

TECHNICAL SPECIALTIES

Dr. Gerbig's practice includes environmental engineering; environmental chemistry; chemical bioavailability, fate, and transport; litigation support; and site investigation and remediation. Dr. Gerbig has provided technical analyses and designs for complex environmental matters involving chlorinated solvents, metals, petroleum, coal tar, VOCs, SVOCs, PAHs, and indoor air contamination at CERCLA sites and in various state-level regulatory programs. Dr. Gerbig's technical expertise includes:

- Geochemistry of organic and inorganic contaminants;
- Bioavailability of heavy metals;
- Design and evaluation of engineering remedies to remediate and/or mitigate environmental contamination in soil, sediments, and groundwater;
- Apportionment of liability and cleanup costs among potentially responsible parties;
- Evaluation of remediation compliance with National Contingency Plan, CERCLA, and State Programs;
- Assessment of the necessity and reasonableness of past remediation costs;
- Estimation of future remediation costs; and
- Environmental data analysis

TRAINING & CREDENTIALS

Post Doctorate, 2012-2013 – Yale University, School of Forestry and Environmental Studies

Ph.D., Civil Engineering, 2011 – University of Colorado, Boulder

M.S., Civil Engineering, 2008 – University of Colorado, Boulder

B.S., Civil & Environmental Engineering, 2005 – Clarkson University

E.I.T. (Engineer-in-Training) Certification

EXPERIENCE SUMMARY

Over 10 years of experience in environmental chemistry, environmental remediation, regulatory compliance, cost evaluation, and fate & transport of organic and inorganic compounds.

- Principal Engineer, Roux, 2020-Present
- Senior Engineer, Roux, 2016-2019
- Project Engineer, Roux, 2013-2016
- Post-doctoral Research Associate, Yale University School of Forestry and Environmental Studies, 2011-2013.
- Graduate Student Researcher/Lead Teaching Assistant, University of Colorado Boulder and US Geological Survey, 2005-2011.

KEY PROJECTS

Litigation Support

Former Landfill, Chlorinated Solvents and Vapor Intrusion, Ohio: Testified regarding chemical leaching from reclaimed asphalt adjacent to a former landfill undergoing a CERCLA cleanup.

Considered the potential for chemicals released from reclaimed asphalt to impact soil, groundwater, and soil vapor at levels that required vapor intrusion mitigation measures at adjacent buildings. Supported the allocation of costs for vapor intrusion mitigation measures associated with the landfill.

Former Equipment Testing Laboratory, Chlorinated Solvents, Alabama: Evaluated the necessity and reasonableness of past site investigation and remediation and remediation costs associated with historic TCE releases at an engineering and parts testing facility. TCE and associated degradation products impacted overburden and bedrock, shallow soil, and indoor air. Evaluation of costs on behalf of insurance carriers involved in the litigation.

Former Dry Cleaner, Chlorinated Solvents, Oklahoma: Testifying expert regarding the necessity and reasonableness of past and future costs, and compliance of the response action with the National Contingency Plan. Developed alternative remediation scenarios based on excavation and in-situ approaches to demonstrate that the opposing cost estimate was unreasonably high and largely unnecessary. Demonstrated that response actions were inconsistent with the NCP due to various factors, including, but not limited to failure to provide appropriate opportunities for community involvement, violation of Applicable or Relevant and Appropriate Requirements (ARARs), and the incorrect selection of the type of removal action. Cost analysis was utilized to prepare an allocation of response action costs among responsible parties.

Uranium Mine Tailings Pond, Australia: Modelled the complex geochemistry of a uranium mine tailings pond water treatment system to determine causes of failure during operation, including excessive scale formation during water pre-heating. Considerations included the effects of water chemistry variations, pH, and temperature on the system's thermodynamic equilibrium and the effects of system operations on the kinetics of scale formation.

Former Landfill, Chlorinated Solvents, Metals, and 1,4-dioxane, Massachusetts: Retained by a community group to evaluate potential groundwater (including drinking water) and surface water contamination originating from a closed and capped municipal landfill. Evaluated the historic closure of the landfill and modern groundwater chemistry and hydrology to determine the nature, extent, and source of chlorinated solvents, metals, and 1,4-dioxane impacts.

Prepared two technical memoranda for the community group and represented the community group at town meetings.

Former Chemical Distribution Facility, Chlorinated Solvents, Florida: Evaluated the efficacy, costs, and regulatory compliance of a bioaugmentation remedy to treat chlorinated solvents (PCE, TCE, DCE, and Vinyl Chloride). Prepared less expensive and more effective alternative air sparge-soil vapor extraction (AS/SVE) system design. Evaluated chlorinated solvent fate and transport model and developed alternative model.

Former Naval Facility, Various Contaminants, California: Evaluated metals, total petroleum hydrocarbon (TPH), volatile organic compound (VOC), semi-volatile organic compounds (SVOC),

and chlorinated solvent contamination in soil and groundwater to determine when contamination was known or reasonably knowable, necessity and reasonableness of remediation costs/insurance claims, and nature of the interaction with regulators. Conducted analysis for three sites at the facility: a sanitary sewer pump station with deep contamination, an industrial building with petroleum pipelines below the building structure, and a paved area with near-surface contamination. Prepared evaluations and sections of the expert report in support of an expert witness and assisted with strategy.

Former Manufactured Gas Plant Superfund Site, PAHs and Tar, Wisconsin: Evaluated necessity and reasonableness of past site investigation and remediation costs (~\$25M), and site investigation and remediation compliance with the National Contingency Plan (NCP). Supported allocation of responsibility among PRPs based on calculations of Manufactured Gas Plant (MGP) tar in the environment and historical analysis of MGP operations from ~1880-1940s. Project manager, prepared sections of expert report, prepared expert witness for depositions and trial, evaluated expert reports and deposition testimony of seven opposing experts, and prepared trial testimony.

Former Mining and Fertilizer Manufacturing Facility, Superfund Site, Arsenic and Radionuclides, Florida: Determined necessity and reasonableness of past site investigation and remediation costs, remediation compliance with the National Contingency Plan, and appropriateness of selected remedy for an approximately 1,000-acre facility with surface water, groundwater, soil, and sediment contamination. Evaluation included an analysis of a cap for contamination in a former holding pond and surface water management system. Prepared sections of expert report and supported expert witness in depositions.

Former Landfill and Current Middle/High Schools, PCBs, Massachusetts: Determined compliance of remedy with

Massachusetts Contingency Plan (MCP) regulations, including public involvement requirements, and Toxic Substance Control Act (TSCA). Evaluated necessity and reasonableness of ~\$20M of remediation costs that included soil removal, wetland sediment removal, building materials surveys, installation of a soil cap, and installation of a liner for a building constructed on the remediated site.

Chemical Manufacturing Facility, Chlorinated Solvents, New Jersey: Evaluated the historical standard of care and state of knowledge of trichloroethylene (TCE) handling and toxicity at a chemical manufacturing facility. TCE disposal allegedly contaminated groundwater and impacted residential neighborhood. Prepared sections of expert report.

Govanus Canal Superfund Site, Coal Tar, PAHs, and metals, New York: Developed an allocation model to assign costs for the remedial design of the site remedy to multiple potentially responsible parties, including parties responsible for Manufactured Gas Plant (MGP) tar and PAHs, and combined sewer overflows (CSO). Remediation will include

dredging, in-situ solidification, installation of a sub-aqueous cap, and various other upgrades. The model coupled the costs of the design components, the portion of the site to be remediated by those design components, and forensic analyses to determine responsibility of reach portion of the site to be remediated.

Landfill, Metals and Other Landfill Leachate Contaminants, New Jersey: Evaluated the landfill leachate to determine if there was a unique industrial source of contamination that was distinguishable from municipal solid waste leachate. Estimated a municipality's contribution of waste to the landfill, the amount of the landfill covered by that waste, the economic benefit derived by the municipality from disposing of their waste for free at the landfill, and the hazardous substances likely present in the municipality's waste. Identified the allocation factors pertinent to an allocation of remediation costs of the site to the municipality, including the municipality's ownership of the site, generation of waste, transport of waste, arrangement for others to dispose of waste, economic benefit derived from the disposal of the waste, and participation in past remediation.

Dry Cleaner Release, Massachusetts and New Hampshire: Evaluated the time of travel of releases from a dry cleaner operation that began in the 1970s to demonstrate that two PCE plumes actually exist at the Site. Corroborated the differentiation of the two plumes with soil gas data, information about historic dry cleaner operations and release mechanisms, and transport of contaminants at other, nearby sites. Evaluated the stability of the chlorinated solvent plume and the viability of monitored

natural attenuation as a remedy. Estimated future costs for the remediation. Allocated responsibility for the remediation based on duration of operation and release timing.

Magnesium Manufacturing Facility, Utah: Prepared cost estimates for the complete remediation and closure of a large manufacturing facility under CERCLA, RCRA, and state-level programs in support of bankruptcy litigation. Contaminants include dioxins, furans, PCBS, and hexachlorobenzene in waste pond sediments, a sanitary lagoon, a solid waste landfill, and several industrial waste streams stored on the property. Evaluated the viability of a novel, green remedial capping technology utilizing accumulated salt from the Great Salt Lake to prevent exposure to contaminants, as well as more traditional capping and excavation remedies.

Petroleum Filling Station, New York: Evaluated the source of petroleum contamination at an abandoned filling station and demonstrated that a portion of the on-site impacts were originating from an up gradient source. Surficial soil on the site showed evidence of release, but forensic information

associated with groundwater plume, coupled with the site hydrogeology, indicated that an adjacent site, not the former filling station, was the source of groundwater contamination.

Engineering, Site Investigation, & Remediation

Brownfields Cleanup Program Site, New York: Conducted investigation and pre-characterization of petroleum and lead contaminated soil; planned and executed interim removal action to facilitate immediate site redevelopment; designed sub-slab depressurization system for new and existing buildings to mitigate indoor air impacts; prepared engineering specifications for excavation, transportation, and disposal of approximately 20,000 tons of contaminated soil and approximately 10,000 tons of soil for reuse on site; oversaw field efforts; prepared New York State Department of Environmental Conservation Brownfields Cleanup Program submissions, including Remedial Investigation/Alternatives Analysis Report, Interim Remedial Action, and Remedial Action Work Plan. Following completion of remediation designed stormwater management system and managed the installation of the stormwater management system design.

Real Estate Redevelopment Site, Brookline, Massachusetts: Conducted and prepared ASTM Phase I investigation, designed and implemented Phase II investigation of soil and groundwater, oversaw building materials survey and remediation of lead, asbestos, and PCBs, pre-characterized on-site soil for reuse or for off-site disposal, managed soil removal activities, and prepared

Massachusetts Contingency Plan submissions (RAM Plan, Completion Report).

Petroleum Terminal, Massachusetts: Planned technical excavations of petroleum and metals-impacted soil adjacent to sensitive infrastructure, include bulk petroleum storage tanks and historic buildings. Projects included design of remedial approach, preparation of technical specifications, structural and vibration monitoring of sensitive infrastructure, soil pre-characterization, abandoned pipeline removal, and reporting under the Massachusetts Contingency Plan.

Wetland Remediation, Connecticut: Prepared remedial investigation work plan and conceptual remedial design alternatives analysis for in-situ remediation of metal- and solvent-contaminated wetland sediment. Prepared novel wetland remedial design which includes stabilizing metals in place with additions of compost and gypsum, in lieu of substantially more expensive excavation and reconstruction alternatives.

River Sediment Dredging, New York: Prepared investigation plan and conceptual remedy alternatives for dredging of petroleum-contaminated sediments in a large river where State and Federally listed threatened and endangered species of muscels reside. Conceptual remedies include wet and dry dredging alternatives. Planned and permitted the sediment remedy, including managing of threatened and endangered species present in the river, and addressing U.S. Army Corps of Engineers' requirements regarding work on and near flood control structures.

Waste Oil Site Superfund Site, New Hampshire: Evaluated the effectiveness of remedial actions following the first five-year review of a Superfund Site on behalf of one PRP at a multiple PRP site. Considerations included the effectiveness of hydraulic containment of groundwater treatment system; presence, distribution, and treatment system effectiveness addressing perfluorinated compounds and 1,4-dioxane in the groundwater; soil remediation and separate phase product recovery with thermal remediation methods; and exposure to adjacent residential receptors.

Petroleum Pipeline, Massachusetts: Designed and oversaw installation of an engineering solution to an exposed petroleum pipeline crossing of an ephemeral stream. The active petroleum pipeline was exposed and suspended above the stream channel. Remedy included installation of culverts below the pipeline to provide structural support, reconstruction and armoring of stream channel, and burial of the pipeline above culverts.

Lead Mining and Smelting Operation, Missouri: Evaluated natural resource damages (NRD) claim related to impacts from lead smelting operations and transport of lead-laden ore in support of an insurance analysis. Impacted natural

resources included forest lands, stream ecosystems, surface and groundwater impacts, and several endangered/threatened species.

Superfund Site, Woburn, Massachusetts: Implemented surface water monitoring program, including operation and maintenance of surface water monitoring equipment, baseline water quality sampling, and storm water sampling during high-flow events.

Former Dry Cleaner and Current Shopping Mall, Enfield, Connecticut: Remediated a former dry cleaner location with solvent contamination below the slab of an occupied commercial building. Designed a combined in-situ chemical oxidation and sub-slab depressurization system to remediate dry cleaning solvent (PCE) contamination below an operating commercial building and protect human health. The remediation system was designed to allow for all future chemical injections over an approximately two-year period to take place without disturbing building operations.

Industrial Chlorinated Solvent Site, Massachusetts: Prepared a Massachusetts Contingency Plan Phase III to evaluate potential response actions to address chlorinated solvents in soil and groundwater. Downgradient receptors included residential properties and wetlands. Evaluated appropriate technologies, prepared cost estimates for viable technologies, and recommended comprehensive remedial alternatives that would achieve a permanent solution. Prepared detailed evaluations and cost estimates for various technologies, including indoor air mitigation measures, barrier walls, and soil excavation.

ASTM Phase I Environmental Site Assessments: Prepare Phase I Environmental Site Assessments that meet the standards and requirements of ASTM E1527-13 Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process. Performed Phase I's on properties utilized historically for various purposes, including: automobile repair, printing operations, general commercial office space, residential homes, and painting and metal working.

Industrial Compliance: Assist industrial clients with compliance services, including evaluations of stormwater systems, preparation of stormwater pollution protection plans (SWPPPs) and coverage under EPA's National Pollution Discharge Elimination System (NPDES) Remediation General Permit (RGP). Recent RGP works involves obtaining RGP coverage for a groundwater pump and treatment system treating chlorinated solvent contaminated groundwater and discharging to an Outstanding Resource Water.

PUBLICATIONS

Poulin, B.A.; Gerbig, C.A., Kim, C.S., Stegemeier, J.P., Ryan, J.N., Aiken, G.R. (2017) Effects of Sulfide

Concentration and Dissolved Organic Matter Characteristics on the Structure of Nanocolloidal Metacinnabar. *Environmental Science & Technology*, 51(22): 13133-13142. doi: 10.1021/acs.est/7b02687.

Sullivan, D.; Kwan, W.; Gerbig, C.A.; Moore, C. (2015) Proactive Evaluation of PRP Status at Hazardous Waste Disposal Sites. *Environmental Claims Journal*, 27(2): 140-148. doi: 10.1080/10406026.2015.1035570

Ram, N.M.; Kwan, W.; Gerbig, C.A.; Moore, C. (2014) Extricating Membership as a PRP at Hazardous Waste Disposal Sites. *Remediation*, 24(2): 91-106. doi: 10.1002/rem.21386

Gerbig, C.A.; Ryan, J.N.; Aiken, G.R. (2011) The Effects of Dissolved Organic Matter on Mercury Biogeochemistry in *Environmental Chemistry and Toxicology of Mercury* (eds. G. Liu, Y. Cai, and N. O'Driscoll, eds.), John Wiley & Sons, Hoboken, NJ, USA. doi: 10.1002/9781118146644.ch8

Gerbig, C.A.; Kim, C.S.; Stegemeier, J.P.; Ryan, J.N.; Aiken, G.R. (2011) Formation of Nanocolloidal Metacinnabar in Mercury-DOM-Sulfide Systems. *Environmental Science & Technology*, 45(21): 9180-9187. doi: 10.1021/es201837h

PROCEEDINGS

Ram, N.M.; Gerbig, C.A. (2014). Boston Bar Association Trying Environmental and Land Use Cases: Draw Me the Line; See What I Mean; Hear What I Say, Panel Presentation, Boston, Massachusetts.

Gerbig, C.A.; Kim, C.S.; Stegemeier, J.P.; Ryan, J.N.; Aiken, G.R. (2011) "The role of DOM, Hg:DOM ratio, sulfide concentration, and kinetics on the formation of metacinnabar-like particles in Hg-DOM-sulfide systems." Tenth International Conference on Mercury as a Global Pollutant, Halifax, Nova Scotia, Canada, July.

Gerbig, C.A.; Ryan, J.N.; Aiken, G.R.; Kim, C.S.; Stegemeier, J.P.; Moreau, J.W. (2010) "Identification of metacinnabar in mixed mercury, sulfide, and dissolved organic matter solutions through chromatographic concentration and EXAFS." Goldschmidt Conference, Knoxville, TN.

Slowey, A.J.; Gerbig, C.; Aiken, G.R.; Ryan, J.N. (2010) "Development of an electrochemical surrogate for copper, lead, and zinc bioaccessibility in aquatic sediments." SERDP Partners in Environmental Technology Technical Symposium & Workshop, Washington, D.C., November 30-December 2.

Gerbig, C.A.; Kim, C.S.; Moreau, J.W.; Aiken, G.R.; Nagy, K.L.; Ryan J.N. (2008) "Evidence for the presence of colloidal metacinnabar in Hg- DOM-sulfide systems as

determined by a novel chromatographic-EXAFS method.” American Geophysical Union Fall Meeting, San Francisco, California, December.

Moreau, J.W.; Roden, E.E.; Gerbig, C.A.; Kim, C.S.; Aiken, G.R.; DeWild, J.F.; Krabbenhoft, D.P. (2007) “The role of dissolved organic matter in environmental mercury methylation by sulfate-reducing bacteria.” American Geophysical Union Fall Meeting, San Francisco, CA.

Ryan, J.N.; Aiken, G.R.; Ravichandran, M.; Gerbig, C.A. (2007) “Effects of natural organic matter on mercury(II) speciation: Inhibition of metacinnabar precipitation and nanocolloid formation.” American Geophysical Union Fall Meeting, San Francisco, California, December.

Gerbig, C.A.; Aiken, G.R.; Ryan, J.N. (2007) “Competitive binding between mercury and copper for reduced sulfur binding sites on dissolved organic matter from the Florida Everglades.” American Geophysical Union Fall Meeting, San Francisco, California, December.

Gerbig, C.A.; Grimberg, S. (2006) “Mercury complexation with dissolved organic matter as a function of redox conditions.” Eighth International Conference on Mercury as a Global Pollutant, Madison, WI.

Gerbig, C.A.; Grimberg S. (2006) “Mercury complexation with dissolved organic matter as a function of redox conditions.” CU Boulder Hydrologic Sciences Symposium, Boulder, CO.

PROFESSIONAL AFFILIATIONS

American Bar Association Section of Energy, Environment, and Resource, Science and Technology Committee – Co-chair

American Society of Civil Engineers – Member

HEALTH & SAFETY

OSHA 29 CFR 1910.120 40-hour Safety Trained

OSHA 29 CFR 1910.120(e)(8) 8-hour Refresher Trained

Smith System® Driving Certified

CPR/First Aid Certified

Loss Prevention System™ (LPS) Trained

Transportation Worker Identification Credential (TWIC®)

VOLUNTEER

Board of Selectmen (active), Littleton, MA

Conservation Commissioner (former), Littleton, MA

Science Communication Fellow, The Discovery Museums, Acton, MA