

Exponent®
Engineering & Scientific Consulting


# Kristin Robrock, Ph.D., P.E.

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## Professional Profile

Dr. Kristin Robrock is a Senior Managing Engineer in Exponent's Environmental Sciences practice. She is an environmental engineer and microbiologist who specializes in the biodegradation, fate and transport, and forensics of hazardous chemicals in the environment.

Dr. Robrock's expertise includes emerging contaminants such as PFAS and brominated flame retardants like PBDEs, as well as conventional contaminants such as chlorinated solvents, PCE and TCE, perchlorate, metals, PCBs, and petroleum hydrocarbons in soil and groundwater. Dr. Robrock specializes in environmental forensics, reconstructing environmental releases to determine the timing, sources, and mechanisms of contaminant releases, and identifying other potential sources of contamination. Dr. Robrock has also conducted numerous CERCLA cost allocation analyses and provides technical consulting on the appropriateness of remediation activities and costs, standards of the practice for historical environmental assessments, as well as compliance with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). She also assists clients with emerging issues such as environmental considerations with plastic recycling and PFAS in consumer products.

Dr. Robrock is a California licensed civil engineer and has testified as an expert witness.

## Academic Credentials & Professional Honors

Ph.D., Environmental Engineering, University of California, Berkeley, 2008

M.S., Environmental Engineering, University of California, Berkeley, 2003

B.S., Earth and Environmental Engineering, Columbia University, 2001

Tien Scholar for Environmental Science and Biodiversity, 2007-2008

University of California Toxic Substances Research and Teaching Program Fellowship, 2003-2005

Civil and Environmental Engineering Graduate Student Fellowship, 2002-2003

Tau Beta Pi Honor Society, 2000

## Licenses and Certifications

Professional Engineer Civil, California, #77047

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## Languages

French (France)

Italian

## Publications

Robrock K, Pitts B. EPA's Hazardous Substances Designation for Two PFAS May Increase CERCLA Liability for Past, Mandated PFAS Usage. American Bar Association 2024

Shields WJ, Ahn S, Pietari J, Robrock K, Royer L. Atmospheric fate and behavior of POPs. Gwen O'Sullivan and Court Sandau, editors, Environmental Forensics for Persistent Organic Pollutants. Chennai: Elsevier, 2014, pp. 199-290.

Robrock KR, Mohn WW, Eltis LD, Alvarez-Cohen L. Biphenyl and ethylbenzene dioxygenases of Rhodococcus jostii RHA1 transform PBDEs. Biotechnol Bioeng 2011; 108(2):313-321.

Robrock KR, Coelhan M, Sedlak DL, Alvarez-Cohen L. Biodegradation of polybrominated diphenyl ethers by aerobic bacteria. Environ Sci Technol 2009; 43(15):5705-5711.

Zeng X, Robrock KR, Simonich SL, Alvarez-Cohen L, Korytár P, Barofsky DF. Application of a congener specific degradation model to study photodegradation, anaerobic biodegradation, and Fe0 reduction of polybrominated diphenyl ethers. Environ Toxicol Chem 2009; 29(40):770-778.

Zeng X, Simonich SL, Robrock KR, Korytár P, Alvarez-Cohen L, Barofsky DF. Development and validation of a congener specific photodegradation model for PBDEs. Environ Toxicol Chem 2008; 27(12):2427-2435.

Robrock KR, Korytar P, Alvarez-Cohen L. Pathways for the anaerobic microbial debromination of polybrominated diphenyl ethers. Environ Sci Technol 2007; 42(8):2845-2852.

He J, Robrock KR, Alvarez-Cohen L. Microbial reductive debromination of polybrominated diphenyl ethers (PBDEs). Environ Sci Technol 2006; 40(14):4429-4434.

Robrock KR, He J, Alvarez-Cohen L. Degradation of Polybrominated Diphenyl Ethers by Anaerobic Dehalogenating Cultures. Organohalogen Compounds 2005; 67:594-597.

### Presentations

Robrock KR, Bell SP, NA Yanochik. What’s Next for PFAS: Federal & State Regulations & Looking Ahead. The 16th Annual Santa Fe Advanced Conference on Litigating Natural Resource Damages. Santa Fe, NM. September 2023.

Robrock KR, RA Billott, A Campbell, LH Shah. PFAS Regulation: Impacts on Litigation Strategies and NRD Claims. The 15th Annual Santa Fe Advanced Conference on Litigating Natural Resource Damages. Santa Fe, NM. July 2022.

Robrock KR, K Brown, B Seitz. A Best Practice Framework: PFAS And Natural Resource Damages. Natural Resources Symposium. Washington DC. September 2022.

Robrock KR and B Drollette. An Evaluation of Potential Background PFOS and PFOA Concentrations in California Groundwater. Battelle Twelfth International Conference on the Remediation of Chlorinated and Recalcitrant Compounds. Palm Springs, CA. May 2022.

Robrock KR and G Caviness. Regulating Emerging Contaminants as a Single Class: Does This Make

Sense? SETAC Conference. Virtual. November 2021.

Robrock KR. Emerging Contaminants and NRDA. The 11th Annual Santa Fe Advanced Conference on Litigating Natural Resource Damages. Santa Fe, NM. August 2018.

Robrock KR and PM Mesard. Distinguishing between multiple dry cleaner sources in a comingled chlorinated solvent plume. Battelle Eleventh International Conference on the Remediation of Chlorinated and Recalcitrant Compounds. Palm Springs, CA. April 2018.

Robrock KR. Flame Retardants: An Overview of Environmental Regulations. AATCC Flammability Symposium, Cary, NC, September 2016.

Mesard PM and Robrock KR. Forensic Evaluation and Allocation of Heavy Metals in Surface Water Runoff from Multiple Sources to an Urban Lake. Battelle Sediment Conference, New Orleans, LA, January 2015.

Robrock KR. Is human activity a good predictor for polybrominated diphenyl ether (PBDE) concentrations in the Pacific Northwest? Groundwater Resources Association of California, Emerging Contaminants Conference, Concord, CA, February 2014.

Robrock KR, Cushing C, Kierski M. Polybrominated diphenyl ether concentrations in Columbia River sediment and fish compared to other areas in North America. Poster presentation. SETAC, Long Beach, CA, November 2012.

Robrock KR. Biotransformation of polybrominated diphenyl ethers by aerobic bacteria. IWA/GRA Micropol & Ecohazard, San Francisco, CA, June 2009.

Robrock KR. Aerobic biodegradation of polybrominated diphenyl ethers (PBDEs) by PCB-degrading bacteria. Norcal SETAC Conference, Berkeley, CA, May 2008.

Robrock K, Alvarez-Cohen L. Degradation of polybrominated diphenyl ethers by aerobic PCB-degrading organisms. Poster presentation, NIEHS Superfund Basic Research Program Meeting, Durham, NC, 2007.

Robrock KR. Biodegradation of polybrominated diphenyl ethers. California Water Environment Association Student Night, Oakland, CA, March 2007.

Robrock KR, Korytar P, Alvarez-Cohen L. Anaerobic microbial degradation pathways for seven environmentally relevant PBDE congeners. Poster presentation, 107th General Meeting for the American Society for Microbiology, Toronto, Canada, 2007.

Robrock KR, He J, Korytar P, de Boer J, Alvarez-Cohen L. Degradation of polybrominated diphenyl ethers (PBDEs) by Dehalococcoides species. Poster presentation, Groundwater Resources Association Emerging Contaminants in Groundwater, Concord, CA, 2006.

Robrock KR. Anaerobic microbial debromination of polybrominated diphenyl ethers. Association for Environmental Health and Sciences West Coast Conference, San Diego, CA, March 2006.

Robrock KR, He J, Korytar P, de Boer J, Alvarez-Cohen L. Degradation of polybrominated diphenyl ethers by Dehalococcoides species. Poster presentation, 106th General Meeting of the American Society for Microbiology, Orlando, FL, 2006.

Robrock KR. Anaerobic microbial debromination of polybrominated diphenyl ethers. Dioxin 2005 Conference, Toronto, Canada, August 2005.

Robrock K, Alvarez-Cohen L. Effect of triclosan on denitrifying bacteria. Toxic Substances Research & Teaching Program Annual Conference, Sacramento, CA, 2005.

Robrock K, Alvarez-Cohen L. Triclosan: Should we worry? Effects of triclosan on environmental microbial communities. Toxic Substances Research & Teaching Program Annual Conference, San Diego, CA, 2004.

## Project Experience

### PFAS

Assisted an airport in California with identification of the per- and polyfluoroalkyl substances (PFAS) in soil, sediment and groundwater due to aqueous film-forming foams (AFFF) usage and the delineation of the groundwater plume in response to an investigative order by the Regional Water Quality Control Board (RWQCB). Reviewed PFAS occurrence in private residential wells and recommended drinking water treatment options. Provided guidance on sampling and analytical strategies, including the use of the Total Oxidizable Precursor (TOP) Assay and total organic fluorine (TOF) methods, as part of negotiations with the RWQCB. Assessed occurrence of PFAS in groundwater flowing onto the airport from upgradient biosolid application areas and PFAS present in residential septic systems not associated with airport AFFF use. Used leaching models to assess the potential for PFAS-impacted groundwater used as irrigation supply to contribute PFAS to surface soils. Estimated costs for multiple groundwater remediation strategies, including a novel in-situ biobarrier approach. Provided guidance on switching to non-fluorinated firefighting foams and equipment decontamination.

Evaluated 3 metal plating facilities for releases of chlorinated solvents, hexavalent chromium, and PFAS as part of a dispute with a landlord involving the magnitude of environmental liabilities. Conducted a forensic evaluation to distinguish between releases likely originating from the facility compared to those that likely originated from off-site sources. Prepared a cost estimate for remediation of chlorinated solvent and hexavalent chromium contamination.

Assessed the source of PFAS in groundwater in the vicinity of a former aerospace manufacturing facility in Oklahoma. Researched the historical and current use of PFAS in metal plating chemicals, hydraulic fluids, paints, fire sprinkler systems, and other industrial uses. Determined the forensic fingerprints specific to PFAS use in metal plating and AFFF and compared those to fingerprints from nearby groundwater samples. Determined that the source of PFAS in a drinking water supply well was most likely AFFF from an upgradient airport and not a nearby metal plating facility.

Researched the chemistry and biodegradation of fluorotelomer PFAS formulations used in the coated paper industry. Evaluated the fate and transport of PFAS-containing biosolids from manufacturing facilities placed on agricultural fields. Used forensic techniques to assess whether PFAS present in drinking water wells originated from the biosolids-amended fields.

Assisted in evaluating the potential source(s) of PFAS in a river used as a drinking water supply, including nearby biosolid application fields, treated wastewater discharges to surface waters, septic systems, and stormwater runoff.

Researched the historical timeline of invention, production, and common usage of PFAS chemicals, including fluoropolymers, in multiple consumer products, such as aqueous film-forming foams (AFFF), stain-resistant textiles, metal plating, and medical devices. Reviewed patents, trade journals, regulatory approvals, and historical reports to determine when certain PFAS-containing consumer products were first invented, when production first started, and when their use became commonplace. Identified key players and major events that defined the PFAS marketplace, including fluoropolymer manufacturers' response to the PFOA manufacturing phaseout. Researched the industry's analyses to understand the fate and transport of PFAS at manufacturing facilities, conducted in response to requests by the US EPA under TSCA.

Researched PFAS uses that are considered “essential uses” and how and why PFAS are used in those specific products and processes. Evaluated the potential for alternative non-fluorinated chemistries as substitutes for “essential” PFAS uses.

Analyzed a petition submitted to the European Union to request that a PFAS compound, Perfluorobutane sulfonic acid (PFBS), be classified as a “Substance of Very High Concern.” Assessed whether the fate and transport information provided in the dossier was sufficient and met the classification criteria.

Assisted various food, beverage, and consumer product companies in complying with various state PFAS food-contact regulations. Compiled company-specific information and researched the usage of PFAS in food-contact materials. Provided strategies for most-efficiently meeting the new regulations and advised on analytical testing procedures.

### Chlorinated Solvents

Evaluated the sources of TCE contamination in soil and groundwater at a former lead-smelter in Los Angeles in a RCRA action by the Department of Toxic Substances Control (DTSC). Delineated the vertical and lateral extent of the TCE groundwater impacts, as part of a contention as to which groundwater zones were impacted by the smelter and the associated remediation liability. Using other chlorinated chemicals as forensic tracers, identified contamination from a nearby site as being the contributor to TCE groundwater impacts at the smelter. Evaluated the divisibility of lead, TCE, and other chemicals present at the site based on multiple divisibility factors.

Evaluated whether the sanitary sewer was a source of PCE to groundwater in a city in the Central Valley of California due to dry cleaning discharges to the sanitary sewer. Reviewed sanitary sewer videos and sewer maintenance records, as well as leakage rates from sanitary sewers. Assessed the City’s response to research conducted by the State of California identifying sewers as a source of PCE in the city’s groundwater compared to the response from other similar cities.

Identified sources of TCE and PCE contamination in soil and various groundwater zones as part of a commingled groundwater plume in Los Angeles. Using historical site operation information, building construction documents, and historical groundwater flow patterns in the different groundwater zones, determined that deep groundwater contamination originated from adjacent sites.

Disentangled the sources of a PCE groundwater plume between a dry cleaning facility and the sanitary sewer in Santa Clara. Directed a CCTV video survey of the sanitary sewer mains and laterals. Using sewer defect information, historical groundwater flow and elevation information, and chlorinated solvent fingerprints, evaluated the potential for PCE discharged to the sewer to leak into the environment.

Reconstructed historical industrial manufacturing processes and operations and chlorinated solvent usage over time to distinguish the source of contamination between two historical site operators at a DNAPL TCE-impacted site in Northern California. Evaluated locations of historical operations, equipment, sewer lines, and other features to identify potential source areas. Conducted a spatial chemical fingerprinting analysis for various chlorinated solvents present at the site to understand the allocation of impacts. Evaluated claims of cross-contamination due to groundwater monitoring well construction, by calculating the forces required to mobilize DNAPL in the subsurface.

Assessed ongoing remediation progress and provided guidance for future remediation strategies at a former dry cleaning facility in Northern California. Reviewed available biogeochemical information to recommend using bioremediation as a cleanup approach. Recommended additional remediation strategies in light of failure of the bioremediation amendments to reach the impacted zones.

Provided guidance on vapor intrusion issues from vinyl chloride to current residents of an office complex undergoing bioremediation for TCE. Discussed potential impacts to the residents due to proposed

thermal/electrical resistance heating remediation. Provided comments to the RWQCB on the feasibility study.

Reviewed remediation work conducted at a former dry cleaner in northern California to assess whether it was conducted according to the standards of the practice at the time. Reconstructed historical release information and evaluated quantities of PCE present in the sub-surface to determine whether PCE vapors in indoor air at an adjacent facility originated from PCE left in the sub-surface after remediation activities were completed.

Investigated the timing of release of PCE at a dry cleaner facility in northern California. Evaluated costs for the on-going remediation activities.

Investigated sources of chlorinated solvents to a large, complex, commingled VOC plume in Ohio. Researched historical documentation (e.g., Sanborn maps and RCRA hazardous waste filings) to identify previously unidentified potentially responsible parties (PRPs) that had likely contributed VOCs to the plume. Used multiple fingerprinting and forensic techniques, as well as groundwater particle tracking, to disentangle and delineate the VOC plume originating from one of the PRPs.

Investigated sources of chlorinated solvents to a VOC plume in Orange County, California. Evaluated the impact of a former transducer manufacturer to the groundwater VOC plume from post-remedial residual PCE concentrations in soils compared to other industrial sites in the region. Calculated potential PCE mass contribution to the VOC plume using SESOIL. The former transducer manufacturer was also located at the head of a perchlorate plume. Researched historical information and groundwater perchlorate data to determine whether this site had been a source of perchlorate.

Investigated potential sources contributing to a large commingled PCE and Stoddard solvent plume originating from three nearby dry cleaners in Northern California. Developed chlorinated solvent biodegradation fingerprints for each dry cleaner and reviewed soil vapor concentrations to determine the each dry cleaner had contributed PCE to the groundwater plume. Developed an allocation between the three parties for remediation costs. Analyzed historical sanitary sewer plans and specifications to determine potential contributions to the PCE plume from releases from the sanitary sewer.

Assessed whether a request for "No Further Action" from the Regional Water Quality Control Board (RWQCB) for a TCE-impacted site in Southern California met the standards of the practice. Evaluated the chemical soil, soil vapor, and groundwater data available at the time upon which the request was based to determine whether the information and understanding of that information was sufficient. Evaluated whether soil vapor concentrations would have posed a threat to industrial workers at the site. Conducted a review of other sites in California that obtained "No Further Action" letters from the RWQCB to determine the environmental conditions at those sites at the time of their "No Further Action" requests.

Identified the source and timing of releases of TCE, PCBs and Stoddard solvent present at an aluminum processing facility. Evaluated whether TCE present in soil vapor originated from the site or a nearby chlorinated solvent recycling facility. Reviewed historical Toxic Substances Control Act (TSCA) regulations to determine whether the former owner had followed the TSCA regulations for investigating and remediation PCBs that were applicable at the time. Assessed whether manufacturing activities by the current owner contributed additional releases compared to those from the prior owners as part of an allocation between the site owners.

Analyzed contamination scenarios for PCE in dry cleaning facilities in the Central Valley of California, determining the quantities of PCE that could be released to sewers from various disposal methods. Quantified potential releases to the subsurface through leaking sewer pipes.

Allocated response costs among the various former and current owners and operators of a dry cleaning facility in San Francisco, California. Evaluated the degree of involvement of an absentee landlord formerly married to the dry cleaner operator as one of the Gore Factors in the allocation analysis.

Investigated the source of PCE at a former dry cleaner in Monterey, California as part of a cost recovery issue. Determined that releases most likely originated from the dry cleaning equipment instead of the sanitary sewer.

Investigated the source of PCE at a dry cleaning facility in Sonoma, California. Evaluated whether releases had occurred directly from the dry cleaning equipment as pure phase PCE or dissolved-phase PCE in separator water discharged to the sanitary sewer. Determined that leaking sanitary sewers likely contributed to the expansion of the plume cross-gradient to the direction of groundwater flow.

Conducted a cost estimate for remediation of a PCE plume at a dry cleaner facility in Oakland. Analyzed data to determine extent of contamination and possible remediation strategies.

Investigated the timing of release of PCE at a dry cleaner facility in northern California. Evaluated costs for the on-going remediation activities.

Conducted a National Contingency Plan (NCP) compliance study for remediation activities conducted at a large former manufacturing site in New York impacted with chlorinated solvents and evaluated incurred costs in a $150 million CERCLA cost recovery litigation.

Conducted a source and timing investigation at a former dry cleaning operation in northern California destroyed by a fire. Evaluated potential release mechanisms of PCE due to the fire and determined that the PCE had been released prior to the fire.

Evaluated whether a Phase I Environmental Site Assessment met the standards of the practice at the time in a case involving vapor intrusion from a PCE-plume into an adjacent residential apartment building.

Reviewed chemical and biological data at a TCE-contaminated site undergoing enhanced bioremediation. Based on 16S Dehalococcoides and dechlorinating enzyme gene counts, assessed the progress of the remediation and recommended additional substrate injection.

### Metals and Inorganic Chemicals

Assessed whether lead present in residential soil after a large wildfire originated from the fire or was pre-existing. Used statistical and spatial analysis methods to compare thousands of residential soil samples collected after the fire with pre-fire data from parks and other open space areas. Estimated potential lead remediation costs for residential homes.

Investigated the sources of heavy metals for an urban lake contaminated with lead and other metals. Quantified the amount of lead present in the lake and yearly depositional patterns. Calculated the lead contamination from direct urban runoff and aerial deposition from an adjacent roadway from historical and present automobile use. Investigated other potential sources of lead from nearby residential, military, and industrial uses, and determined the total lead input from all sources of runoff in the watershed.

Conducted a forensic analysis to identify the source of lead, arsenic, dioxins, and PAHs in soil at a school constructed on a site historically used as burn dump, containing a former manufactured gas plant (MGP) and golf course. Also evaluated lead-based paint, the school incinerator, and historical arsenical herbicide use as potential sources. Researched hundreds of historical documents to reconstruct the history of building and play areas, as well as grading events that moved soils around the site. Evaluated hundreds of soil samples to determine the relationship between the presence of ash, historical artifacts, and lampblack with the concentrations of COCs in the samples. Correlated the presence of arsenic with the location of historical golf course greens. Demonstrated that lead and dioxins originated predominantly from the burn dump, that arsenic originated from both the burn dump and arsenical herbicide usage, and that the PAHs originated from the MGP.

Evaluated a statistical analysis for natural-occurring radionuclides and radiation scans to ascertain whether a government contractor falsified data during a site remediation. Analyzed natural-occurring radionuclides present in soil samples for statistically significantly different outlier results, suggesting that those outlier results potentially represented falsified soil samples. Reviewed radiation scan data for the presence of repeated numerical patterns that suggesteddata had been copied and/or manipulated and thus represented falsified data.

Conducted an assessment of the potential environmental impacts of applying flame retardants, predominantly phosphate-based chemicals, prophylactically before the start of fire season in California.

Determined historical hexavalent chromium concentrations in groundwater for a drinking water dose reconstruction case in California.

Conducted an NCP compliance evaluation for remediation costs of a hexavalent chromium-impacted former metal plating facility in Southern California. Determined that selected activities conducted by the State of California to remediate the facility were inconsistent with the NCP and therefore the incurred costs were not recoverable.

Investigated sources of heavy metals, particularly copper, nickel and zinc, at a ship building facility to assist with NPDES compliance for water discharged to the San Diego Bay from the graving dock. Determined quantities of heavy metals in the storm water drainage system at the site draining to the graving dock. Conducted water sampling to determine rates of heavy metal leaching from ship hulls and other surfaces in the graving dock. Assisted with creation of a water quality model to compare predicted copper loadings into the graving dock with actual measured quantities. Based on modeling results, determined the most important sources of copper to the graving dock. Determined several readily-implementable recommendations for the ship builder to reduce copper loadings to achieve compliance with NPDES permit requirements.

Determined the mass allocation to the groundwater contamination from evaporation ponds at a coal-burning power plant in Nevada. Modeled seepage of salts and metals into the underlying groundwater for each evaporation pond. Allocated environmental cleanup costs owed by the two co-owners of the power plant. Investigated whether elevated total dissolved solid (TDS), sulfate, and sodium concentrations in selected wells at the site were impacted by the evaporation ponds or other background sources using geochemical data, pond construction information, and hydrogeological information.

Evaluated investigation and remediation activities for a perchlorate groundwater plume for a CERCLA cost recovery litigation. Evaluated investigations, remedial activities and removal actions conducted at the site for compliance with the NCP. Determined costs associated with past environmental investigation and remedial activities and evaluated and critiqued proposed costs for future remediation activities. Investigated other potential sources of perchlorate in the area that could be impacting groundwater. Evaluated groundwater data and regional hydrogeology to assess the extent of the groundwater perchlorate plume and potential migratory pathways—both natural and manmade—within the regional aquifer system. Assisted with MODFLOW groundwater modeling to determine future migration pathways and to reconstruct historical migration pathways for the groundwater plume. Evaluated the efficacy of the ongoing remediation activities at the site and assisted with MODFLOW groundwater modeling to evaluate the impact of a proposed remediation strategy by an opposing party on the existing remediation activities. Reviewed the groundwater investigations conducted by another party in the litigation to determine which investigation activities may have been reasonable and necessary to delineate the perchlorate plume and thus would be subject to cost recovery.

Conducted an NCP assessment of response actions carried out by a water agency in Southern California concerning drinking water supply wells impacted by perchlorate and trace concentrations of VOCs. Assessed whether the water agency’s actions were consistent with the NCP and whether the incurred costs were reasonable and necessary.

Evaluated potential sources of perchlorate at a Superfund site in Southern California with multiple historical pyrotechnics, explosives and military testing operations. Reconstructed historical operations to identify those operations most likely to have released perchlorate and those most likely to have used significant quantities of water, which could cause perchlorate to migrate deep into the subsurface. Used various soil infiltration models to estimate the time for perchlorate to reach groundwater under different hydrologic conditions, including natural rainfall and leaky water impoundments. Used MODFLOW model to estimate the travel time for perchlorate to reach drinking water supply wells.

Conducted an assessment of ammonia in the Sacramento-San Joaquin Delta in California as part of a dispute regarding ammonia releases from a wastewater treatment plant. Analyzed and mapped ammonia concentrations throughout the Delta over time and calculated ammonia biodegradation rates. Identified and quantified potential ammonia sources to the Delta, including agricultural and urban runoff. Determined that USEPA ammonia water quality criteria are attained throughout the Delta and that existing areas with elevated ammonia in parts of the Delta are unassociated with the wastewater treatment plant.

Conducted an assessment of potential impacts from "soda blasting," in which baking soda was used to remove paint from a residential property. Evaluated the mass of baking soda used and the fate baking soda after blasting. Conducted soil sampling to determine any changes to soil pH and sodium concentrations. Evaluated potential impacts to the asphalt roof from the baking soda by conducting Fourier Transform Infrared Spectroscopy (FTIR) on a roof sample. Developed costs estimates to remediate a small area of the yard that was potentially impacted by baking soda.

### Petroleum Hydrocarbons

Conducted a mass balance on a crude oil release along the coast in Southern California to determine the amount of oil that reached the ocean for a Clean Water Act (CWA) fine and a Natural Resource Damage Assessment. Calculated the approximate flow velocity of the oil. Determined rates of evaporation and biodegradation of the oil to account for losses prior to the oil reaching the ocean and for losses from the oil recovered from land. Conducted a mass balance of the crude oil once it reached the ocean. Calculated oil volumes that were lost to evaporation and biodegradation, as well as the volumes of oil that were recovered from the ocean surface and beaches. Identified the duration and extent of the oil spill on the property in which the release occurred and evaluated whether contamination associated with the spill remained on the property after remediation. Assessed whether remediation conducted on private property met cleanup goals and whether remaining TPH present at the site was associated with the spill or was pre-existing.

Reconstructed the volumes and timing of crude oil and produced water released during four separate spills at an oil production facility in central California. Estimated release volumes based on available information, including oil field pumping records, produced water reinjection records, cleanup records, as well as dimensions of the oil and produced water storage tanks.

Conducted a mass balance calculation for a gasoline release from an underground pipeline into a fractured bedrock aquifer. Calculated biodegradation rates for BTEX compounds from field data and estimated the mass of gasoline that had biodegraded since the release. Using VENT2D modeling, estimated the mass of gasoline that had evaporated from the soil shortly after the release.

Evaluated the timing and flow patterns of a release of crude oil that flowed beneath a town and created crude oil seeps along a cliff face.

Evaluated the timing and volume of a release of heating oil from a residential underground storage tank (UST) in the Northwest as part of an allocation between multiple historical property owners.

Devised a sampling plan and conducted sampling of a hydrocarbon sheen on an urban estuary using a sheen-specific Teflon ® net sampling device. Oversaw chemical fingerprinting of the collected sheen for source identification.

### Other Contaminants

Evaluated the presence of dioxins in pyrolysis oil, including incoming plastic and residue materials at a post-consumer plastic recycling facility. Worked with the EPA to identify an appropriate laboratory and analytical method for quarterly dioxin sampling under EPA TSCA requirements.

Prepared a soil management plan for the demolition of a former coastal power plant in California that was submitted to and accepted by the Department of Toxic Substances Control (DTSC). The plan was meant to assist with identifying, sampling and disposing of soils contaminated with PCBs, heavy metals, TPH and PAHs during removal of demolished structures at the site. Prepared sampling plans for PCB-impacted concrete following EPA TSCA guidance in 40 CFR 761 which were approved by the EPA for disposal of PCB-impacted concrete. Prepared a soil sampling plan for determining residual contamination after completion of demolition activities. Prepared a completion report summarizing remaining contamination at the site after demolition activities were completed that distinguished between contamination associated with historical activities carried out by the former operator and contamination associated with new activities carried out by the current operator. Conducted a forensic analysis on TPH contamination present in site soils to determine the sources and ages of the TPH releases.

Investigated a PCB release associated with a vandalism event at a building undergoing demolition in Northern California. Using PCB fingerprints, determined the extent of PCB contamination associated with the vandalism event and previously existing PCB contamination. Reviewed the reasonableness of costs for remediation and disposal of PCB-containing concrete and soil waste at a TSCA-approved disposal facility.

Modeled the fate and transport of pesticides and herbicides sprayed at a Christmas tree farm in Washington State that were claimed to have impacted an adjacent cattle ranch. Modeled both aerial transport and deposition of liquid droplets as well as transport to an adjacent stream via stormwater runoff. Using biodegradation half-lives, estimated residual pesticide concentrations in downgradient vegetation and surface water runoff six months after spraying.

Evaluated the mobility of dense non-aqueous phase liquids (DNAPLs) present in sediments in the Chicago River near a former manufactured gas plant (MGP). Oversaw DNAPL lab testing of the sediment samples using a centrifuge method (modified ASTM D425 and API RP40 [Dean-Stark method]) and water-drive method (API RP40) to determine the DNAPL saturations. Calculated the potential mobility of DNAPL based on theoretical principles and compared it to the laboratory results to determine that the DNAPL present in river sediments is below residual saturation levels and would likely not be mobile.

Compiled anaerobic biodegradation rates for a cap design of contaminated lake sediments, and calculated the range of expected half-lives. The contaminants of interest included BTEX, PAHs, chlorinated benzenes, phenol, and PCBs.

Researched historical documentation on Natural Resource Damage (NRD) claims in the State of New York, in particular for the time frame before NRD regulations were promulgated. Determined the sites in which NRD claims had been made and the outcomes of those claims.

Conducted an assessment of the concentrations of the flame retardants PBDEs in fish and sediments in the Columbia River near a consortium of industrial facilities in Trail, British Columbia, Canada. Calculated doubling times and compared concentrations to fish and sediments in other areas of the Pacific Northwest. Compared PBDE concentrations to human health effect and ecological screening levels to assess potential risks from local fish consumption and exposure to sediments for humans and animals. Evaluated potential sources contributing PBDEs to the region.

Prepared a sampling plan and conducted sampling of soils and hydraulic fluids in 55-gallon drums for chromium, dioxins and furans, and VOCs from a former metal-plating facility.

Conducted a literature review of bacteria associated with foot odors in healthy people for an FDA 510K submission for anti-embolism stockings treated with the antimicrobial triclosan. Devised a testing protocol for determining the antimicrobial effectiveness of the stockings against appropriate odor-causing foot bacteria. Oversaw antimicrobial testing of stockings and determined appropriate odorous chemicals to analyze during a sniff test.

### Environmental Engineering

Investigated causes of flooding at a residential development from a stormwater system consisting of an underground stormwater sewer and a natural drainage channel. Oversaw topographic surveying and sewer surveying. Developed hydraulic grade lines and calculated volume of sediment to be removed to restore conveyance of stormwater through the channel.

Reviewed historical waste regulations, including RCRA and CWA, to determine the standard of practice for construction, closure, and groundwater monitoring of surface impoundments for red mud, or alumina processing residue, at a former alumina facility in the Caribbean. Researched available records for alumina facilities world-wide to establish the standards of the practice for siting and construction of surface impoundments in the 1960s through 1980s. Reviewed literature of the hydraulic conductivity of red mud when used as a liner for surface impoundments.

Assessed historical RCRA closure documentation for waste management units (WMUs) at a former transducer manufacturing facility in Indiana to determine whether the WMUs had been appropriately closed and if they were in current compliance with RCRA.

Reviewed historical California and federal asbestos waste handing regulations to determine whether a former asbestos pipe manufacturing facility met the applicable regulations at the time.

Conducted a review of design criteria and estimated construction costs for a wastewater treatment plant upgrade in Pennsylvania as part of dispute over the standards of practice. Analyzed the projected flow rates and projected NPDES effluent limits used as the design basis for the upgrade. Determined that the projected flow rates and NPDES effluent limits were appropriately developed. Determined that the design firm had appropriately developed and notified the client of estimated construction costs.

Conducted an analysis of groundwater flow between two adjacent basins as part of a dispute over water replenishment costs in Southern California. Researched hydrogeological information to determine the extent of the groundwater divide separating the basins. Compiled groundwater pumping and flow records to determine the volumes of water entering and exiting the basins. Determined that natural flow between the basins was not being accounted for in the replenishment assessment calculations used to establish costs for water replenishment activities in the basins.

Compiled water quality data, specifically hardness and sodium levels, for drinking water in major metropolitan cities throughout the United States. The data were to be used by a consumer project manufacturing client to determine the appropriate water quality to use in product testing.

Investigated chemical compounds likely historically present in stormwater runoff from a variety of industries with stormwater outfalls that discharged into a canal. Determined the historical time frames in which stormwater runoff could have discharged to the canal and the specific discharge locations for each industry. Developed an allocation method for contributions from stormwater runoff based on surface area for each property as a proxy for historical stormwater flow rates and an allocation matrix for remedial design costs.

Oversaw daily dredging activities of PCB-contaminated sediment in a ship-loading channel in New York harbor for a metal recycling facility. The sediment was chemically stabilized and used for an experimental project involving stabilization of mining-impacted hillsides in Pennsylvania. Oversaw construction of a golf course on a brownfield using the stabilized sediment. Handled an extension of the dredging permit and performed field sampling. Assisted with design of the dredged channel.

Assessed design criteria for a wastewater treatment plant (WWTP) in Pennsylvania as part of a contractual dispute between the WWTP designer and the municipality. Specifically, determined whether the future flow rates and water quality criteria developed by the WWTP designer were appropriate. Also assessed whether the costs incurred by the WWTP designer were necessary and whether the designer appropriately communicated with the municipality regarding the design and construction costs.