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**Lucinda A. Jacobs, Ph.D.**  
**Principal**

#### **PROFESSIONAL PROFILE**

Dr. Lucinda Jacobs is an environmental scientist who specializes in aquatic and sediment geochemistry, processes that mitigate exposure to toxic chemicals, and processes that control chemical transport and fate. During her 25 years of experience, she has designed, directed, and contributed to a variety of multidisciplinary environmental studies, including global studies of metal behavior in anoxic marine systems; RI/FS and ecological risk assessment projects in wetlands, river systems, urban lakes, and bays; and natural resource damage assessments (NRDAs). Dr. Jacobs has developed and directed investigations that integrated source control and chemical fate processes (e.g., bioavailability, natural recovery) with effects-based testing to derive site-specific toxicity thresholds, cleanup levels, and benchmark values. She is familiar with a wide variety of field sampling and laboratory analytical methods, including toxicity testing and radionuclide dating techniques, and she has designed or contributed to the design of a variety of field studies. She has directed the preparation of two data validation guidance manuals.

Dr. Jacobs has served as an expert witness and expert consultant on chemical fingerprinting, loading analyses, the timing of releases, natural resource injury, and the interpretation and conclusions of environmental investigations. This work has included reconstructing historical scenarios for environmental releases and analyzing existing environmental distributions in the context of current and ongoing sources and transport/fate processes.

#### **CREDENTIALS AND PROFESSIONAL HONORS**

Ph.D., Chemical Oceanography, University of Washington, 1984

M.S., Chemical Oceanography, University of Washington, 1982

B.S., Chemistry, University of California, Los Angeles (honors), 1974

#### **CONTINUING EDUCATION AND TRAINING**

Hazardous Waste Operations and Emergency Response 40-hour Certification

## PROFESSIONAL AFFILIATIONS

Society of Environmental Toxicology and Chemistry

## RELEVANT EXPERIENCE

### *Litigation Support*

*Balloon Track Litigation, Eureka, California*—Subject: Basis for assessing ecological risks attributable to contaminated property. Deposition: 2008. Trial: Scheduled for 2010.

*Puget Sound Energy v. Alba Insurance Company et al.*—Subject: Property damage, historical and ongoing sources, timing and pathway of releases, and continuity of releases associated with the Gas Works Park Site in Seattle, Washington. Deposition: 2005.

*Port of Portland v. Union Pacific*—Case No. CV 98-886-PA in the United States District Court for the District of Oregon. Subject: The relative contributions of PAHs from pencil pitch and diesel. Evaluations included a quantitative assessment of the relative contribution of PAHs from the two sources, a statistical evaluation the relationship between sediment toxicity testing, and a reassessment of available data on sediment chemistry and toxicity testing. Deposition: October 17, 2000. Testimony at trial: January 30, 2001.

*3M v. Rohm & Haas et al.*—Subject: Physical and chemical distinctions between tape ash and chemical tars and environmental consequences. Included field simulation of tape burn, laboratory analyses of waste matrices, assessment of data quality, and evaluation of physical and chemical properties to demonstrate uniquely different characteristics of different waste types. Deposition: 1996. Arbitration: Testimony 1996.

*Matter of the Certifications under Section 401 of the Clean Water Act of EPA General Permit AK-67-1000 and AK-70-0000*—Before the Alaska Department of Environmental Conservation, State of Alaska. Subject: The environmental consequences of wood and bark debris releases associated with log transfer facilities in Alaska, their effects on sediment and surface water, and the effectiveness of EPA general permits in mitigating these consequences. The National Resource Defense Council challenged the appropriateness of permits. Deposition: December 11, 2000. Hearing testimony: January 24 and 25, 2001. Client: Ziegler Law Firm (representing Alaska Forest Association).

*Loughridge and Consolidated Parties v. Goodyear*—Case No. 98-B-1302 in the United States District Court for the District of Colorado. Subject: Fluid sampling methodology performed by Goodyear representatives related to the failure of Goodyear tubing used in hydronic heating systems. Deposition: April 11, 2001.

*Georgia-Pacific Corp. v. Aetna et al.* Case No. 92-2-21950-6 in the Superior Court of the State of Washington—Subject: Industrial releases of mercury that occurred when water quality or waste discharge regulations were nonexistent or extremely limited in their application. Reconstructed the nature and magnitude of historical releases and assessed the relationship between site activities and substances of concern in adjacent water and sediments. Deposition: 1995. Settled before trial.

*Weyerhaeuser Company v. Commercial Union Insurance Company*—Case No. 92-2-05214-8 in the Superior Court of the State of Washington. Subject: Assessment of historical activities at a log sorting yard located in a commercial waterway, determination of the relative magnitude of releases relative to other sources, and evaluation of divisibility of environmental damage. Deposition: 1995. Testimony at trial: 1996.

*Time Oil v. Underwriters at Lloyd's London*—Case No. 96—2-06023-B in the Superior Court of the State of Washington. Subject: The nature and magnitude of historical releases, transport and fate of PAHs, and acceptability of environmental investigations. Deposition: 1998. Settled before trial.

*Alcoa v. Accident & Casualty*—Case No. 92-2-28065-5 in the Superior Court of the State of Washington. Subject: Transport and fate processes controlling mercury in Lavaca Bay and evaluation of release mechanisms and timing, environmental harm, and divisibility of harm. Deposition: 1996.

*Rockwell International Corporation v. Aetna et al.*—Case No. BC 050767 in the Superior Court of the State of California. Subject: Nature, transport, and fate of contaminants (including TCE and degradation products) at 16 facilities throughout the country. Case was settled before deposition.

*Western Processing, Kent, Washington*—Evaluated the transport and fate of organic and inorganic contaminants at the Western Processing Superfund site, a hazardous waste recycling facility in Kent, Washington.

*Foss/Marine Industries Northwest v. Paxport Mills et al.*—Case No. C98-5238-FDP in the Superior Court of the State of Washington. Assessed the importance of wood waste and wood waste constituents in the designation of problem sediments and as causative agents for sediment toxicity. Settled prior to deposition.

### ***Surface Water and Sediment Assessment and Remediation (including Ecological and Human Health Risk)***

*Upper Columbia River RI/FS, Washington*—Served as technical coordinator with EPA Region 10 and EPA headquarters through the initial planning stages of the RI/FS. Currently serving as principal-in-charge for Integral team activities in support of field study design and sampling, ecological risk, and remedial investigation. Key issues include metal bioavailability, strategies for efficiently characterizing and prioritizing a 150-mile-long study area, and integration of various lines of evidence related to risk.

*Ward Cove Sediment Remediation Project, Alaska*—Project manager and technical coordinator of all technical activities related to sediment assessment and remedy design, including facilitating communication with regulators. Project addressed historical pulp mill releases, which consisted largely of wood debris, organic matter, and organic matter degradation products. The absence of unacceptable human and wildlife risks, the nature of chemicals of concern, and the type of sediment toxicity were the basis for developing an innovative remedy for the 80-acre problem area that consisted of thin capping/sediment amendment

(27 acres) and natural recovery (53 acres). Successfully achieved site closure in 2009, after 6 years of natural recovery monitoring.

*Engineering Evaluation Cost Analysis Preparation for the Thorne Bay Wood Waste Landfill, Thorne Bay, Alaska*—Managed preparation of an engineering evaluation cost analysis for a wood waste landfill adjacent to the largest log transfer facility in Southeast Alaska. Project included field study design, assessment of potential impacts from leachate from a wood debris landfill, and consideration of other sources of organic material (e.g., bog leachate) to an adjacent stream. Assessment resulted in the determination that no response action was needed, and that monitoring would address any problems that may develop.

*Grand Calumet River, Indiana*—Prepared a fast-track work plan, field sampling plan, and interpretative report to meet the requirements of a RCRA corrective action order. Project included development of an innovative chemical-specific and effect-based approach that related study objectives to the restoration of the impaired uses in a manner consistent with the requirements of the Great Lakes Initiative. Indicator chemicals were identified to delineate areas affected by site chemical and distinguish historical site releases from historical and ongoing upstream loading. Ongoing loading from steel manufacturers was demonstrated to be a serious impediment to downstream sediment recovery.

*Pompton Lake Ecological Assessment, New Jersey*—Managed an ecological investigation of a lake affected by historical releases (mercury and other metals) from an explosives facility. Project included design and implementation of a phased field effort, development of an innovative interpretative approach, and negotiations with agencies. Project included food web and mass loading modeling, and development of site-specific sediment quality objectives.

*Investigation at Two Shipyards, San Diego Bay, California*—Principal-in-charge for sediment investigations, including study design, development of site-specific cleanup levels, development of remedial alternatives, and communication with regulators and environmental groups.

*Confidential Ecological Assessment*—Directed an ecological risk assessment for a former wood treatment facility located in a freshwater wetland. Activities included a parallel-track review of EPA's ecological risk assessment, negotiation of refinements to the EPA approach (e.g., use of more technically appropriate toxicity reference values and exposure assumptions), development of site-specific remedial action objectives, and incorporation of risk management considerations into the feasibility study.

*Pulp Mill Investigation, Sitka, Alaska*—Served as an independent reviewer and technical resource for a fast-track RI/FS at a former pulp mill site. Participated in the development of technical strategies for interpreting sediment data, assessing exposure and risk, and developing appropriate remedial approaches.

*Shipyards Sediment Investigation, San Diego Bay, California*—Managed an investigation of sediment contamination, biological effects, and human health effects at shipyards in San

Diego Bay, California. Project included developing effect-based, site-specific cleanup levels and communications with regulators and environmental groups.

*Onondaga Lake Remedial Investigation, Syracuse, New York*—Served as assistant program manager of a \$10 million remedial investigation conducted on a eutrophic urban lake influenced by more than 150 years of urbanization and industrial activities. Project required coordination of activities in five branch offices and involved more than 60 technical staff, 22 subcontractors, and 2 research institutes. Study addressed mercury species, chlorinated benzenes, other substances of concern, and interrelated effects of eutrophication in surface water and sediments.

*Commencement Bay, Tacoma, Washington*—Provided various levels of management and technical support for the Commencement Bay Superfund site in Washington for EPA and Washington State Department of Ecology. Activities included evaluating the relationship between source control and sediment recovery, incorporating natural recovery into site-specific cleanup levels, preparing the sediment feasibility study, and preparing an integrated action plan designed to prioritize and coordinate upland remedial activities. Also directed preparation of the record of decision and responsiveness summary for EPA.

*Clark Fork River, Montana*—Designed a sampling and analysis strategy for metals and related chemicals to support an evaluation of the processes influencing metal toxicity in a river basin impacted by mining activities.

*U.S. Navy Homeport at Everett, Washington*—Co-authored the monitoring plan for dredged disposal operations during construction activities on the proposed Navy Homeport.

*Santa Monica Bay, California*—Developed a conceptual model of contaminant transport and fate processes for a report on the bay.

*Southern California Bight*—Performed a QA/QC review of historical sediment data.

#### ***Natural Resource Damage Assessment***

*Exxon Valdez Oil Spill, Prince William Sound, Alaska*—Served as project manager and project executive for the State of Alaska and, subsequently, the EVOS Trustee Council. Project involved evaluation of the injury and restoration status of resources 17 years after the 1989 Exxon Valdez oil spill. Technical activities include document review, information synthesis, communication and coordination with trustee agencies, and public communication.

*Clark Fork River, Montana*—Managed a natural resource injury assessment at a former mining and smelting site in anticipation of litigation. Activities included study design, development of key technical arguments, design of data interpretation strategy and injury assessment methods, and preparation of an expert report.

*Confidential Wood Treatment Facility*—Served as technical advisor for a confidential client on NRDA at a former wood-treating facility. Participated in the development of methodology for identifying and prioritizing sites with potential NRD liability, prepared comments on proposed sampling plan, and participated in design of supplemental sampling effort.

*Confidential Log Transfer Facility*—Managed a project involving general technical support for a major wood products manufacturer. Project tasks included technical analyses to demonstrate to regulators that the facility was not a significant source of contaminants to a Superfund site, tracking of national policy on NRDA's and sediment-related issues, review of miscellaneous documents, and an abbreviated determination of potential natural resource damages.

*Coeur D'Alene River, Idaho*—Served as a consulting expert for two mining clients in a natural resource damage litigation related to the mining activities in the Coeur d'Alene River basin. Primary focus of assessment was water quality injuries.

*General Support to National Oceanic and Atmospheric Administration (NOAA), Nationwide*—Served as project chemist for a NOAA project to investigate the threat posed to natural resources at a variety of uncontrolled hazardous waste sites. This investigation included the assessment of environmental transport and fate processes that influenced the relationship between contaminants and sensitive resources.

#### ***Soil and Groundwater Assessment (including Human Health and Ecological Risk)***

*Shipyards Investigation, San Diego Bay, California*—Managed a site assessment and corrective action plan for soil and groundwater contamination at a shipyard facility in San Diego, California. The site was slated for redevelopment as a hotel and commercial property. Project was designed to streamline the document submittal/approval process by combining site assessment and remediation planning phases of the process. Project was closely coordinated with the California Regional Water Quality Control Board, the Port of San Diego, and an environmental group coalition.

*Technical Enforcement Support in EPA Regions 8, 9, and 10, Western and Northwestern United States*—As subcontractor, served as program manager of an EPA hazardous waste contract that covered approximately 12 sites. Activities included negotiation support, review of remedial design and remedial action efforts, community relations support, and document review, with emphasis on human health and ecological risk assessment, hydrology, geochemistry, and quality assurance.

*Petroleum Storage Facility, Washington*—Managed an investigation of a former petroleum storage facility to identify current and historical petroleum-related activities on and near the site. Project tasks included the design of a supplemental field investigation and interpretation of petroleum tracer compounds.

#### ***Guidance Documents***

*Risk-Based Site Screening, International*—Managed a project for a confidential industrial client that involved the assessment and risk-based screening of more than 60 industrial sites throughout the world. Decision guidelines for managing environmental risk were developed to allow the objective screening of industrial sites, independent of local regulations. Project involved systematic characterization and scoring of site characteristics relating to chemical use, handling practices, transport pathways, and potential receptors.

*Sediment Management Guidance, Washington*—Managed the development of four guidance documents to support contaminated sediment cleanup decisions for the State of Washington. Guidance documents were developed for general implementation of the sediment management regulations, site ranking, source loading assessment, and sediment assessment and cleanup. Existing hazard ranking systems were reviewed as part of the development of a hazard ranking system for contaminated sediments.

*Background Levels in Soil, Surface Water, and Groundwater, Washington*—Developed reference documents that characterized background concentrations for use in developing cleanup criteria for soil, surface water, and sediment in the state of Washington.

*Data Quality Guidance, Washington*—Directed the preparation of two data quality guidance manuals: one designed to streamline preliminary quality assurance review of sediment data prior to permitting and one providing detailed guidance for data validation.

### **Research Projects**

Designed sampling and analytical protocols for a field study of trace metal and sulfur speciation in anoxic marine basins. Applied a thermodynamic model to interpret metal geochemistry and developed a conceptual model of metal behavior.

Evaluated the migration of metals across a river-groundwater infiltration pathway at a polluted river in Glattfelden, Switzerland.

Participated in several field studies to evaluate sediment diagenesis of organic carbon and related constituents as reflected in pore water profiles.

Developed and implemented an integrated strategy for characterizing and classifying potentially responsible parties at a complex Superfund site with multiple contaminants, facilities, affected media, and pathways. Project included preparation of a site management database that incorporated activities conducted by state and federal agencies. Automatic output from a site management database provided efficient and timely updates on administrative milestones, enforcement actions, technical activities, and status of potentially responsible parties.

Developed a stoichiometric model to evaluate the effects of fish wastes on water quality at a fish processing plant in Alaska.

Served as task manager for a data review and compliance evaluation for the Clean Water Act Section 301(h) sewage discharge monitoring compliance program.

### **PUBLICATIONS**

Becker, D.S., J.E. Sexton, L.A. Jacobs, B. Hogarty, and K. Keeley. 2009. Biological responses to sediment remediation based on thin layer placement near a former pulp mill in Ward Cove, AK (USA). *Environ. Monitor. Assess.* 154:427-438.

Becker, D.S., L.A. Jacobs, J.E. Sexton, B. Hogarty, and K. Keeley. 2007. Biological responses to thin layer capping of organically enriched sediments near a former pulp mill in Ward

- Cove, Alaska. Presentation at the Fourth International Conference on Remediation of Contaminated Sediments, Savannah, GA.
- Klein, S.M., and L.A. Jacobs. 1995. Distribution of mercury in the sediments of Onondaga Lake, NY. *Water Air Soil Pollut.* 80:1035–1038.
- Jacobs, L.A., S.M. Klein, and E.A. Henry. 1995. Mercury cycling in the water column of a seasonally anoxic urban lake (Onondaga Lake, NY). *Water Air Soil Pollut.* 80:553–562.
- Jacobs, L.A., H.R. von Gunten, R. Keil, and M. Kuslys. 1988. Geochemical changes along a river-groundwater infiltration flow path; Glattfelden, Switzerland. *Geochim. Cosmochim. Acta* 52:2693–2706.
- Jacobs, L.A., S. Emerson, and S.S. Husted. 1987. Trace metal geochemistry in the Cariaco Trench. *Deep-Sea Res.* 34:965–981.
- Jacobs, L.A., S. Emerson, and J. Skei. 1985. Partitioning and transport of metals across the O<sub>2</sub>/H<sub>2</sub>S interface in a permanently anoxic basin; Framvaren Fjord, Norway. *Geochim. Cosmochim. Acta* 49:1433–1444.
- Tebo, B.M., K.H. Nealson, L.A. Jacobs, and S. Emerson. 1984. Bacterial catalysis of Mn(II) and Co(II) precipitation at oxic/anoxic interfaces in the marine environment. *Limnol. Oceanogr.* 29:1247–1258.
- Emerson, S., L.A. Jacobs, and B.M. Tebo. 1983. The behavior of trace metals in marine anoxic waters: solubilities at the oxygen-hydrogen sulfide interface. pp. 579–608. In: *Trace Metals in Seawater*. C.S. Wong (ed). Plenum Publishing Company, New York, NY.
- Jacobs, L.A., and S. Emerson. 1982. Trace metal solubility in an anoxic fjord. *Earth Planet. Sci. Lett.* 60:237–252.
- Emerson, S., L.A. Jacobs, S. Kalhorn, R. Rossen, B. Tebo, and K. Nealson. 1982. Environmental oxidation rate of Mn(II): bacterial catalysis. *Geochim. Cosmochim. Acta* 46:1073–1079.
- Jacobs, L., S. Becker, and J.A. Maloy. 1999. Assessment and management of historical pulp mill releases to a marine embayment—how toxic are the sediments and what makes them toxic? In: Proc. Technical Association of the Pulp and Paper Industry (TAPPI) International Environmental Conference and Exhibit, April 18–21, 1999. Nashville, TN.
- Yost, L.J., J. Maloy, N. Gard, M. Moore, W. Shields, and L. Jacobs. 1999. Dioxins: threat versus reality. A case study at a sulfite pulp mill. In: Proc. Technical Association of the Pulp and Paper Industry (TAPPI) International Environmental Conference and Exhibit, April 18–21, 1999. Nashville, TN.
- Jacobs, L.A., R. Barrick, and T. Ginn. 1988. Application of a mathematical model (SEDCAM) to evaluate the effects of source control or sediment contamination in Commencement Bay. pp. 677–684. In: Proc. First Annual Meeting on Puget Sound Research, Puget Sound Water Quality Authority, Seattle, WA.

Henry, E.A., L.A. Jacobs, S.M. Klein, and G.N. Bigham. 1993. Bulk sediment vs. pore water concentrations of total and methylmercury in an urban lake. p. 312, Abstract No. P785. In: Proc. of the 14th Annual Meeting of the Society of Environmental Toxicology and Chemistry, Houston, TX.