

Linda M. Ziccardi
Senior Scientist

Professional Profile

Ms. Linda Ziccardi is a Senior Scientist in Exponent's EcoSciences practice. She is an ecologist with 23 years of experience evaluating environmental impacts from chemical exposure, and remedial and development activities. Ms. Ziccardi's particular expertise is conducting ecological risk assessments and natural resource damage assessments (NRDAs) in compliance with CERCLA. Her projects have included field studies such as fish, wildlife, and vegetation baseline assessments, bioaccumulation studies, sediment quality evaluations, and quantitative risk analyses. Ms. Ziccardi also performs bioenergetics-based food chain modeling and toxicity assessments to evaluate risks to ecological receptors from chemical exposure. Her project experience also includes preparing environmental assessments and environmental impact statements (EA/EIS) in compliance with the National Environmental Policy Act (NEPA), wetlands delineation and permitting under Section 404 of the Clean Water Act, habitat restoration, and threatened and endangered species consultations.

Ms. Ziccardi has participated in regulatory negotiations on ecological risk assessment issues on the behalf of industry and has also provided technical support on projects conducted for the U.S. EPA and the U.S. Departments of Energy and Defense (DoD, DoE). She has served on EPA biological technical assistance groups in Regions 2 and 3, and has recently participated in EPA work groups that are developing ecological soil screening levels (Eco-SSLs) and a metals risk assessment framework. Ms. Ziccardi has also presented papers at international professional society meetings on the ecological effects of various chemicals, including metals, PCBs, PAHs, and nanomaterials.

Academic Credentials and Professional Honors

B.S., Natural Resource Management and Applied Ecology, Cook College of Rutgers University,
1985

Masters-level courses in environmental science, aquatic toxicology, water law, and natural resource management at Rutgers University

Publications

Ziccardi L, Salatas JH. The ecological effects of nanomaterials: A risk assessment perspective. ABA Science and Technology Newsletter 2010 Nov; 7(1).

Menzie CA, Ziccardi LM, Lowney YW, Fairbrother A, Shock SS, Tsuji JS, Hamai D, Proctor D, Henry E, Su SH, Kierski MW, McArdle ME, Yost LJ. Importance of considering the framework principles in risk assessment for metals. Environ Sci Technol 2009; 43(22):8478–8482. DOI: [10.1021/es9006405](https://doi.org/10.1021/es9006405).

McArdle M, Ziccardi L, Lowney Y, Kane Driscoll S. Considerations for interpreting nanomaterial toxicity studies for use in environmental risk assessment. Proceedings, International Conference on the Environmental Implications and Applications of Nanotechnology, University of Massachusetts Amherst, pp. 57–60, June 9–11, 2009. <http://scholarworks.umass.edu/tei>.

Ziccardi L, McArdle M, Lowney Y. The ecological effects of nanomaterials: A focus on aquatic life. Special Issue on Applications of Nanotechnologies in Environmental Protection and Pollution, Part 1. Schulte J, Vaseashta A (eds), NANO: Brief Reports and Reviews 2008; 3(4):251–255.

Nielsen D, Ginn TC, Ziccardi L, Boehm P. Study: Proposed offshore gulf LNG terminals will have minor effects on fish populations. Oil and Gas Journal 2006; 104:28, July 28.

Ludwig DF, Iannuzzi TJ, Kannan K, Giesy JP, Safe SH, Schmeising (Ziccardi) LM, Gard NW, Moore ML, Connor T. An innovative injury quantification approach for organisms exposed to AhR-active compounds. Organohalogen Compounds 1999; 44:471–478.

Technical Reports

Kapustka LA, Clements WH, Ziccardi L, Paquin PR, Sprenger M, Wall D. Issue paper on the ecological effects of metals. Submitted to the U.S. Environmental Protection Agency Risk Assessment Forum, 2004.

Framework for Inorganic Metals Risk Assessment (External Review Draft). U.S. Environmental Protection Agency, Washington, D.C., EPA/630/P-04/068B, 2004. (Contributing author).

Presentations

Ziccardi L, McArdle M, Lowney Y, Kane Driscoll S. Considerations for interpreting nanomaterial toxicity studies for use in environmental risk assessment. To be presented at the International Conference on the Environmental Implications and Applications of Nanotechnology, U Mass Amherst, June 10, 2009.

Ziccardi L, McArdle M, Lowney Y. The ecological effects of nanomaterials. Presented at nanoECO, Monte Verità, Switzerland, 2008.

Ziccardi L, McArdle M, Lowney Y. The ecological effects of nanomaterials: are new stressors associated with new technologies? Presented at the International Symposium on Nanotechnology in Environmental Protection and Pollution, Fort Lauderdale, FL, 2007.

Ziccardi LM, Bodishbaugh D. Ecological risk screening levels for total petroleum hydrocarbons: a review. Presented at the Society of Environmental Toxicology and Chemistry (SETAC) Annual Meeting, Montreal, Canada, 2006.

Ruby M, Salatas J, Darmani N, Trinh C, Lowney Y, Pastorok R, Ziccardi L. The relative bioavailability of metals from soil to least shrew. Presented at the 24th Annual Meeting of the Society of Environmental Toxicology and Chemistry, Austin, TX, 2003.

Iannuzzi TJ, Ludwig DF, Truchon SP, Schmeising LM, Gard NW. Natural resource injury assessment for polychlorinated biphenyls (PCBs) in the Lower Fox River System: Part I: Water, sediments and aquatic organisms. Presented at the SETAC 21st Annual Meeting, Nashville, TN, 2000.

Gard NW, Iannuzzi TJ, Ludwig DF, Schmeising LM, Truchon SP. Natural resource injury assessment for polychlorinated biphenyls (PCBs) in the Lower Fox River System: Part II: Fish-eating birds and mammals. Presented at the SETAC 21st Annual Meeting, Nashville, TN, 2000.

Schmeising LM, Gard NW, Ludwig DF, Wallin JM, Iannuzzi TJ. Ecological risk assessment of polychlorinated biphenyls in the Lower Fox River and Green Bay, Wisconsin. Presented at the SETAC 20th Annual Meeting, Philadelphia, PA, 1999.

Schmeising LM, Moore ML, Salatas JH, Ludwig DF, Wallin JM, Iannuzzi TJ. Assessing the risks of polychlorinated biphenyls on mink (*Mustela vison*) reproduction in the Lower Fox River and Green Bay using a toxic equivalency approach and quantitative habitat analysis. Presented at the SETAC 20th Annual Meeting, Philadelphia, PA, 1999.

Ludwig DF, Iannuzzi TJ, Kannan K, Giesy JP, Safe SH, Schmeising LM, Gard NW, Moore ML, Connor KT. An innovative injury quantification approach for organisms exposed to AhR-active compounds. Presented at the 19th International Symposium on Halogenated Environmental Organic Pollutants and POPs (Dioxin 99), Venice, Italy, 1999.

Salatas JH, Schmeising LM, Wallin JM, Iannuzzi TJ, Ludwig DF. Assessing the risks of polychlorinated biphenyls (PCBs) to bald eagle (*Haliaeetus leucocephalus*) reproduction: methodological considerations and case study. Presented at the SETAC 20th Annual Meeting, Philadelphia, PA, 1999.

Schmeising LM, Connor KT, Salatas JH, Wallin JM, Iannuzzi TJ, Ludwig DF. Extent and magnitude of reported effects of polychlorinated biphenyls, dioxins, and furans on a colonial piscivorous bird, the double-crested cormorant (*Phalacrocorax auritus*). Presented at the SETAC 19th Annual Meeting, Charlotte, NC, 1998.

Schmeising LM. An example of a graphic approach to ecological risk assessment. Presented at the SETAC 18th Annual Meeting, San Francisco, CA, 1997.

Schmeising LM, VanHorn R. A screening level ecological risk assessment for a hazardous waste combustion facility. Presented at the SETAC 18th Annual Meeting, San Francisco, CA, 1997.

Schmeising LM. An evaluation of the wildlife criteria component of the proposed Great Lakes Water Quality Initiative. Presented at the ASTM 5th Symposium on Environmental Toxicology and Risk Assessment, Denver, CO, 1995.

Gordon EK, Brenzikofer AM, Schmeising LM. Evaluating ecological risks using receptor-specific toxicity reference values and USEPA's Exposure Factors Handbook. Presented at the SETAC Second World Congress, Vancouver, British Columbia, 1995.

Schmeising LM, Gordon EK, Brenzikofer AM. Data screening methods for baseline ecological risk assessments. Presented at the SETAC 15th Annual Meeting, Denver, CO, 1994.

Iannuzzi TJ, Schmeising LM. Ecological risk assessment of a tidal creek in the Lower Chesapeake Bay—Approaches and methods. Presented at the SETAC 14th Annual Meeting, Houston, TX, 1993.

Prior Experience

Managing Scientist, Blasland, Bouck & Lee, 2000–2002
Senior Scientist, Exponent/PTI Environmental Services, 1998–2000
Senior Scientist, Parsons Engineering Science, 1994–1998
Project Scientist, Ebasco Environmental, 1991–1994
Associate Scientist, Roy F. Weston, 1987–1991

Project Experience

Natural Resource Damage Assessment (NRDA)

Provided support for a group of mining defendants for the technical and strategic defense of an NRDA case in Oklahoma. This confidential project focused on a critique of the plaintiff's habitat equivalency analysis (HEA) and their use Floristic Quality Assessment (FQA). Critiqued the FQA and floristic quality index (FQI) metric, to interpret its meaning, limitations, and appropriateness for use as a metric for natural resource injuries and service reductions.

Evaluated state trustee ecological injury and damage claims for an oil refinery in New Jersey for a confidential client. Conducted field studies including bird, benthic, and fish community surveys.

Collected data to support or refute ecological injury for a NRDA for a large river system in Oklahoma and Arkansas. This work was conducted for a confidential client.

Reviewed trustee thresholds for assessing injury, and conducted extensive literature reviews to derive alternative PCB injury thresholds for fish and birds for the NRDA for the St. Lawrence River at Massena, New York. This work is being conducted in support of settlement negotiations for a confidential group of potentially responsible parties (PRPs).

Provided technical support for the NRDA of PCBs in the upper Hudson River in New York. Compiled extensive habitat information for key species and evaluated PCB effect levels for benthos, fish, birds, and mammals.

Evaluated trustees' claims of injury and damages from PCBs in the Lower Fox River and Green Bay in support of settlement negotiations for a PRP group of paper companies in Wisconsin.

CERCLA and RCRA Ecological Risk Assessment (ERA)

Managed the ERA of a former smelter in Montana. Designed the comprehensive ERA work plan and supporting field studies to determine if metals in water, sediment, soil, and biota have the potential to cause adverse effects in ecological receptors at the site. Project included negotiations with regulatory agencies including U.S. EPA Region 8, U.S. Fish and Wildlife Service, and the Montana Department of Environmental Quality.

Managed the ERA for three sites located at the former General Motors assembly plant in Framingham, Massachusetts. Work was conducted as part of the Phase II Comprehensive Site Assessment in accordance with the Massachusetts Contingency Plan (MCP), and included habitat characterization, field study design, and risk assessment. Chemicals of concern included PAHs and metals.

Managed the ecological risk assessment of PCBs in the Lower Fox River and Green Bay, Wisconsin for a group of pulp and paper companies. Information from a detailed habitat characterization was used to quantify exposure areas for each wildlife receptor, including fish, passerine birds, piscivorous birds, and mink. An extensive field investigation was conducted including sampling of fish, invertebrates, sediment, and surface water from over 39 miles of the Fox River and the lower half of Green Bay. This project was unique in that it used both a dioxin toxic equivalency (TEQ) approach and a spatially explicit exposure assessment using GIS to assess risks to wildlife.

Managed the ERA task for the RCRA facility investigation for a General Motors assembly plant in Lordstown, Ohio. Directed field activities to collect fish, invertebrates, surface water, and sediment to characterize exposure of wildlife receptors to metals and PAHs from foraging at stormwater detention ponds on the facility.

Managed the ERA for Richardson Flat, a former mining site in Park City, Utah. Also served as field team leader for the ecological evaluation of this site, including study design, and sampling of fish, invertebrates, vegetation, surface water, pore water, and sediment to evaluate the effects of metals on ecological receptors at an onsite wetland and pond.

Conducted habitat characterizations and preliminary risk analyses for Middleground Landfill in Bay City, Michigan, and for a former Army facility at Moses Point, Alaska.

Managed the RCRA ecological risk assessments for active industrial facilities at several sites in Ohio and Michigan. Mapped vegetation cover types and wildlife habitats, sampled fish, invertebrates, surface water and sediment, and identified potential exposure pathways, key ecological receptor species, and contaminants of concern.

Conducted an ecological risk screening for the Fox Point Park site in Claymont, Delaware, to determine the potential for adverse ecological impacts to the aquatic community resulting from exposure to chemicals in sediment.

Conducted ERAs and regulatory negotiations in support of remedial investigations at six sites at Lowry Air Force Base (AFB) in Colorado. Developed food web models to estimate exposure to metals and pesticides by terrestrial and aquatic receptors of concern.

Managed ERAs at an industrial facility and a pesticides disposal site in California for confidential clients. Conducted ecological site characterizations, developed conceptual site models, and developed receptor-specific toxicological benchmark values to evaluate the potential for adverse ecological effects from exposure to petroleum hydrocarbons, metals, and pesticides.

Conducted ERAs at a fuel supply depot in Alaska and a former military missile launch site in Colorado. Developed work plans and conducted ecological site characterizations, threatened and endangered species consultations, and bioaccumulation modeling for petroleum hydrocarbons, metals, and PCBs in terrestrial and aquatic environments.

Provided technical support to Lockheed Martin Idaho Technologies Company for ERAs at the U.S. DOE Idaho National Engineering and Environmental Laboratory. Prepared risk assessments, responded to regulators' comments; technically reviewed baseline risk assessments and field sampling plans; and developed technical scopes and cost estimates. Also designed and conducted an assessment to evaluate hypothetical risks to wildlife from emissions that were predicted from a proposed hazardous waste incinerator operation.

Designed and conducted an ERA at a former pesticides manufacturing facility in New Jersey. Conducted probabilistic bioaccumulation modeling to predict exposure to organochlorine pesticides. Calculated preliminary soil/sediment cleanup goals based on protection of songbird and mammal reproductive success. Assisted in preparing a comprehensive scope of work to quantify environmental risks and develop remedial objectives for pesticides in soil, sediment, and surface water.

Technically reviewed CERCLA ecological risk investigations performed at Hamilton Army Airfield in Novato, California, under the Base Realignment and Closure Program.

Managed fish and wildlife impact analyses at industrial facilities and a former manufactured gas plant (MGP) in New York. Performed site characterizations, coverype mapping, and threatened and endangered species consultations. Evaluated exposure pathways and contaminant concentrations in surface water and sediment.

Technically reviewed the proposed EPA Great Lakes Water Quality Initiative for a coalition of Ohio utilities. Provided comments on toxicity-based water quality criteria designed to be protective of wildlife in the Great Lakes region. Compiled an ecotoxicity database and developed wildlife criteria using EPA's methodology for 16 metals of concern. Critiqued the resulting criteria, made comparisons to existing water quality standards and toxic effect levels, and documented numerous assumptions and uncertainties associated with the proposed method.

Provided technical support to Westinghouse Savannah River Company for ERAs at the U.S. DOE Savannah River site in Aiken, South Carolina. Reviewed remedial investigation work plans and researched and prepared a database of criteria and benchmark screening values, background concentrations, and ecotoxicological effect concentrations for more than 50 organic and inorganic chemicals in environmental media and biota. Prepared a sitewide sampling and analysis plan for conducting ecological assessments at the site.

Served as a technical reviewer as part of the EPA Region 2 Biological Technical Assistance Group (BTAG) and the EPA Region 3 Bioassessment Work Group. Participated as a contractor-member for more than 2 years in these EPA work groups designed to provide technical assistance regarding ecological risk assessment within the RI/FS process. Provided technical expertise in reviewing RI/FS work plans to ensure ecological components were properly addressed.

Managed the environmental evaluation of the Plattsburgh AFB electrical distribution system upgrade project. Conducted a soil sampling program designed to determine the presence and extent of VOCs, PCBs, and metals in areas targeted for excavation under the electrical distribution upgrade project for the base. Also conducted a wetlands impacts evaluation.

Managed a sediment investigation for a pesticides and chemical mixing and storage site in New Jersey. Designed a sediment sampling program to verify remedial objectives for river sediments that were affected by PCBs from historical site operations.

Conducted Environmental Priorities Initiative/Preliminary Assessments (EPI-PAs) for four sites under contract to EPA. Researched and coordinated investigations of RCRA-regulated industrial facilities to determine their potential to be included on the National Priorities List (NPL). Evaluated groundwater, surface water, soil, and air as potential pathways for contaminant migration at each site. Investigated a 15-mile surface water pathway at each site for the presence of fisheries, threatened and endangered species, wetlands, and other sensitive environments that could potentially be impacted by the migration of contaminants.

Conducted ecological investigations for the environmental impact assessment of a proposed cogeneration facility in a rural area in Catskill, New York. Conducted a vegetation survey and ecological site characterization of the proposed project site, and compiled information regarding the potential presence of rare, threatened, or endangered species in the site vicinity.

Conducted QA/QC review and provided technical assistance to EPA at the Love Canal site in Niagara Falls, New York. Served as a member of the quality assurance data validation team for the multi-phase Love Canal Emergency Declaration Area Habitability Study. Also participated in the Phase I indoor air sampling at residences of concern within the Love Canal Emergency Declaration Area.

Habitat Restoration, Wetlands, and NEPA Compliance

Evaluated technical work done by others to assess environmental impacts from liquefied natural gas (LNG) terminals in the northern Gulf of Mexico. . Reviewed the existing EISs' predicted losses of key fish species from entrainment and impingement of eggs, larvae, and fish, and developed recommendations for better scientific assessment techniques to assess the potential impacts.

Managed a stream restoration project on Clear Creek, Colorado, which has been adversely affected by historical mining practices, acid-mine drainage, channelization, runoff, and erosion. Designed instream habitat improvement structures, bank restoration and revegetation alternatives, conducted Section 404 permitting and regulatory agency coordination.

Prepared NEPA environmental assessments to determine the environmental consequences and cumulative impacts to natural resources resulting from the upgrade or replacement of various facilities at Mountain Home AFB in Idaho, Cannon AFB in New Mexico, Falcon AFB in Colorado, and Plattsburgh AFB in New York.

Conducted resource characterizations as part of the EIS for the proposed Adam's Rib Recreational Area ski resort in Colorado.

Developed an Integrated Natural Resources Management Plan for the Army National Guard in Nebraska.

Conducted wetlands investigations for the Tennessee Department of Transportation in support of an EIS for a proposed interstate highway. Delineated and mapped wetlands for five proposed interstate routes.

Prepared a wetlands mitigation plan for wetland impacts associated with remedial actions at the Lowry Landfill Superfund site in Colorado.

Delineated wetlands to determine the impacts of remedial alternatives at a Superfund site in New Jersey. Evaluated the potential for the presence of threatened and endangered species at the site, and prepared the state freshwater wetlands permit application.

Field Studies

Participated in the extent and bioavailability of remaining oil study as part of the NRDA for a large tanker spill in Prince William Sound, Alaska. Sampled fish, bivalves, mollusks, polychaetes, sea weed, crustaceans, and sediment to determine the extent and bioavailability of PAHs in the sediment and biota, and to assess the potential for injury to organisms at higher levels of the food chain.

Managed a stream characterization study for a RCRA site in West Virginia. Conducted a field effort that included riparian habitat characterization, collection of benthic macroinvertebrates, and characterization of the fish community using electro-shocking.

Conducted fish population surveys and bioaccumulation studies for species inhabiting arsenic-contaminated waterways as part of an evaluation of remedial alternatives for the Vineland Chemical Company Superfund site in New Jersey. Also assisted in sampling and data collection for a lake thermal stratification study.

Conducted field investigations at the Oconomowoc Electroplating site in Ashuppin, Wisconsin. Performed geostatistical data analysis using existing sediment analytical data. Developed a sampling plan for the assessment of a freshwater marsh that was impacted by cyanide and metals from the plating facility's outfall. Collected surface water and sediment samples for chemical analyses and bioassay, and generated a detailed site map using AutoCAD.

Conducted an extent of contamination study on a stream impacted by historic mining activities as part of the Clear Creek Superfund site remedial investigation in Idaho Springs, Colorado. Sampled surface water and sediment, and performed water quality monitoring.

Conducted an ecological assessment, including sampling of surface water and sediment for chemical analysis and bioassay, for the Ridge Road Superfund site near Harrisburg, Pennsylvania. . Also collected fish and benthic macroinvertebrates for an evaluation of species diversity and population density.

Designed and conducted extent of contamination investigations at more than 30 Superfund sites nationwide. Developed sampling strategies and conducted soil gas surveys, soil sampling, and surface water and groundwater monitoring for sites with a variety of contaminants. Assisted in developing the methodology for soil gas sampling and field screening. Produced the soil gas SOP for EPA's Environmental Response Team. Prepared site reports and contaminant plume maps.

Developed a work plan for a multi-media sampling effort at the Primoshield NPL site in Utica, New York. Sampled soils and construction materials (concrete, cinderblock, and wood beams from onsite structures) to determine waste concentrations and future disposal alternatives.

Developed a method for field screening hexavalent chromium in soil and groundwater samples at the Mouat Industries site in Columbus, Montana. Prepared a report outlining the successes/problems associated with the field screening method, and compared field data with that acquired through laboratory analysis of samples.

Professional Affiliations

- Society of Environmental Toxicology and Chemistry
- Rocky Mountain Association of Environmental Professionals
- Colorado Hazardous Waste Management Society