

**Anne Fairbrother, DVM, Ph.D.**  
**Principal Scientist and Office Director**

**Professional Profile**

Dr. Anne Fairbrother is a Principal Scientist in Exponent's EcoSciences practice, with more than 30 years of experience in ecotoxicology, wildlife toxicology, contaminated site assessment, and regulatory science. She has conducted large-area (>100 sq mile) risk assessments at mines in tropical, desert, and mountain ecosystems, determining risk thresholds for plants and wildlife. She provided consultation on future development of mine pit lakes, assessed the risk to livestock from use of wastewater on irrigated pasture during mine closure operations, and conducted several assessments of risk to terrestrial and aquatic organisms from mercury. She also assessed risks to wildlife at sites contaminated with organic chemicals, including DDT, PCBs, dioxins, and petroleum hydrocarbons in Delaware, Texas, Oregon, Washington, and California.

Dr. Fairbrother has supported industry groups and government agencies in compiling and reviewing literature and industry reports in support of U.S., Canadian, and European regulatory processes. She has testified in front of Boards of Review and Science Advisory Boards, and prepared expert testimony on environmental risks of pollutants for legal cases within the U.S.

Dr. Fairbrother has drafted guidance documents for ecological risk assessments. For example, she was co-author of the EPA's *Framework for Metals Risk Assessment* and for BC Ministry of Environment guidance for implementing Tier 1 ecological risk assessments of contaminated sites, incorporating weight of evidence practices into ecological risk assessments, and for setting soil clean-up values; she participated in the development of Ecological Soil Screening Levels (Eco-SSLs) for EPA.

While a scientist at the EPA, Dr. Fairbrother led research into the ecological risks of genetically modified crops, methods for assessing risks of nanomaterials, and some of the early guidance for field assessments of Superfund sites and effects of pesticides on birds. She researched and developed methods for assessment of chemical effects on bird immune and endocrine systems.

Dr. Fairbrother has published more than 90 peer-reviewed articles and book chapters that reflect her expertise in wildlife toxicology, immunotoxicology, endocrine-disrupting chemicals, and ecological risk assessment. She serves on numerous scientific boards, expert panels, and editorial boards in support of scientific and regulatory issues. A veterinarian and Certified Wildlife Biologist, Dr. Fairbrother served as President of the Society of Environmental Toxicology and Chemistry, American Association of Wildlife Veterinarians, and Wildlife Disease Association (WDA). She is the recipient of the WDA Distinguished Service Award (2002), and a gold medal for Commendable Service from EPA. Dr. Fairbrother holds an adjunct professorship at Oregon State University, Department of Environmental and Molecular Toxicology.

## **Academic Credentials and Professional Honors**

Ph.D., Veterinary Science, University of Wisconsin, Madison, 1985  
M.S., Veterinary Science, University of Wisconsin, Madison, 1982  
D.V.M., Veterinary Medicine, University of California, Davis, 1980  
B.S., Wildlife and Fisheries Biology, University of California, Davis, 1976

Distinguished Service Award, Wildlife Disease Association, 2002  
Gold Medal for Commendable Service, EPA, 2005  
Bronze Medal for Commendable Service, EPA, 2006, 2008

## **Licenses and Certifications**

Certified Wildlife Biologist, The Wildlife Society, 1995  
40-hour Hazwoper Training and Certification

## **Publications**

DeForest DK, Schlekat CE, Brix KV, Fairbrother A. Secondary poisoning risk assessment of terrestrial birds and mammals exposed to nickel. *International Environmental Assessment and Management* 2011; 8(1):107–119.

Palmquist K, Fairbrother A, Salatas J, Guiney P. Environmental fate of pyrethroids in urban and suburban stream sediments and the appropriateness of *Hyalella azteca* model in determining ecological risk. *International Environmental Assessment and Management*, 2011, in press. DOI: 10.1002/ieam.

Diamond ML, Gandhi N, Adams WJ, Atheron J, Bhavsar SP, Bulle C, Campbell PGC, Dubreuil A, Fairbrother A, Farley K, Green A, Guinee J, Hauschild MZ, Huijbregts MAJ, Humbert S, Jensen KS, Jolliet O, Margni M, McGeer JC, Peignenburg WJGM, Rosenbaum R, van de Meent D, Vijver MG. The clearwater consensus: The estimation of metal hazard in fresh water. *International Journal of Life Cycle Assessment* 2010; 15:143–147.

Solomon KR, Dohmen P, Fairbrother A, Marchand M, McCarty L. Use of (eco) toxicity data as screening criteria for the identification and classification of PBT / POP compounds. *International Environmental Assessment and Management* 2009; 5:680–696.

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. *Environmental Science and Technology* 2009; 43(22):8478–8482.

Fairbrother A. Federal environmental legislation in the U.S. for protection of wildlife and regulation of environmental contaminants. *Ecotoxicology* 2009; 18:784–790.

Allard P, Fairbrother A, Hope BK, Hull RN, Johnson MS, Kapustka L, Mann G, McDonald B, Sample BE. Recommendations for the development and application of wildlife toxicity reference values. *International Environmental Assessment and Management* 2009; 6:28–37.

Fairbrother A, Fairbrother JR. Are environmental regulations keeping up with innovation? A case study of the nanotechnology industry. *Ecotoxicology and Environmental Safety* 2009; 72:1327–1330.

Fairbrother A, Wentsel R, Sappington K, Wood W. Framework for metals risk assessment. *Ecotoxicology and Environmental Safety* 2007; 68:145–227.

Nagy LR, Fairbrother A, Orme-Zavaleta J, Etterson M. The intersection of independent lies in ecological risk assessment. *Human and Ecological Risk Assessment* 2007; 13:355–369.

Gallagher K, Benson WH, Brody M, Fairbrother A, Hasan J, Klaper R, Lattier D, Lundquist S, McCarroll N, Miller G, Preston J, Sayre P, Seed J, Smith B, Street A, Troast R, Vu V, Reiter L, Farland W, Dearfield K. Genomics: Applications, challenges and opportunities for the U.S. EPA. *Human and Ecological Risk Assessment* 2006; 12(3):572–590.

Suter II GW, Norton SB, Fairbrother A. Individuals versus organisms versus populations in the definition of ecological assessment endpoints. *Integrated Environmental Assessment and Management* 2005; 1:397–400.

Fairbrother A, Turnley JG. Predicting risks of uncharacteristic wildfires: Application of the risk assessment process. *Forest Ecology and Management* 2005; 211:28–35.

Bennett RS, Dewhurst I, Fairbrother A, Hart ADM, Hooper M, Leopold A, Mineau P, Mortensen S, Shore RF, Springer TA. A new interpretation of avian and mammalian reproduction toxicity test data in ecological risk assessment. *Ecotoxicology* 2005; 14(8):1–15.

Shore RF, Crocker DR, Akcakaya HR, Bennett RS, Chapman PF, Clook M, Crane M, Dewhurst IC, Edwards PJ, Fairbrother A, Ferson S, Fischer D, Hart ADM, Holmes M, Hooper MJ, Lavine M, Leopold A, Luttik R, Mineau P, Moore DRJ, Mortenson SR, Noble DG, O'Connor RJ, Roelofs W, Sibly RM, Smith GC, Spendiff M, Springer TA, Thompson HM, Topping C. Case Study Part 1: How to calculate appropriate deterministic long-term toxicity to exposure ratios (TERs) for birds and mammals. *Ecotoxicology* 2005; 14(8):1–17.

Roelofs W, Crocker DR, Shore RF, Moore DRJ, Smith GC, Akcakaya HR, Bennett RS, Chapman PF, Clook M, Crane M, Dewhurst I, Edwards PJ, Fairbrother A, Ferson S, Fischer D, Hart ADM, Holmes M, Hooper MJ, Lavine M, Leopold A, Luttik R, Mineau P, Mortenson SR, Noble DG, O'Connor RJ, Sibly RM, Spendiff M, Springer TA, Thompson HM, Topping C. Case Study Part 2: Probabilistic modelling of long-term effects of pesticides on individual breeding success in birds and mammals. *Ecotoxicology* 2005; 14(8):1–29.

Clark J, Oretgo L, Fairbrother A. Sources of variability in plant toxicity testing. *Chemosphere: Environmental Toxicology and Risk Assessment* 2004; 57:1599–1612.

Watrud LS, Lee Eh, Fairbrother A, Burdick C, Reichman JR, Bollman M, Storm M, King G, Van de Water PK. Evidence for landscape-level, pollen-mediated gene flow from genetically modified creeping bentgrass with CP4 EPSPS as a marker. *Proceedings of the National Academy of Sciences* 2004; 101(40):14533–14538.

Fairbrother A, Smits J, Grasman K. Avian immunotoxicology. *Journal of Toxicology and Environmental Health, Part B* 2004; 7:105–137.

Fairbrother A. Lines of evidence in ecological risk assessment. *Human and Ecological Risk Assessment* 2003; 9:1475–1491.

Sappington K, Fairbrother A, Wentsel R, Wood W. Development of a framework for risk assessment of metals. *Journal of Environmental Management* 2003; 5:122–132.

Brewer L, Fairbrother A, Clark J, Amick D. Acute toxicity of lead, steel, and an iron-tungsten-nickel shot to mallard ducks (*Anas platyrhynchos*). *Journal of Wildlife Diseases* 2003; 39(3):638–648.

Adams WA, Brix KV, Edwards M, Tear LM, DeForest DK, Fairbrother A. Analysis of field and laboratory data to derive selenium toxicity thresholds for birds. *Environmental Toxicology & Chemistry* 2003; 22(9):2020–2029.

Phipps T, Tank SL, Brewer L, Wirtz J, Coyner A, Ortego LS, Fairbrother A. Essentiality of nickel and homeostatic mechanisms for its regulation in terrestrial organisms. *Environmental Reviews / Dossiers Environment* 2002; 10(4):209–261.

Stroo HF, Jensen R, Loehr RC, Nakles DV, Fairbrother A, Liban CB. Environmentally acceptable endpoints for PAHs at a manufactured gas plant site. *Environmental Science and Technology* 2000; 34(18):3831–3836.

Fairbrother A. Comparative aspects of estrogen functions and measurements in oviparous and viviparous vertebrates. *Human and Ecological Risk Assessment* 2000; 6:73–102.

Fairbrother A, Brix KV, DeForest DK, Adams WJ. Egg selenium thresholds for birds: A response to J. Skorupa's critique of Fairbrother et al., 1999. *Human and Ecological Risk Assessment* 2000; 6:203–212.

Fairbrother A, Brix KV, Toll JE, McKay S, Adams WJ. Egg selenium concentrations as predictors of avian toxicity. *Human and Ecological Risk Assessment* 1999; 5:1229–1253.

Fairbrother A, Bennett RS. Ecological risk assessment and the precautionary principal. *Human and Ecological Risk Assessment* 1999; 5:943–950.

Glicken J, Fairbrother A. Environment and social values. *Human and Ecological Risk Assessment* 1998; 4:779–786.

Ozman M, Dominguez SE, Fairbrother A. Effects of dietary azinphos methyl on selected plasma and tissue biomarkers of the gray-tailed vole. *Bulletin of Environmental Contamination Toxicology* 1998; 60:194–201.

Fairbrother A, Landis WG, Dominguez S, Shiroyama T, Buchholz P, Roze MJ, Matthews GB. A novel nonmetric multivariate approach to the evaluation of biomarkers in terrestrial field studies. *Ecotoxicology* 1998; 7:1–10.

Chapman, P. M., Fairbrother A, Brown D. A critical evaluation of safety (uncertainty) factors for ecological risk assessment. *Environmental Toxicology & Chemistry* 1998; 17(1):99–108.

Fowles JR, Fairbrother A, Kerkvliet NI. Effects of induced hypo and hyperthyroidism on immune function and plasma biochemistry in mallards (*Anas platyrhynchos*). *Comparative Biochemistry and Physiology* 1997; 118C:213–220.

Fowles JR, Fairbrother A, Trust KA, Kerkvliet NI. Effects of Aroclor-1254 on the thyroid gland, immune function, and hepatic cytochrome P-450 activity in mallards. *Environmental Research* 1997; 75:119–129.

Fairbrother A, Kapustka LA, Williams BA, Bennett RS. Effects-initiated assessments are not risk assessments. *Human and Ecological Risk Assessment* 1997; 3:119–124.

Kapustka LA, Williams BA, Fairbrother A. Evaluating risk predictions at population and community levels in pesticide registration--hypotheses to be tested. *Environmental Toxicology & Chemistry* 1996; 15:427–431.

Larson OR, Schwab RG, Fairbrother A. Seasonal occurrence of fleas (Siphonaptera) on deer mice (*Peromyscus maniculatus*) in Northern California. *Journal of Vector Ecology* 1996; 21:31–36.

Fairbrother A, Kapustka LA, Williams BA, Glicken J. Risk assessment in practice: Success and failure. *Human and Ecological Risk Assessment* 1995; 1:367–375.

Fowles J, Fairbrother A, Baecher-Steppan L, Kerkvliet NI. Immunologic and endocrine effects of the flame-retardant pentabromodiphenyl ether (DE-71) in C57B1/6J mice. *Toxicology* 1994; 86:49-61.

Marden B, Fairbrother A, Bennett J. Interlaboratory comparison of cholinesterase assay. *Environmental Toxicology & Chemistry* 1994; 13:1761–1768.

Trust KA, Fowles JR, Hooper MJ, Fairbrother A. Cyclophosphamide effects on immune function of European starlings. *Journal of Wildlife Diseases* 1994; 30:328–334.

Fairbrother A, Fix M, O'Hara T, Ribic CA. Impairment of growth and immune function of avocet chicks from sites with elevated selenium, arsenic, and boron. *Journal of Wildlife Diseases* 1994; 30:222–233.

Trust KA, Fairbrother A, Hooper MJ. Effects of 7,12-dimethylbenz[a]anthracene on immune function and mixed-function oxygenase activity in the European starling. *Environmental Toxicology & Chemistry* 1994; 13:821–830.

Fowles JR, Kerkvliet N, Fix M, Fairbrother A. Glucocorticoid effects on natural killer cell activity, antibody response, and plasma chemistry in mallards. *Developmental & Comparative Immunology Vector Ecology* 1993; 17:165–177.

Dominguez SE, Mnkell JL, Fairbrother A, Williams BA, Tanner RW. Effect of 2,4-dinitrophenol on metabolic rate of bobwhite quail. *Journal of Toxicology and Applied Pharmacology* 1993; 123:226–233.

Buchholz P, Fairbrother A. Pathogenicity of *Salmonella pullorum* in northern bobwhite quail and mallard ducks. *Avian Diseases* 1992; 36:304–312.

Marden BT, Fowles JR, Fairbrother A. [<sup>3</sup>H]N-methylscopolamine binding to heart atrium and four brain regions from the mallard. *Comparative Biochemistry and Physiology* 1992; 103:115–120.

Fairbrother A, Fowles J. Subchronic effects of sodium selenite and selenomethionine on immune functions of the mallard. *Archives of Environmental Contamination and Toxicology* 1990; 19:836–844.

Fairbrother A, O’Loughlin D. Hematological values of the mallard (*Anas platyrhynchos*) during different reproductive states. *Journal of Wildlife Diseases* 1990; 26:78–82.

Fairbrother A, Craig MA, Walker K, O’Loughlin D. Changes in mallard (*Anas platyrhynchos*) serum chemistries due to age, sex, or reproductive condition. *Journal of Wildlife Diseases* 1990; 26:67–77.

Fairbrother A, Wagner SL, Welch S, Smith BB. Influence of menstrual cycle on serum cholinesterase. *Environmental Health* 1989; 49:181–189.

Fairbrother A, Bennett JK. The usefulness of cholinesterase measurements. *Journal of Wildlife Diseases* 1988; 24(3):587–590.

Fairbrother A, Bennett RS, Bennett JK. Sequential sampling of plasma cholinesterase (ChE) in mallards (*Anas platyrhynchos*). *Environmental Toxicology & Chemistry* 1987; 8:117–122.

Fairbrother A, Bennett RS. Changes in mallard hen behaviors in response to methyl parathion-induced illness of ducklings. *Environmental Toxicology & Contamination* 1987; 7:499–503.

Crawford JA, Cole PJ, Kilbride KM, Fairbrother A. Atypical plumage of a female California quail. *California Department of Fish and Game Health* 1987; 73:244–247.

Knittel MD, Fairbrother A. Effect of either above optimum temperature or low pH on survival of free virus of *Autographa californica nuclear polyhedrosis virus*. *Applied Environmental Microbiology* 1987; 53: 2771–2773.

Fairbrother A, Yuill TM. Experimental infection and horizontal transmission of Modoc virus in deer mice (*Peromyscus maniculatus*). *Journal of Wildlife Diseases* 1987; 23:179–185.

Fairbrother A, Yuill TM, Olson LJ. Effects of three plant growth regulators on the immune response of young and aged deer mice (*Peromyscus maniculatus*). *Arch Environ Contam Toxicol* 1986; 15:265–275.

Paull JA, Fairbrother A. Vaginal lavage for pregnancy diagnosis in deer mice, *Peromyscus maniculatus*. *Journal of Experimental Zoology* 1985; 233:143–149.

Fairbrother A, Yuill TM. Experimental viral infections of deer mice (*Peromyscus maniculatus*). *Journal of Mammals* 1984; 65:499–503.

Fairbrother A, Yuill TM, Olson LJ. Effects of ingestion of chlorocholine chloride and cyclophosphamide on Venezuelan equine encephalitis virus infections in deer mice (*Peromyscus maniculatus*). *Toxicology* 1984; 31:67–71.

Porter WP, Hinsdill RD, Fairbrother A, Olson LJ, Jaeger J, Yuill TM, Bisgaard S, Hunter WG, Nolan K. Toxicant-disease-environment interactions associated with suppression of immune system, growth and reproduction. *Science* 1984; 224:1014–1017.

Glicken (Fairbrother) A, Schwab RG. Modes of ectoparasite reinfestations of deer mice (*Peromyscus maniculatus*). *Journal of Wildlife Diseases* 1980; 16:577–586.

Glicken (Fairbrother) A, Kendrick JW. Hoof overgrowth in Holstein Frisian dairy cattle. *Journal of Heredity* 1977; 68:386–390.

## **Books**

Clark J, Fairbrother A, Kapustka LA. Adaptation and acclimation of terrestrial organisms to metals in soil. International Copper Association Special Publication, SETAC Press, Pensacola, FL, 2001.

Fairbrother A. Seminars in Avian and Exotic Pet Medicine—Toxicology. Guest Editor and Introduction for Volume 8(1). WB Saunders Company, Philadelphia, PA, 1999.

Fairbrother A, Kapustka LA. Hazard classification of inorganic substances in terrestrial systems. International Council on Metals and the Environment, Ottawa, Canada, 1997.

Glickman L, Fairbrother AA, Guarino M, Bergman HL, Buck WB, Cork LC, Hayes HM, Legator SM, McConnell EE, Mcnelis DN, Temple SA. The use of animals as sentinels of environmental health hazards. National Academy Press, Washington, DC, 1991.

## Book Chapters

Palmquist K, Salatas J, Fairbrother A. Pyrethroid Insecticides: Use, Environmental Fate, and Ecotoxicology. pp. 251–278. In: *Insecticides—Advances in Integrated Pest Management* Perveen F (ed), InTech, ISBN: 978-953-307-780-2. Available from: <http://www.intechopen.com/articles/show/title/pyrethroid-insecticides-use-environmental-fate-and-ecotoxicology>, 2012.

McLaughlin MJ, Lofts S, Warne M St J, Amorim MJB, Fairbrother A, Lanno R, Hendershot W, Schlekat CE, Ma Y, Paton GI. Derivation of ecologically-based soil standards for trace elements. In: Merrington G and Schoeters I. (eds.). *Soil quality standards for trace elements*. CRC Press, Boca Raton, FL. pp.6–84, 2010.

Moore DRJ, Warren-Hicks WJ, Qian S, Fairbrother A, Aldenberg T, Barry T, Luttk R, Ratte H-T. Uncertainty analysis using classical and Bayesian hierarchical models. In: *Application of Uncertainty Analysis to Ecological Risks of Pesticides*. Warren-Hicks WJ, Hart A. (eds), SETAC Press, Pensacola, FL, 2010.

Hodson PV, Reash RJ, Canton SP, Campbell PV, Delos CG, Fairbrother A, Hitt NP, Miller LL, Ohlendorf HM. Selenium risk assessment. In: *Ecological Assessment of Selenium in the Aquatic Environment*. Chapman PM, Adams WJ, Brooks ML, Delos CG, Luoma SN, Maher WA, Ohlendorf HM, Presser TS, Shaw DP (eds), SETAC Press, Pensacola, FL, 2009.

Fairbrother A. Risk management safety factors. In: *Encyclopedia of Ecology*. Jorgensen SE (ed), Elsevier: Oxford, 2008.

Lewis MA, Fairbrother A, Menzer RE. Methods in environmental toxicology. In: *Principles and Methods of Toxicology*, Fifth Edition. Hayes AW (ed), Taylor and Francis: Philadelphia, PA, 2007.

Fairbrother A, Hope B. Terrestrial ecotoxicology. pp. 138–142. In: *Encyclopedia of Toxicology*, Second Edition. Wexler, P. (ed), Elsevier: Oxford, 2005.

Mount DR, Ankley GT, Brix KV, Clements WH, Dixon DG, Fairbrother A, Hickey CW, Lanno RP, Lee CM, Munns WR, Ringer RK, Staveley JP, Wood CM, Erickson RJ, Hodson PV. Effects assessment. pp. 53–118. In: *Reevaluation of the State of the Science for Water-Quality Criteria Development*. Reiley MC, et al. (eds), SETAC Press: Pensacola, FL, 2003.

Fairbrother A, Kapustka LA. A historical perspective of environmental concerns to frame the issues. pp. 1–17. In: *High-Potency Herbicides Impact on Nontarget Plants*. Ferenc SA (ed), SETAC Press: Pensacola, FL, 2001.

Fairbrother A. Putting the impacts of environmental contamination in perspective. pp. 671–689. In: *Ecotoxicology of Wild Mammals*. Shore RE, Rattner BA (eds), *Ecological and Environmental Toxicology Series*, John Wiley and Sons: Chichester, UK, 2001.

Fairbrother A, Lewis MA, Menzer RE. Methods in environmental toxicology. In: *Principals and Methods of Toxicology, Fourth Edition*. Hayes AW (ed), Taylor and Francis: Philadelphia, PA, 2000.

Fairbrother A, Bennett RS. Multivariate statistical applications for addressing multiple stresses in ecological risk assessments. pp. 69–115. In: *Multiple Stressors in Ecological Risk and Impact Assessment: Approaches in Risk Estimation*. Ferenc SA, Foran JA (eds), SETAC Press: Pensacola, FL, 2000.

Fairbrother A, Ankley GT, Birnbaum LS, Bradbury SP, Francis B, Gray LE, Hinton D, Johnson LL, Peterson RE, Van Derkraak G. Reproductive and developmental toxicology of contaminants in oviparous animals. pp 283–362. In: *Reproductive and Developmental Effects of Contaminants in Oviparous Vertebrates*. In: DiGiulio RT, Tillit DE (eds), SETAC Press: Pensacola, FL, 1999.

Klump JU, Adams WJ, Cardwell R, Fairbrother A, Harris HJ, Ingersoll CG, Power M, Reid LM. Conceptual approaches to identify and assess multiple stressors. pp. 1–26. In: *Multiple Stressors in Ecological Risk and Impact Assessment*. Foran JA, Ference SA (eds), SETAC Press: Pensacola, FL, 1999.

Kelsch T, Powell RL, Dixon KR, Fairbrother A, Helgen JC, Klaine SJ, Mayer FL, Pascoe GA, Shaw SL, Theriot RF. Regulatory issues and risk assessment. pp. 275–314. In: *Ecotoxicology and Risk Assessment for Wetlands*. Lewis MA, Mayer FL, Powell RL, Nelson MK, Klaine SJ, Henry MG, Dickson GW (eds), SETAC Press: Pensacola, FL, 1999.

Peakall DB, Fairbrother A. Biomarkers for monitoring and measuring effects. pp. 351–376. In: *Pollution Risk Assessment and Management*. Douben PET (ed), John Wiley and Sons: Chichester, UK, 1998.

Fairbrother A. Establishing the health of ecosystems. pp. 101–108. In: *Multiple Stresses on Ecosystems*. Cech JJ, Wilson BA, Crosby DG (eds), Lewis Publishers: Boca Raton, FL, 1998.

Fairbrother A. Ecotoxicological principles for avian field studies. pp. 11–16. In: *Radiotelemetry for Avian Field Studies*. Brewer LW, Fagerstone KA (eds), SETAC Press: Pensacola, FL, 1998.

Kapustka LA, Fairbrother A, Williams BA, Glicken J, Bennett RS. Environmental risk assessment for sustainable cities. Technical Publication Series [3], UNEP International Environmental Technology Centre, Osaka, Japan, 1996. ISBN 92-807-1505-4.

Fairbrother A. Cholinesterase inhibitors. In: *Non-Infectious Diseases of Wildlife, Second Edition*. Fairbrother A, Locke L, Hoff GL (eds), Iowa State University Press, Ames, IA, 1996.

Fairbrother A, Knapp CM. Ecological aspects of land spreading sewage sludge. pp. 75–80. In: *Sewage Sludge: Land Utilization and the Environment*. Clapp CE (ed), ASA-CSSA-SSSA, Madison, WI, 1994.

Menzer RE, Lewis MA, Fairbrother A. Methods in environmental toxicology. pp. 1391–1418. In: Principles and Methods of Toxicology, Third Edition. Hayes AW (ed), Raven Press, New York, NY, 1994.

Fairbrother A. Clinical enzymology. pp. 63–92. In: Nondestructive Biomarkers in Vertebrates. Fosi C, Leonzio C (eds), Lewis Publishers: Boca Raton, FL, 1993.

Fairbrother A. Immunotoxicology of captive and wild birds. pp. 251–262. In: Wildlife Toxicology and Population Modeling: Integrated Studies of Agroecosystems. Kendall R, Lacher TE (eds), Lewis Publishers: Boca Raton, FL, 1993.

Weeks BA, Anderson DP, DuFour AP, Fairbrother A, Goven AJ, Lahvis GP, Peters G. Immunological biomarkers to assess environmental stress. pp. 212–234. In: Biomarkers: Biochemical, Physiological, and Histological Markers of Anthropogenic Stress. Huggett RJ, Kimerle RA, Mehrle PM, Bergman HL (eds), Lewis Publishers: Boca Raton, FL, 1992.

Fairbrother A. Decontamination and mitigation of baculoviruses. pp. 843–850. In: Microbial Ecology: Principles, Methods, and Application to Environmental Biotechnology. Levin M, Seidler R, Rogul M (eds), McGraw Hill: New York, NY, 1991.

Rattner BA, Fairbrother A. Sources of variability in cholinesterase measurements. pp. 89–108. In: Cholinesterase-Inhibiting Insecticides—Their Impact on Wildlife and the Environment. Mineau P (ed), Elsevier Science Publishers B.V., Amsterdam, Holland, 1990.

Fairbrother A, Bennett JK, Marden B, Hooper NJ. Methods of cholinesterase analysis, A United States perspective. pp. 35–72. In: Cholinesterase-Inhibiting Insecticides—Their Impact on Wildlife and the Environment. Mineau P (ed), Elsevier Science Publishers B. V., Amsterdam, Holland, 1990.

### **Books Edited**

Fairbrother A (ed). Test Methods for Hazard Determination of Metals and Sparingly Soluble Metal Compounds in Soils. SETAC Press: Pensacola, FL, 2002.

Fairbrother A, Locke L, Hoff, GL (eds). Non-Infectious Diseases of Wildlife, Second Edition. Iowa State University Press: Ames, IA, 1996.

### **Selected Published Abstracts**

#### *International*

Fairbrother A, Wentsel R, Wood W, Sappington K, Noyes P. Framework for inorganic metals risk assessment. Presented at Society of Environmental Toxicology and Chemistry Annual Meeting, Montreal, Canada, November 2006.

Gallagher K, Morris J Willis, J., Alwood A, Bauer D, Boethling R, Brody M, Burgin D, Chow F, Dreher K, Fairbrother A, Henry T, Karn B, Libelo L, Lingle S, Nabholz J, Prothero S, Savage N, Sayre P, Scalera J, Schoepf W, Street A, Utterback D, Williamson T, Zepp R. Nanotechnology: environmental opportunities and challenges. Presented at Society of Environmental Toxicology and Chemistry Annual Meeting, Montreal, Canada, November 2006; and Society for Risk Analysis Meeting, Baltimore, MD, December 2006.

Schumaker N, Nagy L, Fairbrother A. PATCH: A spatially explicit wildlife population model for assessing risks of pesticides to songbirds. Presented at the Wildlife Disease Association World Congress, Cairns, Australia, June 2005.

Fairbrother A, Wentsel R. Framework for inorganic metals risk assessment. Presented at Society of Environmental Toxicology and Chemistry, European Annual Meeting, Lille, France, May 2005.

Fairbrother A. Communicating probabilistic risk outcomes to risk managers. Presented at Society of Environmental Toxicology and Chemistry, European Annual Meeting, Hamburg, Germany, April 2003.

Clark J, Fairbrother A, Brewer L, Bennett RS. Effects of exogenous estrogen on mate selection of house finches. Presented at Society of Environmental Toxicology and Chemistry, European Annual Meeting, Vienna, Austria, May 2002.

Blanton ML, Driver CJ, Fairbrother A, Touart L. Detailed review paper for an avian two-generation and partial life-cycle reproductive and developmental toxicity test. Presented at Society of Environmental Toxicology and Chemistry, European Annual Meeting, Vienna, Austria, May 2002.

Trust KA, Fairbrother A, Hooper MJ. Effects of 7,12-dimethylbenz[a]anthracene on immune function and mixed-function oxygenase activity in the European starling. Society of Toxicology Annual Meeting, New Orleans, LA, March 1993; and Wildlife Disease Association Annual Meeting, Guelph, Canada, August 1993.

Fairbrother A. Biomarkers in wildlife. Society of Environmental Toxicology and Chemistry Annual Meeting, Toronto, Canada, November, 1989.

Fairbrother A. Immunotoxicology of wild and laboratory birds. Wildlife Disease Association 6th International Meeting, East Berlin, GDR, August, 1990.

Yuill TM, Hinsdill RD, Porter WJ, Fairbrother A. The hidden challenge: determining sublethal effects of wildlife diseases. Wildlife Disease Association 6th International Meeting, East Berlin, GDR, August, 1990.

*National*

Edwards M, Fairbrother A. Surface water quality in the upper Columbia River, Washington. Presented at the Society of Environmental Toxicology and Chemistry Annual Conference, Portland, OR, November 2010.

Fairbrother A, Edwards M, Mayfield D. Contaminant analysis of fish in the upper Columbia River, Washington. Presented at the Society of Environmental Toxicology and Chemistry Annual Conference, Portland, OR, November 2010.

Fairbrother A, Menzie C. Integrated exposure analysis for human health and ecological risks at contaminated site. Presented at the Society of Environmental Toxicology and Chemistry Annual Conference, Portland, OR, November 2010.

Palmquist K, Fairbrother A, Salatas J, Guiney P. Environmental fate of pyrethroids in urban stream sediments and the appropriateness of *Hyalella azteca* model in determining ecological risk. Presented at the Society of Environmental Toxicology and Chemistry Annual Conference, Portland, OR, November 2010.

Fairbrother A. The art and practice of weighing evidence for environmental assessment. Presented at the Society of Environmental Toxicology and Chemistry Annual Conference, New Orleans, LA, November 2009.

Fairbrother A, Dohmen P, Marchand M, McCarty LS, Solomon K. Use of (Eco) toxicity data as screening criteria for the identification and classification of PBT / POP compounds. Presented at the Society of Environmental Toxicology and Chemistry Annual Conference, Tampa, FL, November 2008.

DeForest D, Fairbrother A, Adams BA. Selenium hormesis in birds—Implications for developing dietary and egg-based toxicity thresholds. Presented at the Society of Environmental Toxicology and Chemistry Annual Conference, Tampa, FL, November 2008.

Fairbrother A, Dohmen P, Marchand M, McCarty LS, Solomon K. Use of (Eco) toxicity data as screening criteria for the identification and classification of PBT / POP compounds. Presented at the Society of Environmental Toxicology and Chemistry Annual Conference, Tampa, FL, November 2007.

DeForest D, Fairbrother A, Adams BA. Selenium hormesis in birds—Implications for developing dietary and egg-based toxicity thresholds. Presented at the Society of Environmental Toxicology and Chemistry Annual Conference, Tampa, FL, November 2007.

Grim KC, Fairbrother A, Monfort S, Tan S, Rattner B, Gerould S, Beasley V, Aguirre A, Rowles T. Results of a wildlife toxicology workshop held by the Smithsonian Institution—Identification and prioritization of problem statements. National Presented at the Society of Environmental Toxicology and Chemistry Annual Conference, Milwaukee, WI, November 2007.

Hope B, Allard P, Fairbrother A, Hull R, Johnson MS, Kapustka LA, McDonald B, Sample BE. Representation and consequences of uncertainty in the toxicity reference value. Presented at the Society of Environmental Toxicology and Chemistry Annual Conference, Milwaukee, WI, November 2007.

Allard P, Hill R, Mann G, Mackintosh C, Hull R, Kapustka LA, McDonald B, Hope B, Sample BE, Fairbrother A, Johnson MS. Using dose-response relationships for wildlife TRVs. Presented at the Society for Risk Analysis Annual Conference, Milwaukee, WI, November 2007.

Kapustka L, Fairbrother A, Sample BE. Linking assessment endpoints and wildlife TRVs. Presented at the Society for Risk Analysis Annual Conference, Milwaukee, WI, November 2007.

Hull RN, Allard P, Fairbrother A, Hope B, Johnson MS, Kapustka LA, McDonald B, Sample BE. Summary of recommendations for wildlife TRV development and use. Presented at the Society of Environmental Toxicology and Chemistry Annual Conference, Milwaukee, WI, November 2007.

Fairbrother A. Environmental immunotoxicants: Human-wildlife relationships. Presented at the Society of Environmental Toxicology and Chemistry Annual Conference, Milwaukee, WI, November 2007.

Fairbrother A, Sappington K, Wentsel R, Menzie C, Bottimore D, Downey P, Haber L, Harding-Barlow I, Nelson M, Thornton K. Principles for Metals Risk Assessment USEPA Framework. Presented at the Society for Risk Analysis Annual Conference, Baltimore, MD, December 2006.

Fairbrother A, Wentsel R, Sappington K, Wood W, P. Noyes. Framework for inorganic metals risk assessment. Presented at Society of Environmental Toxicology and Chemistry Annual Meeting, Montreal, Canada, November 2006.

Morzillo AT, Fairbrother A. Effects of human activities on resident mammals within urban ecosystems. Presented at the 86th Annual Meeting of the American Society of Mammalogists meeting, Amherst, MA, June 2006.

Smith C, Stubblefield W, Clark J, Fairbrother A, Allen H, Schoeters I, Dwyer R. Distribution of soil bioavailability parameters throughout Europe and development of metalloregions. Major Scientific/Technical Contributions. Presented at Society of Environmental Toxicology and Chemistry Annual Meeting, Portland, OR, November 2004.

Wentsel R, Fairbrother A. Overview of the development of the Framework for Metals Risk Assessment. Presented at Society of Environmental Toxicology and Chemistry Annual Meeting, Portland, OR, November 2004.

Fairbrother A. Comparison of European and United States approaches to new and existing substances regulation. Presented at Society of Environmental Toxicology and Chemistry Annual Meeting, Portland, OR, November 2004.

Adams W, Brix K, DeForest D, Toll J, Fairbrother A, Kapustka L. Ecological risk assessment at a copper smelter. Presented at Society of Environmental Toxicology and Chemistry Annual Meeting, Portland, OR, November 2004.

Suter II GW, Fairbrother A, Munns Jr WR, Norton SB, Wentzel R, Kravitz MJ. Individuals versus organisms versus populations in the definition of ecological assessment endpoints. Presented at Society of Environmental Toxicology and Chemistry Annual Meeting, Portland, OR, November 2004.

Smolders E, Fairbrother A, Hale B, Lombi E, McGrath S, McLaughlin M, Rutgers M, Van der Vliet L. Hazard assessment of metals and metal compounds in terrestrial systems. Presented at Society of Environmental Toxicology and Chemistry Annual Meeting, Austin, TX, November 2003.

Adams WJ, Tear LM, Edwards M, Fairbrother A, Brix KV. Re-analysis of field data used to derive selenium toxicity thresholds for birds. Presented at Society of Environmental Toxicology and Chemistry Annual Meeting, Nashville, TN, November 2000.

Fairbrother A. Values of constructed and natural ecosystems: Are they equivalent? Presented at Society for Risk Analysis Annual Meeting, Arlington, VA, December 2000.

Fairbrother A, Tear L, Toll J. Probabilistic risk assessment of methiocarb in terrestrial agroecosystems. Presented at Society of Environmental Toxicology and Chemistry Annual Meeting, Nashville, TN, November 2000.

McQuillen H, Brewer L, Fairbrother A, Clark J, Bennett RS, Fry DM. Field deployable techniques to monitor exposure to environmental estrogens throughout the reproductive cycle of wild birds. Presented at Society of Environmental Toxicology and Chemistry Annual Meeting, Nashville, TN, November 2000.

Fairbrother A. A critical review of avian test methods for endocrine disrupting activity of environmental chemicals. Presented at Society of Environmental Toxicology and Chemistry Annual Meeting, Philadelphia, PA, November 1999.

Fairbrother A, Bennett RS. Environmental risk assessment and the precautionary principle. Presented at Society of Environmental Toxicology and Chemistry Annual Meeting, Charlotte, NC, November 1998.

Fairbrother A, Bennett RS. Ecological risk assessment at the Mother Lode mercury mine, Ochoco National Forest. The 47th Annual Meeting of the Wildlife Disease Association, Madison, WI, August 1998.

O'Hara T, Franson C, Fairbrother A. Forensic investigations of wildlife: contaminants. Presented at Society of Environmental Toxicology and Chemistry Annual Meeting, San Francisco, CA, November 1997.

Clark J, Fairbrother A, Brewer L, McQuillen H, Bennett RS. Effects of exogenous estrogen on mate selection of house finches. Presented at Society of Environmental Toxicology and Chemistry Annual Meeting, Nashville, TN, November 2000.

## **Invited Presentations**

### *International*

Fairbrother A. Environmental effects of manufactured nanomaterials. Invited plenary presentation at SETAC World Conference, Sydney, Australia August 2008.

Fairbrother A. Ecological risk assessment and wildlife toxicology. 1<sup>st</sup> International Conference on Environmental Issues, Hanoi, Vietnam, March 2004.

Fairbrother A. Genetically modified foods: Technological breakthrough or ecological nightmare? Keynote address at SETAC Asia Pacific conference, Christchurch, New Zealand, September 2003.

Fairbrother A, Turnley JG. Communication of probabilistic risk assessments. Invited presentation in special symposium on Probabilistic Risk Assessment at SETAC Europe 13<sup>th</sup> annual conference, Hamburg, Germany, April 2003.

Clark J, Fairbrother A, Brewer L, Bennett RS. Effect of exogenous estrogen exposure on mate selection by the female house finch. Invited presentation at SETAC Europe 12<sup>th</sup> Annual Conference, Vienna, Austria, May 2002.

Robinson S, Fairbrother A. Human health risks from organotins in household products. Proceedings of the Organotin Environmental Programme Association Meeting, Sardinia, Italy, October 2000.

Fairbrother A, Brix KV, DeForest DK, Adams WJ. Critical review of tissue-based selenium toxicity thresholds for fish and birds. Presented at Mine Reclamation Symposium, Williams Lake, British Columbia, June 2000.

Fairbrother A. Fellow of the Crown Research Institute, Wellington, New Zealand. Invited lectures to scientific staff, regulators and academics (University of NZ, Christchurch), October 2000.

Fairbrother A. Keynote speaker and invited lecturer, Zoo and Wildlife Veterinary Medicine, Continuing Education. Western Plains Zoo, Dubbo, Australia. September 1999.

Fairbrother A. Tier 1 (Screening Level) risk assessments in British Columbia. Workshop sponsored by the Ministry of the Environment, Vancouver, BC, November 1998.

*National*

Seminar/Lecture: Introduction to Ecological Risk Assessment. Environmental and Molecular Toxicology Department, Oregon State University, Corvallis, OR April 2011.

Plenary: Federal environmental legislation in the U.S. for protection of wildlife and regulation of environmental contaminants. Smithsonian Wildlife Toxicology Symposium, Washington DC March 2007.

Keynote: History of development and use of bioindicators and biomarkers in the U.S. 14<sup>th</sup> International Conference on Bioindicators. Baltimore, MD April 2006.

Lecture: RCRA and CERCLA: Environmental containment, contamination, and clean up. School of Veterinary Medicine, University of Illinois, March 2005.

Co-instructor: Introduction to Ecological Risk Assessment. Dept. of Fisheries and Wildlife *and* Dept. of Environmental and Molecular Toxicology, Oregon State University, Corvallis, OR, Winter 2003–2007.

Lectures: Risk assessment overview and introduction to TSCA and FIFRA. Presented in an upper division graduate level course on environmental studies. Department of Environmental Science, Oregon State University, Corvallis, OR, Fall 2002, Winter 2003, 2004.

Ecological Risk Assessment Guidelines in Oregon -- Case Study. Presentation at the Environmental Law Education Center, 2<sup>nd</sup> Annual Meeting on Contaminated Sites Issues, Portland, OR, March 1998.

Selenium toxicity in wetland birds. Selenium Symposium, Salt Lake City, UT, March, 1997.

Toxicity Extrapolations in Terrestrial Systems. Lead Instructor. A short-course workshop at the Society of Environmental Toxicology and Chemistry 17<sup>th</sup> Annual Meeting, Washington, DC, November, 1996.

Environmental Risk Assessment for Sustainable Development. Nevada Environmental Conference, Reno, NV, September–October, 1996.

Ecological risk assessment benefits, environmental management. Invited presentation at Ecological Risk Assessment Symposium, Corvallis, OR, November, 1994.

The biomedical paradigm applied to ecosystems. Ecosystem Health Meeting sponsored by University of California, Davis, Sacramento, CA, October, 1993.

Ecological aspects of land spreading of sewage sludge. Land Application of Sewage Sludge Symposium, Minneapolis, MN, August, 1993.

Seminar: Ecological risk assessment: from biomarkers to landscapes. Department of Environmental and Molecular Toxicology, Oregon State University, Corvallis, OR, February 2003.

Lectures: Ecological Risk Assessment. Team-taught upper division/graduate level course at Oregon State University, Corvallis, OR, Winter Quarter 2003.

Lectures: Wildlife Toxicology. Presented in an upper division graduate level course on wildlife diseases. Department of Fisheries and Wildlife, Oregon State University, Corvallis, OR, March 1998 and 1999.

Lectures: Situational Ethics – the use of science in policy making. Oregon Junior Science and Humanities Symposium, Oregon State University, Corvallis, OR, March 1996–1999.

Invited Weisse Lecturer: Ecological Risk Assessment and Wildlife Toxicology. Department of Zoology, University of Oklahoma, Norman, OK, January 1998.

Seminar: Toxicity extrapolations in terrestrial systems. University of Nevada, Reno, NV, April 1997.

Lecture: Introduction to ecotoxicology. University of Nevada, Reno, NV, April 1997.

Lecture: Ecotoxicology and veterinary medicine. School of Veterinary Medicine, Oregon State University, Corvallis, OR, August, 1995 and 1996.

Lecture: Ecological risk assessment practices. Envirovet Program, Duluth, MN, August, 1994.

Lecture: Current and future ecological risk assessment approaches in the EPA. Envirovet Program, Duluth, MN, July, 1993.

Lecture: Environmental science and policy in the 21st century. Oregon Junior Science and Humanities Symposium, Corvallis, OR, March, 1993.

Lecture: Wildlife veterinary medicine and conservation biology. School of Veterinary Medicine, University of California, Davis, CA, February, 1992.

Seminar: Environmental toxicology: a growing concern? College of Veterinary Medicine, Oregon State University, Corvallis, OR, November, 1990.

Lecture: Career opportunities in wildlife medicine. Keynote speaker at Phi Beta chapter Annual Meeting, Oregon State University, Corvallis, OR, May, 1990.

Lecture: Wildlife immunotoxicology. Oregon State University, spring term of even years, Corvallis, OR.

Lecture: The role of the USEPA in environmental toxicology. Institute of Wildlife Toxicology and Chemistry, Western Washington University, Bellingham, WA, April, 1990.

Lecture: The Wildlife Toxicology Research Team at the USEPA Environmental Research Laboratory in Corvallis. Institute of Wildlife Toxicology and Chemistry, Western Washington University, Bellingham, WA, 1987.

### **Prior Experience**

Sr. Consultant and Lead for Environmental Risk Assessment and Toxicology, Parametrix, Inc., 2007–2008

Associate Director for Science, U.S. EPA, National Health and Environmental Effects Research Laboratory, Western Ecology Division, 2006–2007

Chief, Risk Characterization Branch, (Supervisory Life Scientist, hired at the GS-15 level [science promotion to Grade 15, 9/02]); U.S. EPA, National Health and Environmental Effects Research Laboratory, Western Ecology Division, Corvallis, 2002–2006

Director and Senior Ecotoxicologist, Terrestrial Ecotoxicology; Parametrix, Inc., 1999–2002

Sr. Wildlife Ecotoxicologist; Ecological Planning and Toxicology, Inc., 1994–1999

Chief, Ecotoxicology Branch, (Supervisory Ecologist, detailed at the GM-15 level), USEPA Environmental Research Laboratory, 1992–1994

Research Ecologist USEPA Environmental Research Laboratory (GS12 – GS14), 1986–1992

Courtesy Associate Professor, College of Veterinary Medicine, Oregon State University, 1987–2003

Courtesy Professor, Department of Environmental and Molecular Toxicology, Oregon State University, 2003–present

### **Selected Project Experience**

Conducting an RI/FS for 150 miles of the upper Columbia River (Canadian border to the Grand Coulee Dam) and surrounding uplands to assess potential ecological risks of smelter emissions to aquatic life, plants, and wildlife. Studying contaminated sediments to ascertain bioavailable metals, conducting food-chain analyses for fish and wildlife, and evaluating soil and uplands in depositional areas to assess risks to plants and wildlife. Work is being conducted under agreement with EPA and participating parties.

Provided expert testimony on ecotoxicity and risk for decamethylcyclopentasiloxane (Siloxane D5) in front of the Canadian Board of Review under the Canadian Environmental Protection Act (CEPA).

Conducted a Detailed Ecological Risk Assessment of the tailings management system of the Gratzburg mine, Irian Jaya, Indonesia. This included assessing risks to plants and wildlife in jungles and estuarine mangrove ecosystems through food-chain analyses, ecological function studies, and floristic composition analyses. Performed extensive plant phytotoxicity and metal

uptake studies to determine risk thresholds for tropical species. A detailed report was written estimating current and future (until mine closure in 2034) risks.

Served as an Expert Advisor to Cominco and its contractors for design and conduct of a terrestrial wide-area assessment under the Contaminated Site Regulations of British Columbia. This included development of appropriate assessment endpoints, conceptual site models, sampling and analysis plans, and final risk estimates. The area encompassed the upper Columbia River Valley and associated side valleys that had been subject to past deposition from the zinc-lead smelter plume.

Conducted an Ecological Risk Assessment for 165 square miles of property surrounding the Bingham Canyon, Utah, gold mine. Work included a survey of plants and wildlife on the site, food-chain analysis of potential metal contamination, field measurements of small-mammal populations, nesting surveys of shorebirds, and development of management options for various portions of the site. Included a probabilistic risk assessment of effects of selenium on the local populations of wading birds.

Conducted an assessment of risk to terrestrial and aquatic organisms from an abandoned mercury mine in the Ochoco Mountains, Oregon, and determined risk-based cleanup levels. This was the first risk assessment to follow the newly published Oregon Department of Environmental Quality guidelines.

Assessed the potential for risk to livestock from use of wastewater on irrigated pasture during mine closure. Selenium and thallium were identified as contaminants of concern. Plant uptake studies were conducted to refine risk estimates for thallium, both in laboratory and field situations.

Provided expert consultations on review comments relating to potential future development of pit lakes at gold mines in Nevada. Included interpretation of information on contaminants of concern, potential for bioaccumulation, and wildlife food-chain contamination.

Conducted an assessment of the potential ecological risks posed by use of copper pipes in housing in California. Specific emphasis was on amount of copper discharged to San Francisco Bay. Other areas, such as the Southern California Bight and San Diego Bay, also were assessed. Endpoints included protection of aquatic life, achievement of water quality criteria, and methods for establishing water effect ratios for specific locations.

Collated and reviewed the literature from 2005 to 2010 on environmental effects of lead, in support of the 5-year update of the U.S. national ambient air quality standards (NAAQS) for lead.

Reviewed literature and available toxicity tests for various pesticides to develop Other Scientifically Relevant Information (OSRI) in response to EPA's request for endocrine disruptor Tier 1 screening.

Provided technical and managerial support to the organotin industry for submission of a screening information data set (SID) of information on 27 chemicals to the OECD's High Production Volume (HPV) data call-in program. Reviewed the available literature on physical/chemical properties, environmental fate, ecotoxicity, and human health effects for all the chemicals, and entered appropriate data into the IUCLID database system. Tests were placed with contract laboratories to fill data gaps. Structure-activity relationships and chemical categories were developed to reduce the need for testing. Developed rest plans, SIARs, and dossiers for submission to the regulatory authorities.

Built a database of nickel toxicity and essentiality and mechanisms for maintaining homeostasis. Retrieved and collated all available information on essentiality and toxicity of nickel to terrestrial and aquatic receptors (other than humans). Reviewed papers for data quality and entered information into a Microsoft Access database for easy retrieval (subsequently migrated to IUCLID). Literature citations were entered into ProCite.

Reviewed entire literature for effects of zinc and phthalate esters on terrestrial organisms (plants, wildlife, soil organisms). Qualified all studies for data quality and summarized the extent of the database. Provided all information in written report and electronic database of endpoints and data quality. Zinc data were used in the continent-wide ecological risk assessment conducted by the European Union (EU) and subsequently were migrated to IUCLID for use in REACH.

Wrote a Tier I assessment and supervised the conduct of toxicity and exposure studies for registration with the U.S. Fish and Wildlife Service of a new non-toxic shot for waterfowl hunting. Successfully completed the registration process under the new regulations, which allow selected testing rather than a complete battery of tests. Information also was submitted to Environment Canada for review. Shot has been registered and successfully marketed in the U.S. for several years.

Directed studies in a fully compliant GLP laboratory following FIFRA pesticide registration guideline for mallard and bobwhite quail. Included acute, subchronic, and reproduction studies with novel chemical and biological pesticides, conducted for most of the large agricultural companies. Additional studies included tests specifically tailored to address questions of contaminant uptake from soil, potential food aversion from chemical-treated feed, and other studies to address specific aspects of exposure of wildlife to pesticides.

Conducted and published laboratory studies with the rat as a model of the pica child to determine the uptake efficiency of petroleum hydrocarbons from soils. Soil types included aged soils, treated soils, and lampblack. Information from the study can be used in exposure equations in place of default values when estimating total uptake of PAHs from different soil types during either human or ecological risk assessments of contaminated sites.

Researched effects of estrogen supplementation in house finch breeding behavior, including mate selection, changes in plumage coloration, and reproductive output. Animals were implanted with time-release devices for continual elevation of estrogen levels, and an ELISA method for measurement of fecal/urate estrogens was adapted to the house finch to monitor changes in hormones during the breeding cycle. Used videography to assess effects on nest behaviors.

### **Academic Appointments**

- Associate Professor (Adjunct), Department of Environmental and Molecular Toxicology, Oregon State University, 2003–present
- Associate Professor (Adjunct), College of Veterinary Medicine, Oregon State University, 1987–2003

### **Advisory Appointments**

- National Research Council Committee on FIFRA and ESA, 2011–2013
- European Research Council Expert Panel Reviewer, 2009–2011
- The Institute of Environmental and Human Health, Texas Tech University, Science Advisory Board, 2005–present
- British Columbia Science Advisory Board for Contaminated Sites, 2003–present
- International Metals Consortium Ecological Technical Advisory Panel, 1995–present
- USPEA, Endocrine Disruptor Methods Validation Committee, 2004–2006
- Utah Division of Water Quality, selenium standard development, Science Advisory Panel, 2004–2008
- Novel Methods for Integrated Risk Assessment of Cumulative Stressors in the Environment (NOMIRACLE), Expert Advisory Panel, 2005–2007
- USEPA Risk Assessment Forum member, 2004–2007
- USGS BRD National Wildlife Health Center (NWHC) and Forest and Rangeland Ecology Science Center (FRESC), Peer Review Science Panel, 2005
- USEPA Office of Research and Development, Board of Scientific Counselors, 2001
- USEPA Science Advisory Panel (Pesticides), 2001
- Contaminated Soils Advisory Group, Society of Environment Toxicology and Chemistry, 1996–present
- Science Advisory Committee, US Environmental Protection Agency, Center of Excellence in Ecotoxicology, University of California, Davis, 1992–1998
- Science Advisory Panel for Soil Toxicity Criteria, British Columbia Ministry of Environment, 1996
- Peer Review Panel for Ecotoxicity Threshold Values, Superfund Program, US Environmental Protection Agency, 1995
- US Environmental Protection Agency Peer Review Panel, Ecological Risk Assessment Guidelines, 1995
- Blue Ribbon Peer Review Panel, US Fish and Wildlife Service, Patuxent Wildlife Research Center, 1990–1991

- National Research Council Committee Member, Use of Animals as Indicators of Environmental Health Hazards, 1988–1991

## **Editorships and Editorial Review Boards**

### *Editorial Boards*

- *Environmental Toxicology and Chemistry*, 1995–1997
- *Human and Ecological Risk Assessment*, 2004–present
- *Journal of Wildlife Diseases*, 1998–present
- *Risk Analysis*, 2001–present
- *Ecotoxicology*, 2009–present

### *Associate Editor*

- *Journal of Wildlife Diseases*, 1986–1991
- *Journal of Wildlife Management*, 1995–1996
- *Chemosphere* (Risk Assessment section), 2003–2005
- *Ecotoxicology*, 1995–present

### *Guest Editor*

- Seminars in Avian and Exotic Pet Medicine *Toxicology* Vol 8, Jan 1999
- Fact Sheets on Environmental Risk Assessment, [www.icmm.org](http://www.icmm.org), 2001–2002
- *Ecological Applications* special issue on mercury in Clear Lake, CA, 2006–2007

## **Peer Reviewer**

- *Archives of Environmental Contamination and Toxicology*
- *Bulletin of Environmental Contamination and Toxicology*
- *Comparative Physiology*
- *Ecological Applications*
- *Ecological Modelling*
- *Environmental Science and Technology*
- *Environmental Toxicology and Chemistry*
- *Human and Ecological Risk Assessment*
- *Integrated Environmental Assessment and Management*
- *Journal of Toxicology & Environmental Health*
- *Journal of Wildlife Diseases*
- *Journal of Wildlife Management*
- *Risk Analysis*

## **Professional Affiliations**

- American Veterinary Medical Association—AVMA
  - Committee on Environmental Issues, 2001-2003 (Chair, 2002–2003)
- American Association of Wildlife Veterinarians—AAWV
  - President, 1991–1993
- Society of Environmental Toxicology and Chemistry—SETAC
  - President SETAC North America, 2002–2003
- Society for Risk Analysis—SRA
- Wildlife Disease Association—WDA
  - President, 1995–1997