol Chem 1998; 35:573−579.

Iannuzzi TJ, Bonnevie NL, Huntley SL, Wenning RJ, Truchon SP, Tull JD, Sheehan PJ. Comments on the use of equilibrium partitioning to establish sediment quality criteria for nonionic chemicals. Environ Toxicol Chem 1995; 14(8):1257−1259.

Sheehan PJ, Loucks DL. Effects characterization. In: Ecological Risk Assessment Issue Papers. EPA 6301 R-94-009. U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC, 1994.

Falerios M, Sheehan PJ, Schild K, Paustenbach DJ. Airborne concentrations of total and hexavalent chromium from contaminated soils at unpaved and partially paved commercial/industrial sites. Air Waste Manage Assoc J 1992; 42(1):40−48.

Paustenbach DJ, Sheehan PJ, Paull JM, Wisser LM, Finley BL. Review of the allergic contact dermatitis hazard posed by chromium contaminated soil: Identifying a "safe" concentration. J Toxicol Environ Health 1992; 37:177−207.

Paustenbach DJ, Meyer D, Sheehan PJ, Lau V. An assessment and quantitative uncertainty analysis of the health risks to workers exposed to chromium contaminated soils. Toxicol Ind Health 1991; 7(3):159−196.

Paustenbach DJ, Rinehart WE, Sheehan PJ. The health hazards posed by chromium contaminated soils in residential and industrial areas: Conclusions of an expert panel. Regulat Toxicol Pharmacol 1991; 13:195–222.

Sheehan P, Meyer D, Sauer M, Paustenbach D. Assessment of the human health risks posed by exposure to chromium contaminated soils at residential sites. J. Toxicol Environ Health 1991; 32(2):161–201.

Sheehan P, Ricks R, Ripple S, Paustenbach D. Field evaluation of a sampling and analytic method for airborne hexavalent chromium. Am Ind Hyg Assoc J 1991; 53(1):57–68.

Sheehan PJ. Statistical and non-statistical considerations in quantifying pollutant induced changes in microcosms. pp. 178–188. In: Aquatic Toxicology and Hazard Assessment, 12th Volume. ASTM STP 1027, American Society of Testing and Materials, Philadelphia, PA, 1989.

Mineau P, Sheehan PJ, Baril A. Pesticides and waterfowl on the Canadian prairies: A pressing need for research and monitoring. ICBP Technical Publication No. 6, 1987.

Sheehan PJ, Baril A, Mineau P, Smith DK, Harfenist A, Marshall WK. The impact of pesticides on the ecology of prairie nesting ducks. Technical Report Series No. 19. Canadian Wildlife Service, 1987.

Grue CE, DeWeese LR, Mineau P, Swanson GA, Foster JR, Arnold PM, Huckins JN, Sheehan PJ, Marshall WK, Ludden AP. Potential impacts of agricultural chemicals on waterfowl and other wildlife inhabiting prairie wetlands: An evaluation of research needs and approaches. In: Trans. 51st N.A. Wildlife and National Research Conference, Wildlife Institute, Washington, DC, 1986.

Sheehan PJ, Axler RP, Newhook RC. Evaluation of simple generic aquatic ecosystem tests to screen the ecological impacts of pesticides. pp. 158–179. In: Community Toxicity Testing. ASTM STP 920, American Society of Testing and Materials, Philadelphia, PA, 1986.

Sheehan PJ, Knight AW. A multi-level approach to the assessment of ecotoxicological effects in a heavy metal polluted stream. Verh Internat Verein Limnol 1985; 22:2364–2370.

Shaw GG, Smith DK, Sheehan PJ, Mineau P. Environmental concerns. Proceedings, Symposium on the Future Role of Aviation in Agriculture. Associate Committee on Agricultural and Forestry Aviation, National Research Council Canada, pp. 47–63, 1984.

Geyer H, Sheehan PJ, Kotzias, Freitag D, Korte F. Prediction of ecotoxicological behavior of chemicals: Relationship between physico-chemical properties and bioaccumulation of organic chemicals in the mussel, *Mytilus edulis*. Chemosphere 1982; 11(11):1121–1134.

Siegfried CA, Sheehan PJ, Knight AW. The adults of *Oroperla barbara* (Needham). Pan Pac Entomol 1977; 53:125–128.

**Books Edited**

Sheehan PJ, Klein W, Bourdeau P, Forte F (eds). Appraisal of Tests to Predict the Environmental Behavior of Chemicals. SCOPE 25. John Wiley & Sons, New York, NY, 1985.

Sheehan PJ, Miller DR, Butler GC, Bordeau P (eds). Effects of Pollutants at the Ecosystem Level. SCOPE 22. John Wiley & Sons, New York, NY, 1984.

Vouk VB, Sheehan PJ (eds). Methods of Assessing the Effects of Chemicals on Reproductive Functions. SCOPE 20. John Wiley & Sons, New York, NY, 1983.

**Book Chapters**

Richter RO, Sheehan PJ. Modeling of health risks associated with combustion emissions. In: Air Quality Modeling- Theories, Methodologies, Computational Techniques, and Available Databases and Software. Zannetti P (ed), The EnviroComp Institute and Air and Waste Management Association, Pittsburgh, PA, 2005.

Sheehan PJ, Warmerdam J, Feng SS. Using probabilistic risk assessment methods to predict the effects of pesticides on aquatic systems and waterfowl that use them. In: Health Risk Assessment. Paustenbach DJ (ed), John Wiley & Sons, Inc., New York, NY, 2002.

Sheehan PJ, Dombrowski F, Ungs M, Harmen C. Ecological risk assessment for hazardous waste incineration: Case study. In: Hazardous Waste Incineration: Evaluating the Human Health and Environmental Risks. Roberts SM (ed), Lewis Publishers, Inc., Boca Raton, FL, 1998.

Sheehan PJ. Methods for the assessment of effects of chemicals on ecological systems at a regional scale. In: Methods to Assess the Effects of Chemicals on Ecosystems. SCOPE 53. IPCS Joint Activity 23, SGOMSEC10. Linthurst RA, Bourdeau P, Tardiff RG (eds), John Wiley & Sons, Chichester, UK, 1995.

Sheehan PJ, Baril A, Mineau P, Paustenbach DJ. Predicting the effects of insecticides on aquatic organisms and the waterfowl that use them: An ecotoxicological risk assessment. pp. 827–857. In: Fundamentals of Aquatic Toxicology. Rand G (ed), Taylor and Francis, Washington, DC, 1995.

Sheehan PJ. Ecotoxicological considerations. In: Fundamentals of the Management of Toxic Chemicals. George Allen Unwin, London, 1991.

Sheehan PJ. Functional processes of ecosystems: Their use in assessing the effects of mixtures of chemicals. pp. 691–707. In: Methods for Assessing the Toxicology of Mixtures of Chemicals. SCOPE 30. John Wiley & Sons, New York, NY, 1986.

Korte F, Sheehan PJ, Klein W. The need for appraisal of environmental testing methods. pp. 1–11. In: Appraisal of Tests to Predict the Environmental Behavior of Chemicals. SCOPE 25. John Wiley & Sons, New York, NY, 1985.

Peakall DB, Calamari D, Crose H, Hackaber JW, Kozlowski TT, Lander V, Moustafa L, Sheehan P, Tucker RK, and Waldichuk M. Approaches to measuring chemical injury to non-human biota and ecosystems. pp. 85–106. In: Methods for Estimating Risk of Chemical Injury: Human and Non-Human Biota and Ecosystems. SCOPE 26. John Wiley & Sons, New York, NY, 1985.

Sheehan PJ. Effects on community and ecosystem structure and dynamics. pp. 51–100. In: Effects of Pollutants at the Ecosystem Level. SCOPE 22. John Wiley & Sons, New York, NY, 1984.

Sheehan PJ. Effects on individuals and populations. pp. 23–50. In: Effects of Pollutants at the Ecosystem Level. SCOPE 22. John Wiley & Sons, New York, NY, 1984.

Sheehan PJ. Functional changes in the ecosystem. pp. 101–145. In: Effects of Pollutants at the Ecosystem Level. SCOPE 22. John Wiley & Sons, New York, NY, 1984.

Sheehan PJ, Winner RW. Copper gradient studies in stream systems. pp. 255–271. In: Effects of Pollutants at the Ecosystem Level. SCOPE 22. John Wiley & Sons, New York, NY, 1984.

**Published Abstracts**

Sheehan PJ, Mathur D, Dodge D, Paustenbach DJ. Background risks associated with exposure to n-nitrosodimethyamine (NDMA): Is something amiss in the regulation of this chemical? Abstract 75.02. Final Program and Abstracts. Society for Risk Analysis Annual Meeting and Exposition, 1988.

Schneiter RW, Sheehan PJ, Nosil AW. Dynamic flow-through bioassay for demonstrating suitability of direct discharge of contaminated groundwater to a POTW. Proceedings, Hazmacon ‘87. Association of Bay Area Governments, Oakland, CA, 1987.

**Reports**

Mittelman A, Sheehan PJ. Issues: Ecosystem stability and recovery report. Technical Resources Inc., Rockville, MD, 1987.

Sheehan PJ, Baril A, Mineau P, Marshall WK. Impacts of pesticide on waterfowl in the Canadian prairies. National Wildlife Research Center Report. Environment Canada, Hull, Quebec, 1985.

Sheehan PJ, Knight AW. The benthic macroinvertebrate monitoring program for Dow Chemical outfalls to New York Slough and Kirker Creek, Contra Costa, California. Water Science and Engineering Papers. University of California, Davis, CA, 1980.

Sheehan PJ, Siegfried CA, Knight AW. The macroinvertebrate fauna of two streams of the Sierra Nevada eastern slope. Water Science and Engineering Paper No. 4520. University of California, Davis, CA, 1978.

**Presentations**

Brorby G, Boelter F, Jones R, Simmons C, Berman W, Sheehan P. Spiraling consequences of poor data quality. Professional Conference of Industrial Hygienists 2010, Fort Worth, TX, October 9–12, 2010.

Sheehan P, Bogen K, Brorby G, Goswami E. Improved estimates of worker exposure to benzene during parts washing based on a new approach analyzing solvent and air data for other aromatic constituents. Presented at the American Industrial Hygiene Conference and Expo, Denver, CO May 22–27, 2010.

Brorby GP, Sheehan PJ, Berman DW, Holm SE. Re-interpreting historical exposure data associated with the use of chrysotile-containing joint compound. Society of Toxicology 2010 Annual Meeting, Salt Lake City, UT, March 7–11, 2010.

Sheehan p, Dahlstrom D. Green building: Finding a better way to assure indoor air quality. Presented at the American Industrial Hygiene Conference and Expo, Denver, CO May 22–27, 2010.

Sheehan P, Bogen K, Brorby G, Goswami E. Worker inhalation exposure to benzene from solvents during parts washing. Society for Risk Analysis 2009 Annual Meeting, Baltimore, MD, December 6–9, 2009.

Sheehan P, Goswami E, Hicks J, Barrie M. An assessment of historical benzene exposures of printing press operators. Presented at the American Industrial Hygiene Conference and Expo, Minneapolis, MN, May 31–June 5, 2008.

Brorby G, Kalmes R, Goswami E, Mowat F, Sheehan P. Evaluating exposures to consumer products. Presented at the Society for Risk Analysis, Baltimore, MD, December 3–6, 2006.

Sheehan P, Malzahn D, Goswami E, Kalmes R, Hicks J, Mandel J. Use of a simulation to estimate benzene exposure from degreasing elevator parts. Presented at the Society for Risk Analysis Meeting, Baltimore, MD, December 3–6, 2006.

Goswami E, Malzahn D, Richter R, Sheehan P. Simulation and modeling techniques to reconstruct historical benzene exposures. Presented at the Society for Risk Analysis Meeting, Baltimore, MD, December 3–6, 2002.

Sheehan P, Mowat F, Weidling R. Simulation of asbestos release from asphalt-based roofing products. Presented at the American Industrial Hygiene Conference and Expo, Chicago, IL, May 13–18, 2006.

Sheehan P, Hicks J, Goswami E, Lau E, Greene J, Fedoruk MJ. Assessment of mechanics' exposure to benzene in mineral spirit solvents during parts washing activities. Presented at the American Industrial Hygiene Conference and Expo, Chicago, IL, May 13–18, 2006.

Mowat FS, Sheehan PJ. Estimating asbestos exposures from historical products: Issues related to industrial hygiene and toxicology. Presented at the Andrews Asbestos Litigation Conference, San Antonio, TX, April 26–27, 2006.

Goswami E, Greene J, Sheehan P, Hicks J. Analysis of exposure to benzene in mineral spirit solvents during parts washing and degreasing operations. Presented at the Society of Toxicology Meeting, San Diego, CA, March 5–9, 2006.

Richter RO, Sheehan PJ, Bouse E. Potential environmental impact of mercury emissions from Portland cement kilns. Presented at the 2005 IEEE Cement Industry Technical Conference, Kansas City, MO, 2005.

Sheehan P, Brorby G, Kalmes R, Mowat F, Richter R, Finley B. Characterization of the cumulative asbestos exposures of U.S. automobile brake mechanics. Presented at the American Industrial Hygiene Conference and Expo, Anaheim, CA, May 23–26, 2005.

Finley B, Mowat F, Richter R, Brorby G, Craven B, Sheehan P. Evaluation of proposed threshold doses for chrysotile exposure and respiratory disease. Presented at the Society of Toxicology 2005 Annual Meeting, New Orleans, LA, March 6–10, 2005.

Finley B, Richter R, Mowat F, Mlynarek S, Paustenbach D, Warmerdam J, Sheehan P. Cumulative occupational asbestos exposures of U.S. brake repair mechanics. Presented at the Society for Risk Analysis 2004 Annual Meeting, Palm Springs, CA, December 5–8, 2004.

Paustenbach D, Richter R, Finley B, Williams P, Sheehan P. Evaluating asbestos exposure with vehicle brake cleaning and machining activities using short-term and TWA measurements. Presented at the Society for Risk Analysis 2004 Annual Meeting, Palm Springs, CA, December 5–8, 2004.

Sheehan P, Warmerdam J, Humphrey D, Patenaude S. Aquatic toxicity testing: Assessing the safe use of scrap tires as roadbed fill. Presented at the Fourth Society of Environmental Toxicology and Chemistry World Congress, Portland, OR, November 14–18, 2004.

Sheehan P. Environmental and occupational health hazards associated with the presence of asbestos in brake linings and pads (1900 to present): A state of the art review. Presented at the SAE Brake Colloquium and Exhibition, Detroit, MI, March 7–10, 2004.

Yost L, Greene J, Hays S, Kelsh M, Li A, Sheehan P. Derivation of a range of interim inhalation slope factors for TCE using physiologically based pharmacokinetic modeling. Presented at the Society of Toxicology 43rd Annual Meeting, Baltimore, MD, March 2004.

Williams P, Cushing C, Sheehan P. Evaluating the risks and benefits of MTBE and ethanol as alternative fuel oxygenates. Presented at the Society for Risk Analysis 23rd Annual Meeting, Baltimore, MD, December 7–10, 2003.

Richter R, Paustenbach D, Sheehan P. An evaluation of historical exposures of mechanics to asbestos from brake repair. Presented at the Society for Risk Analysis 23rd Annual Meeting, Baltimore, MD, December 7–10, 2003.

Paustenbach D, Williams P, Brorby G, Sheehan P. Residential exposures to elemental mercury due to releases from gas pressure regulators. Presentation at the Society for Risk Analysis 23rd Annual Meeting, Baltimore, MD, December 7–10, 2003.

Williams P, Benton L, Sheehan P. The risks of MTBE relative to other VOCs in public drinking in California. Presentation at the Society for Risk Analysis 23rd Annual Meeting, Baltimore, MD, December 7–10, 2003.

Finley B, Lu E, Brorby G, Sheehan P. Environmental and occupational hazards associated with the presence of asbestos in brake linings and pads (1900 to present): A "state-of-the-art" review. Presented at the SAE Brake Colloquium & Exhibition, Hollywood, FL, October 19–22, 2003.

Sheehan P, Williams P. Relative risks to consumers posed by MTBE and other VOCs in California's drinking water. Presented at the 13th Annual West Coast Conference on Contaminated Soils, Sediments and Water, San Diego, CA, March 17–20, 2003.

Williams P, Sheehan P. Human health and ecological risks of MTBE. . Presented at the 13th Annual West Coast Conference on Contaminated Soils, Sediments and Water, San Diego, CA, March 17–20, 2003.

Sheehan P, Warmerdam J. Assessing the effects of leachate from tire shreds used as roadbed fill on aquatic organisms. Presentation at the Society of Environmental Toxicology and Chemistry 23rd Annual Meeting, Salt Lake City, UT, November 16–20, 2002.

Sheehan P, Williams P. MTBE: Is it really a concern for drinking water in the United States? Presentation at the Hart World Fuels Conference Asia, Singapore, August 26–27, 2002.

Williams PRD, Sheehan PJ, Paustenbach DJ. A probabilistic assessment of household exposures to MTBE in California drinking water. Presentation at the Society of Toxicology Annual Conference, San Francisco, CA, March 25–29, 2001.

Sheehan PJ, Williams PRD. Risk assessment considerations for MTBE. Air Waste Management Association Winter Conference, Dallas, TX, February 12–13, 2001.

Sheehan PJ, Williams PRD, Paustenbach DJ. MTBE in California drinking water: A probabilistic assessment of exposures. Presentation at the International Society of Exposure Analysis Annual Conference, Monterey, CA, October 24–27, 2000.

Williams PRD, Sheehan PJ, Paustenbach DJ. MTBE ambient air and drinking water exposures in California. Presentation at the International Society of Exposure Analysis Annual Conference, Monterey, CA, October 24–27, 2000.

Sheehan PJ, Warmerdam JM. A probabilistic approach to estimating the indirect risks of pesticide spraying on ducklings. Presented at SETAC 20th Annual Meeting, Philadelphia, PA, November 1999.

Bernhardt T, Madl A, Exuzides A, Sheehan P. Chemical fingerprinting for litigation support: A case study of effective environmental forensics. Presented at Annual Meeting Society for Risk Analysis, Atlanta, GA, December 1999.

Sheehan P, Beach J, Dodge D. Ecological risk assessment for addressing litigation issues. Presented at SETAC 19th Annual Meeting, Charlotte, NC, 1998.

Sheehan PJ, Wenning RJ, Wright BD, Becklin DM. A prospective risk assessment of the potential ecological effects of removal of a dam on the Rogue River. Presented at SETAC 19th Annual Meeting, Charlotte, NC, 1998.

Sheehan PJ, Wenning RJ, Wright BD, King NM, Paustenbach DJ, Becklin DM. Assessing the ecological risks of dam removal. Presentation at the Society for Risk Analysis Annual Meeting and Exposition, 1998.

Alsop WR, Vishwanath GR, Sheehan PJ. Probabilistic methods to estimate potential exposures of endangered species. Presented at Annual Meeting Society for Risk Analysis, Washington, DC, 1997.

Alsop WR, Vishwanath GR, Sheehan PJ. Probabilistic methods to estimate potential exposures of endangered species to emissions associated with proposed incinerators. Presented at SETAC 18$^{th}$ Annual Meeting, San Francisco, CA, 1997.

Alsop WR, Beach JF, Sheehan PJ. Probabilistic methods to develop toxicity reference values for ecological effects assessments. Presented at SETAC 18th Annual Meeting, San Francisco, CA, 1997.

Fuchsman P, Barber T, Sheehan P, Newton F. Spiked sediment toxicity testing with hydrophobic organics: Review and hexachlorobenzene case study. Presented at SETAC 18th Annual Meeting, San Francisco, CA, 1997.

Sheehan P, Alsop B, Wenning R. Taking ecological risk assessment to the next level. Presented at Annual Meeting Society for Risk Analysis, Washington, DC, 1997.

Sheehan PJ, Alsop WR, Vishwanath GR, Kangas MJ. An application of probabilistic methods to estimate the distribution of potential exposures to a least tern population at a RCRA site. Presented at ASTM 7th Symposium on Environmental Toxicology and Risk Assessment, St. Louis, MO, 1997.

Sheehan PJ. Ecological risk assessment. Presented at Risk Assessment and Risk Management Workshop, Society for Risk Analysis, New Orleans, LA, 1996.

Alsop WR, Ghezelbash R, Sheehan PJ. Use of GIS in problem formulation phase of ecological risk assessment. Presented at SETAC 17th Annual Meeting, Washington, DC, 1996.

Alsop WR, Ghezelbash R, Sheehan PJ. Use of geographic information systems (GIS) in the problem formulation phase of ecological risk assessment. Presented at SETAC Northern California Regional Chapter, 6th Annual Meeting, Sacramento, CA, 1996.

Chappie D, Barber T, Sferra J, Fuchsman P, Sheehan P. Chronic effects of hexachlorobenzene on *Hyalella azteca* and *Chironomus tentans* in a spiked sediment bioassay. Presented at SETAC 17th Annual Meeting, Washington, DC, 1996.

Sferra J, Barber T, Fuchsman P, Sheehan P. Development of site-specific sediment no-effect concentrations based on synoptic chemical analysis and toxicity testing. Presented at SETAC 17th Annual Meeting, Washington, DC, 1996.

Sheehan PJ, Barber T, Dombrowski F, Burris J, Wenning R. Developing site-specific sediment toxicity criteria for hexachlorobenzene. Presented at Society of Risk Analysis Annual Meeting, New Orleans, LA, 1996.

Sheehan PJ, Barber T, Kangas M, Dombrowski F. Using multiple lines of toxicity test evidence to identify site-specific sediment quality criteria. Presented at SETAC 17th Annual Meeting, Washington, DC, 1996.

Sheehan PJ, Barber TR, Shaner S, Sferra J. Developing site-specific sediment toxicity criteria for persistent organic chemicals. Presented at SETAC Northern California Regional Chapter, 6th Annual Meeting, Sacramento, CA, 1996.

Sheehan PJ. Assessing chemical exposures to populations and ecosystems. Presented at Prevention Strategies for Living in a Chemical World, Collegium Ramazzini, Washington, DC, 1995.

Sheehan PJ. Using toxicity tests to assess the risks posed by contaminated sediments. Presented at SETAC Northern California Regional Chapter, 5th Annual Meeting, Santa Cruz, CA, 1995.

Sheehan PJ, Lee KH. If fish don't assimilate the lead that they ingest, is there a risk to fish consumers? Second SETAC World Congress, Vancouver, BC, 1995.

Sheehan PJ, Lee KH. Using probabilistic modeling to assess wildlife exposures to chemicals. Presented at Fifth SETAC Europe Congress, Copenhagen, Denmark, 1995.

Sheehan PJ, Tull JD, Dombrowski F. Using toxicity tests to assess the risks posed by contaminated sediments. Presented at Hydrocarbon Contaminated Soils: Expediting Cleanups in USEPA Region 6, New Orleans, LA, 1995.

Sheehan PJ. Application of Monte Carlo modeling to ecological risk assessment. Presented at Monte Carlo Modeling Workshop, Society of Risk Analysis, Baltimore, MD, 1994.

Sheehan PJ. Applying ecological risk assessment strategies to address environmental problems. Presented at AWMA/ACBA Seminar, Pittsburgh, PA, 1994.

Sheehan PJ, Tull JD. Developing screening procedures to focus ecological risk assessments. Presented at 15th Annual Meeting, Society of Environmental Toxicology and Chemistry, Denver, CO, 1994.

Sheehan PJ, Woods PE. Applying ecological risk assessment strategies to address environmental problems. Presented at AEHS Fifth Annual West Coast Conference, Long Beach, CA, 1994.

Sheehan PJ, Lee KH, Woods PE. Use of probabilistic exposure assessment methods for ecological risk assessments for CERCLA and RCRA sites. Presented at Annual Meeting, Society of Risk Analysis, Baltimore, MD, 1994.

Sheehan PJ. Application of Monte Carlo modeling to ecological risk assessment. Presented at Monte Carlo Modeling Workshop, Society for Risk Analysis, Savannah, GA, 1993.

Sheehan PJ. Ecological risk assessment. Presented at Principals of Risk Assessment Workshop, Society for Risk Analysis, Savannah, GA, 1993.

Sheehan PJ. Ecological risk assessment at a regional scale. Presented at the Annual Meeting of the Society for Risk Analysis, Savannah, GA, 1993.

Sheehan PJ. Methods for the assessment of effects of chemicals on ecological systems at a regional scale. Presented at Scientific Group Methods for the Safety Evaluation of Chemical 10, Montpellier, France, 1993.

Hedgecock J, Ungs M, Bubier T, Sheehan P. Establishment of health-based remediation targets for petroleum-contaminated soils based on protection of aquatic organisms and human health. Presented at Association for the Environmental Health of Soils, Fourth Annual West Coast Conference on Contaminated Soils and Groundwater, 1993.

Harman CR, D'Alleinne CP, Sheehan PJ, Dombrowski FJ, Brooke KL. The use of a predictive ecological risk assessment in support of a hazardous waste incinerator siting permit. Presented at 14th Annual Meeting, Society of Environmental Toxicology and Chemistry, Houston, TX, 1993.

Sheehan PJ, Dombrowski F, Tull J, Ungs M, Lee K. A probabilistic approach to assessing ecotoxicological risk of chemical exposures via the food web. Presented at 14th Annual Meeting, Society of Environmental Toxicology and Chemistry, Houston, TX, 1993.

Sheehan PJ, Ungs M, Dombrowski F, Tull J, Otani J, Lee K. Expressing ecotoxicological risks as probabilities. Presented at the Annual Meeting of the Society for Risk Analysis, Savannah, GA, 1993.

Sheehan PJ, Tull JD, Ludwig D. Disturbance versus chemicals: Interpreting chemical effects on biota. Presented at 13th Annual Meeting, Society of Environmental Toxicology and Chemistry, Cincinnati, OH, 1992.

Tull JD, Brown S, Sheehan PJ. A field evaluation of the role of AVS in controlling the toxicity of metals in intertidal marine sediments. Presented at 13th Annual Meeting, Society of Environmental Toxicology and Chemistry, Cincinnati, OH, 1992.

Sheehan PJ. Ecological risk assessment: Multiple approaches. Presented at 12th Annual Meeting, Society of Environmental Toxicology and Chemistry, Seattle, WA, 1991.

Sheehan PJ, Bruce G, Paustenbach DJ. A sampling and analytical method for environmental levels of airborne hexavalent chromium. Presented at AWMA Current Issues in Air Toxics, Sacramento, CA, 1991.

Sheehan PJ. Validation of a sampling method for ambient levels of hexavalent chromium. Presented at EPA/AWMA International Symposium on Measurement of Toxic and related Air Pollutants, Raleigh, NC, 1990.

Sheehan PJ. Upcoming changes in the practices of risk assessment. Presented at Hazmacon '89, Santa Clara, CA, 1989.

Sheehan PJ. Progress in bioreclamation of contaminated groundwater. Presented at 1988 Caltran's Research and Development Program Conference, Sacramento, CA, 1988.

Sheehan PJ, Schneiter RW, Mohr TKG, Gersberg RM. Bioreclamation of gasoline contaminated groundwater without oxygen addition. Proceedings, 2nd National Outdoor Action Conference on Aquifer Restoration, Groundwater Monitoring and Geophysical Methods, National Water Well Association, Dublin, OH, 1988.

Sheehan PJ, Schneiter RW, Mohr TKG, Gersberg RM. Progress in bioremediation of contaminated groundwater without oxygen addition. Proceedings, Hazmacon '88. Association of Bay Area Governments, Oakland, CA, 1988.

Sheehan PJ, Schneiter RW, Mohr TKG, Gersberg RM. Progress in the bioreclamation of gasoline contaminated groundwater without oxygen addition. Presented at Hazmacon '88, Anaheim, CA, 1988.

Sheehan PJ, Schneiter RW, Mohr TKG, Gersberg RM. Bioreclamation of gasoline contaminated groundwater: Step by step. Presented at 8th Annual Meeting, Society of Environmental Toxicology and Chemistry, Pensacola, FL, 1987.

Sheehan PJ. A comparison of three community toxicity test models. Presented at 7th Annual Meeting, Society of Environmental Toxicology and Chemistry, Alexandria, VA, 1986.

Sheehan PJ. Utility of toxicity data from various levels of biological complexity in predicting hazard in aquatic ecosystems. Presented at 6th Annual Meeting, Society of Environmental Toxicology and Chemistry, St. Louis, MO, 1985.

Sheehan PJ. Application of ecological hazard analysis to predict the indirect effects of insecticides on ducklings. Presented at 5th Annual Meeting, Society of Environmental Toxicology and Chemistry, Arlington, VA, 1984.

Sheehan PJ. A multi-level approach to ecotoxicological assessment of pollutant effects. Presented at SIL Meeting, Lyon, France, 1983.

Sheehan PJ. Effects of chemical mixtures on ecosystem function. Presented at GOMSEC Workshop, Guilford, England, 1983.

Sheehan PJ. Predictive tests utilizing ecosystem processes as end points. Presented at SGOMSEC Workshop, Rome, Italy, 1982.

Sheehan PJ. Methods for assessing the effects of chemicals on reproductive function in amphibians and reptiles. Presented at SGOMSEC Workshop, Ispra, Italy, 1981.

Sheehan PJ, Knight AW. Thirty-five years of copper effluent into Little Grizzly Creek. Presented at the 41st Annual Meeting of the American Society of Limnology and Oceanography, Victoria, BC, 1978.

**Prior Experience**

Principal Scientist, McLaren Hart/ChemRisk, 1989–1998
Senior Scientist, Aqua Terra Technologies, 1985–1989
Assistant Professor, Duke University, 1984–1985
Research Scientist, National Research Council Canada, 1981–1984
Postdoctoral Research Associate, New York University, 1980–1981

## Project Experience

### *Human Health Risk Assessments*

Conducted activity-based sampling of occupational activities and simulations of potential future residential activities to assess entrainment of asbestos fibers from soils with pipe wrap debris and characterized potential exposures to assess current and future health risks.

Conducted studies to develop a new procedure for estimating fiber exposures from the use of chrysotile-containing joint compound. This procedure builds upon a series of studies, including re-creation of a chrysotile-containing, calcium carbonate joint compound manufactured historically; design, construction, and validation of a bench-scale test chamber used to test both the re-created and modern-day joint compound, and assessment of potential artifacts associated with historical preparation of joint compound samples.

Conducted simulation studies to measure airborne benzene concentrations for workers using selected solvents, adhesives and other petroleum-based materials under typical use conditions to reconstruct and estimate potential historical exposures experienced by a worker using these products.

Designed and conducted an exposure simulation of the abrasion of asphalt-based roofing materials that contain asbestos to reconstruct and estimate potential historical exposures experienced by a worker applying, repairing, and removing these materials.

Conducted a reconstruction of historical worker exposures associated with the maintenance of pumps used in high-temperature applications. These assessments characterized the potential asbestos exposures that workers received during the replacement of gaskets and packing in pumps, and compared those exposures to what the same workers likely received during the installation, repair, and removal of asbestos insulation in the facilities in which they worked.

Managed and conducted an assessment of historical occupational exposures to asbestos associated with the maintenance of valves and steam traps used on boilers and compared these exposures with those potentially received by workers who installed, repaired, and removed asbestos insulation on boilers.

Managed and conducted an assessment of the state of knowledge through time as to the magnitude of asbestos exposures and relative risk to workers in various occupations making or using asbestos products. This assessment was intended to provide information as to when specific asbestos-related diseases were recognized in worker populations from epidemiology studies, when exposures for these workers were quantified, what information was being provided by regulatory agencies, and what information various companies collected or developed and may have provided to their workers. This analysis also evaluated exposure, toxicology, and epidemiology data for asbestos substitutes for specific products, including manmade fibers.

Managed an assessment of occupational exposures to asbestos of friction material manufacturing workers and vehicle mechanics servicing automobile and truck brakes. Asbestos concentration data from surveys of mechanics were compiled from published studies, and daily time-weighted average (TWA) concentrations were estimated based on concentration measurements during brake repair work, background concentrations in garages, and average numbers of brake jobs conducted per day. TWA concentrations for mechanics in the United States were compared to those for mechanics working in Europe. TWA concentrations were also compared for mechanics using different cleaning methods and for mechanics repairing brakes before and after dust control measures were implemented in garages.

Conducted an assessment of potential maintenance worker exposures to asbestos associated with the replacement of asbestos-containing gaskets in equipment handling high-temperature fluids, steam, and corrosive chemicals.

Managed research on a number of asbestos-related issues, including the influence of fiber size and type on asbestos potency in producing specific diseases, interpretation of "low-dose" studies, threshold doses for specific diseases, and background incidence of mesothelioma.

Conducted a risk assessment to evaluate the health risks associated with the residues that may accumulate in sparkling wine as the result of treating the interior of champagne bottles with 1,1,1,2-tetraflouroethane.

Conducted an assessment to reconstruct potential benzene exposures experienced by printing press operators in offset printing operations. The assessment included an evaluation of data from NIOSH surveys of printing operations, other published studies and specifications for petroleum distillates used in printing solvents as well as analyses of specific solvents.

Conducted an assessment to reconstruct potential benzene exposures experienced by mechanics using mineral spirit solvents and parts washers to degrease and clean parts. The exposure assessment was based on historical and recently collected benzene concentration data for mechanics using parts washers with older and current formulations of the parts-washing solvent. Exposures were estimated with probabilistic methods to provide a better characterization of the variability and uncertainties in the process.

Conducted an exposure simulation to estimate potential historical exposures of a sheet-metal worker to benzene as the result of using a solvent to degrease and clean a bearing housing and other parts on machinery at an agricultural production facility.

Managed an assessment of the risks posed by TCE in indoor air. This assessment included a comprehensive evaluation of the carcinogenic potency of TCE (in the absence of a final EPA evaluation), development of a sampling plan to evaluate buildings on a former Superfund site, and preparation of materials describing the evaluation of air-sampling data and communication of risk estimates to interested parties.

Conducted an assessment of potential exposures to chlorinated solvents migrating in groundwater and stormwater from a chemical production facility to surface water that is used during certain times as a source of drinking water.

Conducted an assessment of company response to a gasoline release from a ruptured pipe where some of the released gasoline was transported in stormwater runoff to a reservoir that supplied drinking water to several cities.

Conducted an assessment of the health risks and benefits of MTBE and ethanol as fuel oxygenates. The assessment characterized the air and water quality impacts of these oxygenates based on data on measured or modeled changes in vehicle emissions or environmental releases associated with MTBE and ethanol fuel blends.

Managed an assessment of airborne and waterborne exposures and associated health risks posed by MTBE reformulated gasoline. The evaluation included a probabilistic assessment of MTBE exposures to the general population, as well as exposures to those using contaminated drinking water supplies, and to service-station workers. An analysis of relative risks and risk trade-offs was conducted for the use of MTBE-reformulated gasoline, ethanol-reformulated gasoline, and conventional gasoline.

Conducted an assessment of the relative risks posed by MTBE and other volatile organic chemicals, such as trichloroethene and perchloroethene, detected in California's drinking-water supply system.

Conducted an assessment to reconstruct contract-worker exposures to benzene from the use of mineral spirit cleaning solvent at a former manufacturing facility. Potential inhalation and dermal exposures were estimated for short-term parts-cleaning tasks at this facility. In addition, the contribution of potential exposure at this facility to the worker cumulative lifetime exposure was estimated.

Managed an assessment to reconstruct exposures of workers to benzene in two chemical manufacturing facilities. The assessments used probabilistic methods and data on benzene levels in air in various parts of the facility, along with worker listing information on job classification and work tasks, to estimate the peak and cumulative exposures of specific workers.

Managed a program to sample homes in which small amounts of elemental mercury had been released, to determine potential exposures and risks posed by these historical releases. The sampling evaluations characterized mercury concentrations in the areas affected by the historical releases and in the breathing zone of living areas in the houses. Developed a statistically based sampling program to assess the incidence of unreported mercury releases, and to characterize potential exposures.

Evaluated whether potential exposures to mercury vapors from accidental releases associated with the removal of gas pressure regulators met medical monitoring criteria.

Managed an analysis of the relationship between the levels of mercury in urine of exposed individuals and the levels of mercury vapor exposure.

Managed a human health risk assessment associated with releases from a former toxaphene production facility. This assessment addressed the most effective ways to evaluate risks from toxaphene, and characterize, both analytically and toxicologically, the multiple-congener mixture that is toxaphene.

Managed an assessment of potential exposure of residents surrounding a former pesticide formulation facility. Samples were collected to characterize pesticide concentrations in soil at these residences, and chemical fingerprinting techniques were used to evaluate whether the former facility was a source of the residues found.

Managed a state-of-the-science evaluation of the exposure and toxicity of silicones from breast implants. The evaluations documented the state of knowledge of the toxicology of silicones and regulatory testing requirements through time, and produced estimates of potential exposure and associated health risks.

Managed RCRA human health assessments for a chemical production facility in Louisiana. The primary chemicals of interest were chlorinated solvents, such as 1,2-DCA, PCE, and TCE, and hexachlorobenzene, hexachlorobutadiene, mercury, and PCBs. These assessments incorporated evaluations of exposure to workers onsite and recreators fishing, boating, and swimming in the estuary offsite. These risk assessments incorporated GIS modeling of vapor exposures, a survey of local fishing habits, a sitewide and offsite analysis of chemicals in air, and a risk management plan for chemicals in groundwater used as drinking water.

Managed a human health and ecological risk assessment for a large brownfields site in California. Metals were identified as the chemicals of primary interest in soil, and perchlorate as the chemical of primary interest in groundwater. The risk assessment process was implemented in close coordination with environmental agencies to achieve the rapid remediation of the site and facilitate its development for residential use.

Managed an evaluation of drinking-water criteria for perchlorate and n-nitrosodimethylamine (NDMA). This evaluation also included an analysis of regulatory policy on health risks associated with short-term exceedance of drinking-water maximum contaminant levels (MCLs).

Managed a human health risk assessment for a Superfund site in the San Francisco Bay, California. This assessment evaluated the risks of local residents' exposure to DDT in windblown dust from a former pesticide formulating facility, and assessed exposure of recreational fishermen catching and consuming fish from the Richmond Harbor area.

Managed a RCRA human health and ecological risk assessment for a chemical manufacturing facility in West Virginia. The assessment is being used as a tool to support negotiations of a cost-effective investigation and remediation strategy for this site.

Managed human health risk assessments for a chemical production facility in Ohio. Assessments were conducted for 14 specific areas of this large facility and for the entire facility. These assessments included a comprehensive analysis of land use and a survey of recreational fishing and fish consumption habits.

Managed a human health and ecological risk assessment for a large brownfields site. The assessment supported the development of a risk reduction strategy to rapidly achieve closure on metal and perchlorate contamination issues at the site in order to facilitate its development.

Managed a large risk assessment involving exposures to chromium on more than 40 sites in Hudson County, New Jersey. The assessment included a review and critique of a risk assessment from a state contractor and independent risk assessments for representative residential, public land, and industrial sites. A statistically based soil sampling program was developed. An ambient air sampling method for hexavalent chromium was developed, evaluated, and published under ASTM. An expert scientific panel was arranged to review chromium health risk issues. A clinical study of chromium allergic contact dermatitis was designed and implemented. Seven manuscripts were published on chromium risk assessment and related health issues, including Monte Carlo analysis of uncertainty in worker exposures at contaminated sites.

Managed a risk assessment for a pesticide formulation facility in New Jersey. Modeling was used to predict the migration of organochlorine pesticides in contaminated soil toward the drinking-water aquifer and the nearest surface-water body. The analysis showed that selective removal of contaminated soil would be sufficient to prevent significant contamination of groundwater and surface water.

Managed a risk assessment for an abandoned oil storage and pigment manufacturing facility on the Hudson River, New York. The assessment showed that small amounts of petroleum constituents and metals were being released from soils to the river but that concentrations were insignificant and posed no hazard to aquatic organisms. Chemical concentrations in soils were shown to pose a negligible human health risk under all likely future use scenarios for the site.

Evaluated the hazardous nature and human health and environmental threat posed by an asphalt-like material found in subsurface soil at a former manufacturing site in Emeryville, California. The material was shown to be non-hazardous in accordance with the criteria in California Code of Regulation, Title 22. Leaving the contaminants capped onsite was demonstrated to be sufficient remediation to allow safe commercial development of the site.

Managed air toxic hot spots risk assessments (California AB 2588) for seven aerospace, chemical, pharmaceutical, and manufacturing facilities in California. Protocols were developed and negotiated with local Air Quality Management Districts and the Department of Health Services. Refined dose-response and exposure analysis was applied to document the conservatism in the recommended regulatory approach.

Managed an assessment of long-term health risks associated with airborne emissions from an industrial oil-fired boiler in Maine during an inefficient short-term burn event. The primary

contaminants released were PAHs, formaldehyde, and metals. Concentrations were shown to be within the range reported for regular operations of oil-fired boilers. The short-term release was shown to pose an insignificant cancer risk to potentially exposed individuals living near the facility.

Performed a Monte Carlo uncertainty analysis of human exposure to benzo[a]pyrene emissions from an aluminum smelter in Quebec, Canada. Characterized airborne concentrations and other exposure parameters, and used Monte Carlo techniques to describe the distribution of exposures. Exposures were shown to be low for most of the exposed population, and estimates based on mean and median parameter values were shown to represent very different portions of the distribution of potential exposures.

Developed and evaluated an air sampling method for hexavalent chromium in ambient air. This method, now published under ASTM, is the most sensitive method currently available for measuring chromium in air. The method has been used to collect samples at more than 40 industrial, commercial, and residential sites and has provided the first data on background concentrations of hexavalent chromium in air away from known sources.

Managed a field and modeling study to evaluate the utility of soil resuspension models in setting risk-based remediation targets. On-source, upwind, and downwind air samples were collected from a chromium-contaminated site over 10 days to represent a variety of meteorologic conditions. These data were used to estimate site-specific chromium emissions rates under various meteorologic conditions. Calculated emissions rates were compared to those generated with EPA rapid assessment models incorporating worst-case default and site-specific soil, chemical, and meteorologic parameters. Current EPA models were shown to overestimate wind-generated chromium emissions from surface soils by factors of 10 to 1,000. A more accurate alternative model was proposed.

Managed a prospective assessment of dioxins that may be released from a magnesium production facility in Canada. The assessment evaluated the accumulation of dioxins in emissions and wastewater discharge from the facility and potential exposures to released dioxins.

Developed an approach for estimating the toxicity of toxaphene-like compounds associated with the paper industry using structure activity relationships and available data on selected congeners.

Managed a risk assessment of environmental exposure to asbestos at the South Bay Asbestos Area Superfund site. The assessment included the quantification of asbestos concentrations in air, a statistical comparison of onsite and background concentrations, and an assessment of site-specific asbestos exposures.

Managed an endangerment assessment for the Berlin and Farro Superfund site in Michigan. The primary contaminants were chlorinated solvents, PCBs, and metals. Human health risks posed by current restricted site use and proposed unrestricted residential site use were evaluated.

Managed a multimedia risk assessment for the landfill disposal of soils from a site contaminated with dry cleaning solvents.

Conducted a risk assessment of human exposure to chlorinated solvents in domestically used groundwater.

Conducted an assessment of human health and ecological risks associated with chemical releases at the Hunters Point Naval Base. Primary contaminants were PCBs, metals, and petroleum constituents. Air sampling was conducted to evaluate airborne exposures.

Managed an assessment of risks posed to women with silicone breast implants. This assessment evaluated the state of the toxicity of silicone toxicity, potential exposures to silicone constituents, and the risks of reported effects.

Managed a reconstruction of potential exposures of residents in the vicinity of a former pesticide formulating facility. The evaluations included the analysis of residential soil samples for pesticides, and the assessment of potential exposures and risks based on soil concentrations. Chemical fingerprinting techniques were used to evaluate whether the former formulating facility was a source of pesticides found in residential soils.

Managed an evaluation of the sufficiency of data collected following a pipeline rupture to characterize human health and ecological risks posed by MTBE and other gasoline constituents.

Managed an assessment to reconstruct exposures to gasoline constituents associated with an underground pipe leak.

Conducted a statistical and spatial analysis of PAH data for soil samples from a parcel of the Hunter's Point Naval Base, to evaluate whether "background" concentrations could be distinguished from spill concentrations. Statistical tools were used to identify the upper bound of background concentrations.

Taught courses on environmental transport and fate analyses and risk assessment for the University of California extension system.

***Proposition 65 Assessments and Consumer Product Assessments***

Conducted evaluations of lead exposure associated with specific consumer products as related to Consumer Products Safety Commission requirements and guidance.

Managed an assessment of phthalates in floor mats and compliance with Proposition 65 regulations.

Managed a simulation and assessment of lead release from casino gaming chips and compliance with Proposition 65 and other regulations.

Managed a simulation and assessment of ethyl benzene releases from large-tipped marker pens and compliance with Proposition 65 regulations.

Managed an assessment and conducted studies to evaluate hand-to-mouth exposure to lead associated with the handling of PVC-coated electrical cables, and compliance with Proposition 65 regulations.

Managed an assessment of potential exposures to lead associated with the use of brass keys, and compliance with Proposition 65 regulations.

Managed a human health risk assessment evaluating the potential exposures of people using recycled paper products to PCBs, and compliance with Proposition 65 regulations.

Managed a human health risk assessment evaluating the potential exposures of users of a hair-coloring product to lead, and compliance with Proposition 65 regulations.

Managed an evaluation of metal and carbon black concentrations in hand-held sprayers, and compliance with Proposition 65 requirements.

Managed an assessment of potential exposures to lead associated with the use of selected consumer products, and compliance with Proposition 65 regulations. The evaluations included studies with volunteers to estimate product-to-hand and hand-to-mouth transfers.

Managed an evaluation of groundwater and stormwater discharges of chemicals from a chemical manufacturing facility to a river considered a drinking-water source, and compliance with Proposition 65 regulations.

Managed an evaluation of mercury released from a dredging/mining operation to river water, and compliance with Proposition 65 regulations.

***Ecological Risk Assessments***

Managed an ecological risk assessment for a former Department of Defense site in northern California that was being redeveloped for residential use.

Conducted a risk assessment of chemicals migrating from a landfill to adjacent aquatic ecosystems.

Managed an ecological risk assessment for an RFI and an RI/FS associated with a former toxaphene production facility. The assessment to date has included a wildlife habitat survey, development of a work plan for further evaluation of the site, and preliminary assessment of risks to wildlife at the former production facility.

Managed a prospective ecological risk assessment evaluating potential sediment impacts associated with the proposed removal of a dam on the Rogue River in Oregon. Evaluations included characterizing concentrations of chlorinated pesticides, metals, and PAHs in

sediments; modeling sediment transport assuming dam removal; and assessing risks to aquatic organisms and users of river water. This assessment is considered critical to the environmental impact assessment evaluating the proposed removal of this dam.

Managed ecological risk assessments for two chemical waste incinerators in Louisiana. The assessment evaluated potential risks to aquatic organisms, mammals, and birds potentially exposed to projected emissions of more than 200 chemicals, including dioxins, PCBs, and PAHs, from operation of the incinerators. These assessments are integral to the permitting of these hazardous-waste incinerators.

Managed RCRA ecological risk assessments for one of the oldest continuously operating chemical manufacturing facilities in the United States located in Ohio. A large number of solid waste management units were identified at this complex site. Area-specific, media-specific, and sitewide assessments were used to assess risks to wildlife, set remediation priorities, and identify appropriate risk reduction goals for chlorinated solvents, hexachlorobenzene, hexachlorobutadiene, PCBs, and metals. Sediment toxicity tests were used to define the extent of sediment toxicity and the primary chemicals contributing to toxicity.

Managed prospective ecological risk assessments for hazardous-waste incinerators at DOD facilities in Utah, Oregon, and Arkansas. The assessments evaluate potential exposures of threatened and endangered wildlife species to persistent and bioaccumulative chemicals, such as dioxins and PCBs, from the incineration of chemical weapons.

Managed an ecological risk assessment for a chemical manufacturing facility in Texas. The assessment is being used to evaluate the bioavailability of petroleum compounds, primarily PAHs, and metals in sediment, and to assess the risks to wildlife posed by the bioavailable concentrations of these substances.

Managed an extensive habitat and biota study on the Tuscarawas River. This study provided data to evaluate the contributions of physical and chemical stressors in limiting aquatic invertebrate and fish populations in the river.

Managed RCRA ecological risk assessments for a chemical manufacturing facility in Louisiana. At this site, risk assessment is being used to guide and focus RCRA investigations, as well as to develop chemical-specific risk-based remediation targets and risk reduction options for various areas of the site. The toxicity of hexachlorobenzene, hexachlorobutadiene, and mercury in site sediments was clearly defined with innovative laboratory tests and GIS analysis of the concentrations of these chemicals in sediments. The relationship of PCBs to historical facility operations was evaluated using spatial and statistical analyses.

Managed a 3-year study of least tern populations on an industrial facility. The study assessed egg laying, hatch success, and fledgling success of tern populations in the same region, with one nesting on an industrial site and another nesting on a nearby refuge. This study showed successful reproduction of terns nesting on the industrial facility and foraging in an adjacent contaminated estuary.

Managed a biological inventory of wildlife using undeveloped portions of an industrial site in Louisiana. The inventory provided data to characterize, both seasonally and spatially, the use of the site by wildlife populations.

Managed a 2-year water quality evaluation in the Calcasieu Estuary. This study showed that low dissolved oxygen concentrations and high ammonia concentrations occur seasonally in the estuary and affect the abundance of aquatic organisms.

Managed a predictive ecological risk assessment for a proposed hazardous waste incinerator in Mississippi. This assessment was based on model projections of incinerator emissions, contaminant dispersion and deposition, and uptake by plants, fish, birds and mammals. An innovative Monte Carlo modeling technique was developed to estimate exposures to fish-eating birds and to quantify related uncertainties.

Served as principal technical advisor for an ecological risk assessment for dioxin-contaminated sediment in Newark Bay. Investigations included toxicity tests for aquatic organisms and food-web exposure assessments for fishermen and fish-eating birds.

Served as principal technical advisor for an ecological risk assessment for a dioxin-contaminated Superfund site in Arkansas. The assessment included evaluations of the toxicity of contaminated sediment to aquatic species and chemical exposures of local wood duck populations foraging in the contaminated aquatic system.

Managed an ecological risk assessment of the effects of organochlorine pesticides (primarily aldrin, dieldrin, and DDT and metabolites) at a Superfund Site in the San Francisco Bay, California. The assessment included a critique of EPA's study plan and an independent evaluation of the toxicity of pesticide-contaminated sediments to aquatic organisms and potential food-web exposures to humans and piscivorous wildlife. Studies showed that shipping disturbance of sediments had a greater effect than pesticides on aquatic biota and that potentially significant exposures to humans and birds were limited. Remediation of a small area of the most contaminated sediments was identified as sufficient to reduce risks to humans and wildlife using the bay.

Provided oversight and consultation on the effects of cadmium on a cove and marsh Superfund site on the Hudson River in New York. Work included the development of plans to reconstruct a wetland ecosystem that will be damaged as part of the planned site remediation. Proposals were also made to use innovative bioassay approaches to measure cadmium bioavailability and to assess the success of sediment remediation.

Managed an ecological risk assessment of aquatic organism and food-web exposures to leaded-glass fines in sediments in a Missouri lake. This phased risk assessment included bioavailability studies, comparison of lead residues in fish in the study area and a reference area, and sediment toxicity tests. The assessment was structured based on clearly defined decision points and criteria and led to a no-further-action decision for the site.

Managed a natural resources damage preassessment for a site in the Lake of the Ozarks, Missouri. The preassessment showed that there was insufficient evidence of injury to wildlife to proceed with a formal natural resources damage assessment.

Managed a risk assessment to develop risk-based remediation targets for petroleum-contaminated soils to protect marine organisms in the Los Angeles Harbor adjacent to the site. This project represents one of the first efforts to establish remediation goals for soils based on an ecological risk assessment of the adjacent aquatic ecosystem.

Provided consultation on the environmental fate and bioaccumulation of mercury released to stream and reservoir sediments in a mercury mining area in California. The assessment showed a low level of mercury accumulation in fish.

Provided technical oversight on an ecotoxicological risk assessment of exposure to mercury- and lead-contaminated sediments in the San Pablo Bay, California. The assessment included bioavailability, bioaccumulation, and toxicity studies to characterize ecological risks.

Developed criteria for hexachlorobenzene and hexachlorobutadiene in the edible tissues of fish caught from the Bayou d'Inde, Louisiana. The analysis included an evaluation of species-specific bioaccumulation potential and population-specific fish consumption rates. Presented testimony on this issue to the Louisiana Estuarine Water Quality Task Force.

Presented expert testimony to the State of Louisiana on proposed ambient water quality criteria for dioxin. The testimony included discussions of the bioaccumulation and aquatic toxicity of dioxin, recent trends in fish consumption, and representative stream-flow conditions for the evaluation of long-term aquatic exposures to dioxin.

Developed an ecotoxicological risk assessment framework for Canadian Hazardous Waste site programs.

Provided consultation to EPA's Risk Assessment Forum in characterizing ecological effects of chemical stressors as part of their program to develop ecological risk assessment guidance.

Developed toxicity testing protocols and conducted a testing program to characterize the toxicity of hexachlorobenzene, hexachlorobutadiene, and mercury in sediment. The toxicity values derived from these tests are currently used to evaluate the toxicity of these compounds to aquatic invertebrates.

Developed a dose-response database for wildlife, identifying toxicity reference values for 200 chemicals.

Conducted biological monitoring programs to assess chemical releases from sewage effluent to the Pajaro River. The monitoring program involved the collection and analysis of sediment, water, and biota samples over a 2-year period.

Served as a technical reviewer to the EPA program to develop guidelines for ecological risk assessments. Prepared guidance documents on ecological effects and ecosystem stability.

Managed effluent toxicity characterization studies of municipal and industrial discharges. Studies included toxicity tests with five to seven freshwater and estuarine species, to quantify toxicity and variability in effluent quality over a one-year period.

Directed Aqua Terra's California State Department of Health Services certified Bioassay Laboratory, which performed aquatic toxicity tests with freshwater and marine organisms as required by TSCA, Title 22, and NPDES.

Managed several bioremediation projects, including onsite and *in situ* treatment of gasoline-, solvent-, and pesticide-contaminated soil and/or groundwater. Projects included the first application of a bacterial denitrification process to remediate gasoline-contaminated groundwater. This project was selected by EPA as a case study on the effective use of alternative technologies to remediate contaminated groundwater.

Conducted research concerning community and *in situ* toxicity testing, biological monitoring, and ecological hazard/risk assessment.

Conducted a comprehensive ecotoxicological risk assessment of the potential adverse effects of pesticides on waterfowl populations in breeding areas in the agricultural regions of central Canada and the United States.

Evaluated the utility of generic microcosm tests for evaluating adverse ecological effects of toxic chemicals on aquatic systems.

Participated in the preparation and editing of four Scientific Committee on Problems of the Environment (SCOPE) books on risk assessment methods. Topics included methods for assessing the adverse effects of chemicals on reproductive function, the effects of pollutants at the ecosystem level, the environmental behavior of chemicals, and effects of chemical mixtures.

Conducted studies to assess the toxic effects of a copper gradient on stream macroinvertebrates. Studies were designed to assess lethal and sublethal effects on individuals and the community in relation to bioavailable copper concentrations.

Developed and presented lectures in the areas of ecotoxicology, environmental fate of pollutants, water pollution/ecology, and stream biology.

**Professional Affiliations**

- Society of Environmental Toxicology and Chemistry
- American Industrial Hygiene Association
- Society for Risk Analysis