

Exponent®
Engineering & Scientific Consulting

Alex Revchuk, D.Env., P.E., BCES

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Professional Profile

Dr. Revchuk provides professional science, engineering, and litigation support consulting services in several areas. These include drinking water treatment process optimization, beverage manufacturing, process failure root cause analysis, engineering cost estimation, selection of environmental remediation alternatives, environmental forensics, environmental damage allocation, regulatory compliance, and impacts of wildfires on surface water supplies.

Dr. Revchuk advises private commercial and industrial entities, beverage manufacturers, medical and recreational facilities, biomedical device manufacturers, public agencies, and utilities in energy production, water, and wastewater sectors.

In the water treatment and beverage manufacture arena, Dr. Revchuk focuses on bench- and pilot-scale studies, costing, preliminary design, and optimization of conventional, ion exchange, reverse osmosis/desalinization, ozone, biological, and proprietary water treatment systems. He also assists clients with process upgrades, project management, development of standard operating procedures that incorporate Good Manufacturing Practices (GMPs), strengths, weaknesses, opportunities, and threats (SWOT), and hazard analysis critical control point (HACCP) analyses.

In the environmental remediation arena, Dr. Revchuk specializes in the evaluation of suitable groundwater and soil remediation alternatives including efficacy, technical limitations, cost estimation, permitting, and regulatory approval for a wide range of chemicals including petroleum hydrocarbon compounds, chlorinated solvents, pesticides, metals, polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs).

During his graduate work, Dr. Revchuk developed natural organic matter (NOM) characterization techniques to identify and classify organic matter in surface waters of California and Colorado. His doctoral thesis explored the impacts of southern California wildfire ash contamination (a type of NOM) on drinking-water supplies and treatment strategies to produce drinking water from wildfire-affected waters.

Academic Credentials & Professional Honors

D.Env., Environmental Science and Engineering, University of California, Los Angeles (UCLA), 2011

M.S., Environmental Health Sciences, University of California, Los Angeles (UCLA), 2006

B.S., Environmental Systems, University of California, San Diego, 2004

Bay Area Water Works Association (BAWWA), Board Member

UCLA Environmental Science & Engineering Program Endowment, 2006-2008

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Completed ABET/ASAC Accredited Industrial Hygiene M.S. Program, UCLA, 2006

Environmental Systems Major Thesis of the Year, UCSD, 2004

California Institute for Telecommunications and Information Technology, Cal-(IT)², Fellow of the Year, UCSD, 2002

Licenses and Certifications

Professional Engineer Civil, California, #84362

Professional Engineer, Idaho, #1871883

Professional Engineer Civil, Nevada, #025178

Professional Engineer Civil, Washington, #25035494

40-Hour Hazardous Waste Operation and Emergency Response Certification (HAZWOPER)

8-Hour HAZWOPER Managers and Supervisor Training (CA)

Board Certified Environmental Scientist (BCES) in Surface Water Resources,Board of American Academy of Environmental Engineers and Scientists

Prior Experience

Scientist/Engineer, Water Quality and Treatment Solutions (WQTS) Inc., 2008-2012

Graduate Lab Researcher IV, UCLA, Environmental Water Quality Lab, 2004-2008

Project Researcher, Castaic Lake Water Agency, Rio Vista Water Plant/Carollo Engineers, 2006

Project Developer and Technician, Scripps Institution of Oceanography, 2001-2004

Professional Affiliations

Bay Area Water Works Association (BAWWA), 2013-present (board member)

American Academy of Environmental Engineers and Scientists, 2014—present (member)

American Water Works Association (AWWA), 2004-present (member)

Languages

Russian

Publications

Revchuk AD, Murphy E, Rackl, S. “Building Operating Management COVID-19 Reopening Risk: Is There Legionella in Your Building's Water?” FacilitiesNet, August 2020.

Electric Power Research Institute (EPRI), Revchuk AD (co-author). Chemical Constituents in Coal Combustion Products: Cobalt. 3002016497. Palo Alto, California, 2019.

Electric Power Research Institute (EPRI), Revchuk AD (co-author). Chemical Constituents in Coal Combustion Products: Lithium. 3002012311. Palo Alto, California, 2018.

Mesard PM, Marjanovic, KC, Revchuk, AD, Schew, W. A Breath of (not-so-) Fresh Air? Recent Regulatory Guidance for Soil Vapor Intrusion Assessments with a Focus on Biogenic Methane. Environmental Perspectives Newsletter, Exponent. January 2017.

Revchuk AD, Suffet IH (Mel). Effect of wildfires on physicochemical changes of watershed dissolved organic matter. Water Environment Research, 2014; 86(4): 372-381. DOI: http://dx.doi.org/10.2175/106143013X13736496909671.

Revchuk AD, Philibert MA, Billica J, Suffet IH (Mel). The relationship of size, polarity and THMFP of DOC in Northern Colorado watersheds. Proceedings, AWWA Annual Conference, San Diego, CA, 2009.

Revchuk AD. Evaluation of the quality assurance of ultrafiltration separation for humic substances by chemical probes. Proceedings,14th Meeting of International Humic Substances Society, Moscow, Russia, 2008.

Presentations

Revchuk AD, Tanaka, G, Head, R. What's the Big Deal about PFAS and Why Should You Care? Presentation at the Association of California Water Agencies (ACWA) Fall Conference, San Diego, California, December 2019.

Revchuk AD, Thacher R. Follow the Water: Causes and Implications of Failures in Industrial and Commercial Water Systems. Presentation at the Southern California Joint Technical Symposium (JTS): American Industrial Hygiene Association (AIHA) and American Society of Safety Professionals (ASSP). Carson, California, October 2019.

Revchuk AD, Suffet IH (Mel). Physicochemical Changes of Wildfire-Derived DOM & Precipitation Effects during First Year Recovery. Presentation at The Fire Continuum Conference: Preparing for the Future of Wildland Fire; organized by Association for Fire Ecology and International Association of Wildland Fire. Missoula, Montana, May 2018.

Revchuk AD. Forensic engineering in water treatment and beverage production. Presentation to South Bay Engineers' Club, Fremont, California, April 2017.

Revchuk AD, Suffet IH (Mel). Burning questions regarding drinking water supplies and treatment. Presentation at the American Chemical Society Annual Meeting, San Francisco, California, April 2017.

Revchuk AD. Wildfire-Induced Physicochemical Changes in DOM: Watershed Dynamics and Water Treatment. Presentation to the Bay Area Water Works Association (BAWWA), San Francisco, March, 2014.

Revchuk AD, Najm I, Suffet IH (Mel), Billica J. Use of physicochemical changes in NOM to evaluate THM formation during snowmelt, after wildfires, and in pre-ozonation water treatment. Proceedings, 4th IWA Specialty Conference Natural Organic Matter: From Source to Tap and Beyond, Irvine, CA, 2011.

Revchuk AD, Najm I, Suffet IH (Mel). Wildfire-derived DOM: Physicochemical changes caused by annual precipitation events. Proceedings, AWWA Water Quality Technology Conference, Savannah, GA, 2010.

Revchuk AD, Najm I, Suffet IH (Mel). Wildfire-induced physicochemical changes in Santa Barbara source water DOC and the subsequent ozone treatment evaluation. Proceedings, AWWA Annual Conference, Chicago, IL, 2010.

Revchuk AD, Suffet IH (Mel). Ultrafiltration separation of aquatic natural organic matter: Chemical probes for quality assurance. Water Research 2009; 43(15):3685-3692.

Project Experience

Drinking Water Treatment

Conducted performance optimization evaluation of seawater desalinization treatment plant consisting of media filtration, multistage ultrafiltration (UF), multistage reverse osmosis (RO), and ultraviolet (UV) disinfection processes. Performed strengths, weaknesses, opportunities, and threats (SWOT) analyses on the complete process, including water treatment, generally recognized as safe (GRAS) ingredients, raw materials, packaging, employee training and qualifications. Oversaw technical implementation of recommendations and regulatory agency interactions. Developed standard operating procedures (SOPs) for the optimized water treatment and product handling production.

Conducted a forensic evaluation of a water treatment system designed for production of critical water for a hospital. Evaluated functionality of unit treatment processes including ion exchange softeners, carbon filters, RO, UV disinfection, water storage reservoirs, and recirculation systems. Reviewed and optimized maintenance and disinfection practices.

Operated a conventional pilot treatment train with pre-ozonation to evaluate disinfection by-product (DBP) minimization strategies following wildfires. Full-scale ozone contactor was constructed based on this pilot study. Evaluated wildfire-induced physicochemical changes in dissolved natural organic matter, post-fire watershed dynamics, and water treatment of wildfire-affected waters in order to improve coagulation efficiency, reduce membrane fouling, and minimize the production of carcinogenic disinfection by-products, such as trihalomethanes (THMs) and haloacetic acids (HAAs), during disinfection.

Performed an evaluation of drinking water treatment systems surrounding Lake Tahoe, including a survey of each plant’s unit treatment processes, and influent and effluent water quality, focusing on lead and other heavy metals. Investigated designs, modifications, operations and maintenance, and regulatory compliance, among other factors. Conducted interviews with operators and regulators.

Investigated a dispute between a municipal water treatment plant and a chemical delivery company. The treatment plant asserted the chemical company had supplied contaminated polymer product that resulted in poor filter performance and damage to pumps and other equipment. Reviewed and analyzed treatment plant performance and purity of bulk chemicals; assessed tank truck cleaning procedures and conducted interviews with chemical company representatives; evaluated cause of mechanical failures and their relations to chemical uses; evaluated costs associated with the claims.

Led a multidisciplinary investigation of UV lamp failures that included elements of water treatment, electrical power quality evaluations, lamp-manufacturing techniques, glass failure, and mechanical resonance. Evaluated installation, operations and maintenance practices, and effects of failures on water quality.

Conducted Step-2 Enhanced Coagulation criteria testing of the Stage 1 D/DBP Rule for several drinking-water treatment facilities in southern California. Established points of diminishing returns for facilities with raw waters not amenable to enhanced coagulation.

Conducted analyses of aged municipal water wells including evaluations of surrounding hydrogeological conditions, effectiveness and efficiencies of various pumping depths and pumping regimes, annular seal integrities, and impacts of corrosion on well performance.

Performed research related to mass and polarity characterization of natural organic matter (NOM) in drinking-water supplies. Evaluated spatial and temporal changes of NOM and their effects on water

treatment plants in Colorado. Made recommendations on water source selection and coagulation optimization.

Conducted a series of rapid small-scale column tests (RSSCTs) to evaluate total organic carbon (TOC) breakthrough on the post-filter adsorber granular activated carbon (GAC). Provided recommendations for GAC replacement rates.

Evaluated a range of ion exchange (IX) resins for removal of nitrate and organic color from groundwater. Developed optimal resin regeneration process. Best performing resin was selected for further pilot-scale demonstration. Operated and optimized an IX pilot treatment plant for removal of nitrate an organic color. Full-scale plant is currently in design based on the pilot scale testing.

Conducted sampling and analysis of groundwater sources for over 50 constituents. Evaluated a range of treatment alternatives, including conventional coagulation/filtration and ion exchange.

Operated an ozonation pilot treatment unit to evaluate the effect of ozone generator feed gas on the production of bromate. Evaluated bromate formation by ozone generated from ambient air and liquid oxygen (LOX). Based on the pilot study findings, a full-scale LOX facility was built at the water treatment plant.

Operated a bench scale electrochemical oxidation reactor prototype for the removal of bromide and nitrate. Performed reactor optimization and aquatic chemistry procedures.

Conducted a series of filter coring procedures in open-top and vessel filters. Filter media evaluations were used to establish a media replacement schedule.

Beverage Production

As part of a Food and Drug Administration (FDA) recall, performed a root cause analysis for a beverage product experiencing bacteriological growth in final bottled configuration. Evaluated ingredient sourcing, ingredient formulation and batching, pasteurization, bulk container handling, and bottling operations and practices. Conducted site visits, inspected equipment, reviewed records, and interviewed executives of the bottling operations. Prepared and submitted a report to the FDA. Assisted client with relaunching of the product using alternative formulator and bottler.

As part of an FDA recall, performed a root cause analysis and investigation of a bottled water and nutritional supplement company whose products were allegedly responsible for severe acute non-viral hepatitis. Conducted site visits, inspected equipment, reviewed production and quality control records.

Conducted a hazard analysis critical control point (HACCP) inspection of a mineral water treatment and bottling plant in Western Asia primarily in preparation for an FDA inspection. Inspection included review of product formulation, sourcing, treatment, carbonation, microbiological and chemical quality control, packaging, product storage, shipping, industrial hygiene, and worker safety. Reviewed ISO 9001 (quality management system), ISO 17025 (competence of testing and calibration laboratories), and ISO 22000 (food safety management system) certified practices. Provided critical, semi-critical, and non-critical recommendations to be implemented prior to FDA’s inspection.

Evaluated design, construction, start-up, optimization, performance, and defects associated with a filtration and softening water treatment system at a large dairy facility. Guided field inspections and samples collection. Conducted filtration media evaluations including scanning electron microscopy (SEM), and energy dispersive spectroscopy (EDS) analyses. Evaluated source water quality, and pump and pipe sizing designs. Reviewed delay claims associated with substandard water quality and its effects on dairy operations.

Investigated a bottled water treatment and bottling facility for alleged illicit production practices which included covert piping connections and product formulations. Assessed staff training and competency. Conducted a screening and interviewing process for replacement staff. Performed treatment process optimization, SOP and maintenance plan development. Interacted and collaborated with state regulators.

Assisted a beverage manufacturer in conducting business due diligence and advising on technical and non-technical matters during merger and acquisition (M&A) process.

Consumer Products Evaluation and Development

As part of a National Sanitation Foundation (NSF) recall of particular water valves (per (NSF/ANSI/CAN 61 “Drinking Water System Components – Health Effects”), investigated concentrations of leachables from epoxy coatings used in the valves. Guided field inspections and sample collection. Conducted theoretical calculations and evaluated leaching studies data via thermal desorption/gas chromatography-mass spectrometry instrumentation (TD/GC MS).

Assisted a consumer products company with implementing anti-scaling technologies in miniature boiler systems. Hard water scale substantially reduced product lifetimes. Assessed quality of waters from regions with most failures, reviewed product design, and assessed spatial considerations. Conducted a treatment technology screening, and developed designs, flow and flow control configurations. Developed a detailed bench-scale test plan and reviewed and summarized results. Bench-scale testing substantially increased operational lifetimes of the systems.

Conducted a survey of water-for-injection (WFI) biomedical equipment in all stages of development, from on the market products, to medical trial equipment, to patents and concepts. Identified water quality constituents dangerous for dialysis patients; selected water treatment processes to treat for these constituents; ranked equipment based on effectiveness of unit processes; ease of sterilization; energy-, space-requirements, loudness, and many other factors, including costs, and anticipated time-to-market.

Advised and peer-reviewed WFI biomedical dialysis equipment design and development process. Collaborated with a multinational team of engineers and medical professionals. Assisted with pilot study designs, performance data reviews; developed criteria and conducted hazard assessments.

Conducted a market research survey to evaluate the demand for calcium carbonate pellets produced as a by-product of a water-softening treatment process. Survey spanned a wide range of markets ranging from cement manufacture to agriculture and livestock. Treatment process feasibility was directly linked to cost recovery through sale of the by-product. Several viable buyers were identified.

Buildings and Indoor Pipe Networks

Conducted investigations and evaluations of crosslinked polyethylene (PEX) piping failures in several states across US, on behalf of both manufacturers and end-users.

Conducted chemical and microbiological evaluations of water quality in medical facility buildings to determine causes, sources, and distribution of contaminants. Developed sampling plans, mitigation and remediation actions, managed field personnel crews. Evaluated causes of algal deposits in dialysis water distribution systems and proposed alternative operations and maintenance procedures to eliminate the algal growth and deposition.

Developed a water quality management and flushing program for a newly-constructed medical facility that was being commissioned months after construction completion. Conducted chemical and microbiological (including Legionella, heterotrophic plate count, total coliform, and E. coli) evaluations, optimized flushing schedule, reviewed hyperchlorination disinfection practices.

Investigated operational and maintenance practices of pool and spa equipment at a large aquatic facility and wellness center. Assessed treatment efficacy (filtration, ozonation, UV disinfection, water heating), chemical dosing practices, pool and spa water quality, documentation and record-keeping practices, personnel training, standard operating procedures, safety practices and controls. Conducted a review of state-of-the-art best-practice regulations and guidance for pool equipment and pool operations. Prepared critical and semi-critical recommendations and oversaw system stabilization and optimization.

Conducted an investigation and characterization of water quality in residential high-rises in a western US city that experienced multiple interior piping failures. Developed sampling and testing plans and managed the sampling teams. Evaluated heating and mechanical equipment operations. Evaluated and interpreted water quality data to determine potential relationships between water quality and degradation of piping materials.

Industrial Water and Wastewater Treatment

Conducted an independent evaluation of water and wastewater treatment processes and practices at five coal/gas-fired power plants in southeast United States, including water treatment processes related to the power cycle, wastewater handling and treatment practices, and ash pond dewatering optimization. Reviewed design criteria, engineering drawings, technical reports, etc. The water and wastewater process evaluation and optimization served as a foundation for the toxicity evaluation.

Conducted analysis of thermal power plant waste streams, evaluated remediation treatment alternatives for the waste streams, including feasibility and cost estimates. Evaluated plant effluent data to assess treatment alternatives, treatment limitations, and disposal options for the dried treatment concentrate. Calculated the feasibility of expanding onsite landfills and estimated the necessary capacities and usable life projections. Developed multiple capital and operations and maintenance (O&M) cost estimates to compare alternatives, including conducting net present value (NPV) analyses.

Investigated the causes of continued contamination of a water treatment and distribution system at a pharmaceuticals manufacturing facility in the eastern United States. Evaluated the equipment replacement and optimization strategy undertaken by the manufacturer. Conducted an audit of GMPs and HACCPs.

Conducted a water quality characterization and operational optimization of a permanent dewatering system for a skyscraper in southern California. Evaluated regulatory compliance and performance of air strippers, filters, and resin treatment used as part of the dewatering system. Developed and implemented a water quality sampling program to assess system performance. Identified and procured alternative treatment technologies and assisted with design of new equipment. Conducted a SWOT analysis and implemented improvements to increase the dewatering system resilience.

Evaluated feasibility and treatment alternatives for removal of metals, color and turbidity from dewatering discharges at a multistory commercial building on the east coast. Assessed efficiencies of several treatment technologies. Evaluated installation, operations, and maintenance requirements.

Evaluated the design, construction, and operation of a manure transfer system at a dairy in Vermont that resulted in exposure decompression causing operator injury. Assessed practice standards, operational awareness, and operator decision-making.

Performed a preliminary feasibility-level design for dairy manure wastewater transfer and treatment systems using conventional and novel techniques, including wastewater treatment, sludge handling and drying, and methane gas management.

Municipal Wastewater Treatment

Investigated the causes of building material failures in a novel urban on-site wastewater treatment and disposal system and the associated wastewater system underperformance, design philosophy, and assumptions. Conducted site inspections, materials evaluations, and operator interviews.

Conducted sewer capacity calculations and evaluated wastewater treatment practices at a large multi-year industrial construction site in the Middle East. Reviewed planning documents, interim disposal practices, and construction delay claims associated with wastewater.

Developed odor mitigation approaches for a sewer lift station located in a residential development, including chemical dosing, manhole cover inserts, flow optimization, installation of turbulence-reducing devices, etc. Developed work plans for installation and operation of a pilot scale chemical dosing plant, retrofitting of an existing lift station, and restarting the operations of the existing lift station. Performed preliminary design and cost estimation. Interacted with concerned residents, local officials, regulators, technical staff, and vendors.

Conducted hydraulic testing of newly built full-scale wastewater chlorine contactors to meet recycled water disinfection requirements under Title 22. Tracer testing was required by the California Department of Public Health (CDPH) to identify the flow rate necessary to achieve a minimum modal time of 90 minutes to ensure that adequate disinfection of the recycled water is maintained.

Operated a demonstration-scale experimental pellet softening water treatment process to reduce the volume of reverse osmosis (RO) waste brine. Full-scale process designed and constructed based on this pilot study, generating pellets for a variety of commercial and industrial uses.

Assessed a municipal wastewater treatment system process and its relationship to an associated poplar grove irrigation system used for beneficial reuse of treated wastewater effluent. Evaluated design and operation intentions of the failed irrigation system, which was used as a wastewater treatment component for an end-use distribution system.

Environmental Remediation, Environmental Forensics, and Cost Estimation

Conducted an environmental assessment of a large steel mill in the midwestern US. Evaluated temporal changes in operations, waste type and management, effluent discharges, wastewater treatment processes, and analyzed pathways of specific chemical constituents of interest to sediment and groundwater. Constituents of interest included PCBs, benzene, metals, and PAHs.

Conducted a forensic environmental water quality investigation into several potential water sources that allegedly resulted in significant nonuniform foundation settling in a 200+ housing development. Evaluated historical information and reviewed hydrogeological design decisions. Developed and executed groundwater and surface water sampling program.

Prepared technical reports on coal combustion product (CCP) constituents for an independent research and development organization. Reports focused on fate and transport, water treatment, wastewater handing, and environmental remediation alternatives for lithium, cobalt, and boron.

Conducted an environmental assessment of a large steel mill. Evaluated temporal changes in operations, waste type and management, effluent discharges, wastewater treatment, and analyzed pathways of chemical constituents to environmental media such as sediment and groundwater. Constituents of interest included PCBs, benzene, metals, and PAHs.

Led a field investigation to determine sources of water in vicinity of a large landslide. Performed groundwater sampling, and utilized aquatic, geochemical, and stable isotope techniques to determine sources of various waters.

Evaluated ex-situ (ion exchange, fluidized bed reactor) and in-situ (biological remediation) remediation technologies. Calculated and determined the feasibility and effectiveness of several groundwater treatment alternatives for the treatment and remediation of organic and inorganic groundwater contaminants, including nitrate. Feasibility of alternatives was based on treatment effectiveness, waste stream production by various processes, site constraints, implementability, and maintenance. Calculated capital and O&M costs associated with the treatment systems.

Evaluated nitrate treatment alternatives for groundwater production, including advantages and disadvantages of ion exchange, reverse osmosis, and biological denitrification treatment, feasibility of the alternatives within site constraints, and order-of-magnitude opinions of probable capital, operational, and maintenance costs. Developed 3-D visualizations and models of the treatment alternatives.

Prepared cost estimates and conducted feasibility studies for mitigation and remediation alternatives for commercial and residential developments with vapor intrusion risks from petroleum and chlorinated solvent contamination. Evaluated potential efficacy, technical and cost limitations, permitting, and regulatory approval considerations.

Developed feasibility-level cost estimates for environmental remediation activities, including soil and groundwater investigation, groundwater well installation, and soil vapor extraction at a large former chemical manufacturing facility in southern California.

As part of a real estate transaction of a former manufacturing facility slated for brownfields redevelopment, prepared a fair value measurement-based forecast of environmental liabilities (per methods in ASTM E2137 and E2173) for remediation of sediments in a river next to the former facility. The forecast was used in the negotiations regarding the establishment of a remediation trust to fund future cleanup of river sediments, and to manage and minimize risks associated with the transaction.

Assisted in the development of an interactive online tool for a research institute. The tool aids users in efficiently locating relevant information on various coal combustion residuals (CCR) compounds and includes fate and transport, ex-situ and in-situ treatment, regulatory considerations.

Conducted a feasibility study of deploying turbines for energy recovery at reservoirs, in water treatment facilities, and in drinking-water distribution systems. Performed analyses of local topography, distribution system evaluations, and costs.

Peer Reviews

Water Research

International Journal of Wildland Fire