

Steven O. Helgen

Principal



Education and Credentials

M.S., Geology, University of Montana, Missoula, Montana, 1995

B.A., Geology, Carleton College, Northfield, Minnesota, 1990

Continuing Education and Training

Short Course: The Environmental Geochemistry of Sulfide Mine Wastes, GAC-MAC, Waterloo, Ontario (1994)

Hazardous Waste Operations and Emergency Response 40-hour Certification (1995; refreshers 1996–2010)

Mine Safety and Health Administration (MSHA) Certification (1996; refreshers 1997–2009)

Professional Affiliations

Sigma Xi

Member of International Association of Geochemistry

Professional Profile

Mr. Steve Helgen is a consultant specializing in geochemistry, hydrogeology, and environmental forensics. He has over 20 years of experience in contaminant fate and transport, geochemical fingerprinting, and apportionment in complex, multiparty environmental disputes involving sediments, groundwater, and industrial facilities. Mr. Helgen has provided expert testimony consisting of depositions, affidavits, and courtroom testimony in both state and federal court. He has developed and published apportionment methods that have proven instrumental in settlement negotiations and at trial.

Mr. Helgen has successfully applied a number of geochemical forensic techniques to identify sources and determine the timing and quantity of releases. At industrial sites, he has performed site investigations, developed innovative remedial strategies, conducted soil gas assessments, performed isotopic studies, and determined the fate and transport of a variety of organic compounds including sulfolane, PCBs, 1,4-dioxane, solvents, coal tar, and perfluoroalkyl compounds such as PFOA and PFOS. For the mining industry, Mr. Helgen has led materials characterization studies and developed numerical models of sulfide oxidation, pit lake geochemistry, and metals behavior in stream sediments and groundwater.

Relevant Experience

Environmental Forensics/Litigation Support— River Sediments

CERCLA PCB Site, Michigan—Provided expert testimony regarding relative contribution of PCBs from a paper mill to a river system with multiple sources of PCBs from a number of paper mills and industrial sources. Work included development of an expert report, an expert rebuttal report, a deposition, and testimony in federal court.

Mine Site, New Mexico—Identified and allocated sources of lead to stream sediments in a large mining district. Provided an expert report, rebuttal report, and courtroom testimony leading to favorable settlement of the case.



Contaminated Sediment Site, New Jersey—Performed an assessment of the potential connection between several properties and the sediments of a large eastern river for an industrial client.

CERCLA Site, Massachusetts—Assessed contribution of arsenic and other metals to stream sediments as part of a settlement negotiation for natural resource damages.

Confidential PCB Site—Investigated the occurrence, distribution, and sources of PCBs and metals in soils and river sediments in the vicinity of a former industrial facility.

CERCLA Site, Summitville, Colorado—Apportioned copper releases from a Superfund site in Colorado using geochemical data and historical information, resulting in a favorable settlement of the case.

Stream Side Tailings, Butte, Montana—Apportioned contribution of silver and copper tailings to the stream side tailings floodplain deposits along Silver Bow Creek. Project included supporting development of an expert report and publication of the methodology.

Clark Fork River, Montana—Used trace metal signatures to apportion the contributions of tailings from various historical mills to floodplain deposits of tailings along the Clark Fork River operable unit of the Silver Bow Creek/Butte Area Superfund site.

Milltown Reservoir, Montana—Apportioned contributions of tailings from several mills to sediments of a reservoir at a Superfund site.

Environmental Forensics/Litigation Support—Groundwater

Perfluoroalkyl Site, Confidential Location—As part of a natural resource damage litigation, investigated sources, assessed impacts to natural resources, and performed a forensic evaluation of individual plume extents for a number of perfluoroalkyl substances including PFOA and PFOS in both groundwater and surface water resources.

Regional Chlorinated Solvent Plume, Los Angeles, California—Performed a hydrologic assessment and geochemical fingerprinting analysis of chlorinated solvents, benzene, and other compounds. Delineated sources and individual plumes in an area with complex structural geology as part of an ongoing site investigation and settlement negotiation.

Mine Site, Arizona—As part of a multiparty litigation, developed and published methods for identifying geochemical fingerprints and source areas contributing to a large acid plume in a mining district.

CERCLA Drum Reconditioning Site, Los Angeles, California—Identified sources and groundwater plume extents for a variety of chlorinated solvents and other organic compounds as part of settlement negotiations at a multiparty Superfund site.



Coal Tar Site, Minneapolis, Minnesota—Assessed historical light and dense nonaqueous-phase coal tar and benzene transport in a fractured bedrock system. Used groundwater data and a passive soil gas survey to identify and quantify sources of coal tar impacting a nearby building. Results of the investigation were presented at a mediation, which led to a favorable settlement recovering past and future costs.

Regional Chlorinated Solvent Plume, Orange County, California—As part of a multiparty litigation, conducted a forensic analysis of numerous potential sources of chlorinated solvents and other compounds to a large regional groundwater plume. Work included providing an expert deposition and affidavit in support of a successful settlement.

Retail Fuel Outlet, Great Falls, Montana—Age-dated petroleum releases and produced an expert report. Work performed as part of a litigation that involved multiple parties contributing to a plume of petroleum hydrocarbons.

Environmental Forensics/Litigation Support—Industrial Facilities

Former Wire Manufacturing Facility, Connecticut—Using electron microprobe analysis and historical data analysis, identified wastes from a wire manufacturing facility used to fill low-lying areas of a site. Results of analysis led to settlement negotiations.

Smelter Site, Omaha, Nebraska—Identified sources of lead surrounding a smelter site, resulting in a favorable conclusion to a class action lawsuit. Testified in federal court in a related matter.

Smelter Site, Denver, Colorado—Identified sources of arsenic and lead to residential yards near three historical smelters, resulting in favorable settlement of a class action lawsuit.

Smelter Site, Tacoma, Washington—Investigated sources of arsenic and lead to soils surrounding a smelter as part of a large bankruptcy litigation.

Zinc Refinery, Corpus Christi, Texas—Identified geochemical fingerprints used to discriminate zinc, lead, and cadmium releases from a metal refinery from other sources at a site.

Natural Gas Storage Reservoir, Wyoming—Conducted a forensic geochemical analysis of natural gas within a storage reservoir and in adjacent production wells using compositional and isotopic data. Produced a series of expert reports outlining differences between storage and native gas, leading to settlement of the case.

Creosote Site, Idaho—Interpreted aerial photographs of a creosote pole-dipping operation to determine when the site was in use, when environmental releases occurred, and when the site was demolished. Authored an expert report.

Pesticide Manufacturing Site, Commerce, Texas—Determined sources, fate, and transport of arsenic around a cotton defoliant plant, resulting in a favorable conclusion to litigation.



Industrial Site, Minneapolis, Minnesota—Discriminated multiple sources of chlorinated solvents and petroleum hydrocarbons in soil vapor, soil, and groundwater at a former railyard. Developed a conceptual site model of contaminant fate and transport. Work led to settlement of a large multiparty litigation.

Petroleum Site, Illinois and Indiana—Determined extent, source, and timing of releases at two diesel bus facilities. Provided a declaration to the court as part of an ongoing litigation.

Hydrogeology/Remediation/Geochemistry

Perfluoroalkyl Site, Confidential Location—Developed a conceptual site model of perfluoroalkyl compound fate and transport, including PFOA, through a variety of pathways and conducted preliminary groundwater modeling to inform a large-scale site investigation including impacts to offsite private and public water supply wells.

Perfluoroalkyl Site, Confidential Location—Reviewed existing groundwater and geologic data to assess performance of a groundwater containment system and proposed an optimized strategy for groundwater pumping to contain a variety of perfluoroalkyl compounds including PFOA and PFOS.

Emerging Contaminant Plume, North Pole, Alaska—Developed a groundwater model of a large sulfolane plume associated with a refinery site in an area with complex hydrogeology including surface water interactions with groundwater and the presence of permafrost.

Miami-Globe Mining District, Arizona—Developed a groundwater model of a shallow alluvial aquifer draining several mine sites within the Miami-Globe mining district.

Chemical Plant, Georgia—Developed a conceptual site model and refined site remedial strategy to address offsite groundwater impacts in an area with complex interactions between fresh and saline groundwater.

Chemical Blending and Distribution Site, Minneapolis, Minnesota—Performed a variety of investigations and remedial actions over a several year period, including:

- Conducted four soil gas surveys as part of an assessment of potential lateral vapor migration and indoor air vapor intrusion
- Developed site- and regional-scale groundwater models used to design a remedial pumping system and bioremediation injection system, and support a monitored natural attenuation remedy within a large dolomitic bedrock aquifer containing chlorinated solvent plumes
- Designed and implemented the first permitted enhanced bioremediation pilot test and full-scale application in Minnesota
- Designed and implemented a pump and treat system for a commingled chlorinated solvent/BTEX plume that has successfully removed more than 1,000 lb of dissolved volatile organic compounds (VOCs)



- Designed and implemented a free-product recovery system for a commingled solvent/diesel plume that has removed more than 100 gallons of product
- Directed design and implementation of a soil vapor extraction system that has successfully removed more than 5,000 lb of VOCs from the vadose zone
- Developed a monitored natural attenuation remedy for a bedrock aquifer and received agency approval
- Conducted an isotopic study, respiration test, and carbon mass balance to assess the relative importance of aerobic and anaerobic biodegradation compared to active remediation.

Chemical Site, Wilmington, Massachusetts—Conducted geochemical modeling to determine the speciation, precipitation, and sorption of chromium in groundwater at a site.

Chemical Site, Orlando, Florida—Demonstrated natural attenuation by calculating total mass of BHC in groundwater over a period of years at a Superfund site.

Superfund Site, Tifton, Georgia—Wrote a computer code to model the fate and transport of organic soil contaminants leaching from soils into groundwater used to optimize the extent of remedial excavation at a Superfund site.

Yellowstone National Park, Wyoming—Installed monitoring wells as part of a project to determine the effects of the surficial groundwater system on the geothermal features in the park.

Mining Industry

Various Mining Clients, Nevada—Developed humidity cell laboratory programs to provide geochemical data on the oxidation characteristics of different rock types used for materials characterization and predictive modeling of water quality.

Various Mine Sites, Nevada—Developed a 2-dimensional model of soil gas transport and sulfide mineral oxidation in mine wastes including reactive gas diffusion, advection, and thermally driven convection.

Various Mining Clients, Nevada—Developed conceptual approach and directed development of numerical codes for groundwater modeling and predicting future pit lake water quality.

Various Mining Clients, Nevada—Developed a custom inflatable packer used to collect soil gas oxygen and temperature profiles from boreholes in active and inactive mine dumps. Published construction methods and results.

Mine Site, Nevada—Wrote a computer code to incorporate complex intersections and truncations of multiple faults into a groundwater model.



Publications

- Helgen, S., A. Davis, and A. Nicholson. 2007. Apportioning mining waste at a Superfund site using four-component linear mixing: Lower Area One, Butte, Montana, USA. *Environ. Forensics* 8:107–117.
- Helgen, S., A. Davis, and A. Nicholson. 2003. Elements influencing cost allocation in the Pinal Creek aquifer, Arizona, USA. Part I: Geochemical fingerprinting and source delineation. *Environ. Forensics* 4:255–269.
- Nicholson, A., S. Helgen, and A. Davis. 2003. Elements influencing cost allocation in the Pinal Creek aquifer, Arizona, USA. Part II: Geochemical controls on groundwater quality recovery. *Environ. Forensics* 4:271–286.
- Moomaw, C., A. Davis, and S. Helgen. 2003. Elements influencing cost allocation in the Pinal Creek aquifer, Arizona, USA. Part III: Quantifying metals releases from multiple sources. *Environ. Forensics* 4:287–303.
- Davis, A., G.G. Fennemore, S.O. Helgen, and K.A. Hoenke. 2002. Characterizing natural attenuation of BHC in seasonally fluctuating groundwater. Proceedings of the Conference on Application of Waste Remediation Technologies to Agricultural Contamination of Water Resources. Hazardous Substance Research Center, Kansas City, MO.
- Folkes, D.J., S.O. Helgen, and R.A. Litle. 2001. Impacts of historical arsenical pesticide use on residential soils in Denver, Colorado. In: *Arsenic Exposure and Health Effects*. Elsevier Science BV. pp. 97–113.
- Davis, A., and S. Helgen. 2001. Discriminating between copper and silver mill tailings in Silver Bow Creek overbank deposits, Butte, Montana, U.S.A. *Environ. Forensics* 2:249–259.
- Helgen, S.O., and A. Davis. 2000. Quantifying metal contributions from multiple sources to the Clark Fork River, Montana, U.S.A. *Environ. Forensics* 1:55–62.
- Davis, A., S.O. Helgen, and C. Byrns. 2000. Measurement of oxygen, temperature, and geochemical profiles in sulfide and oxide waste rock dumps of different ages. Proceedings of the SME ICARD 2000 Meeting, May 21–24, Denver, CO.
- Davis, A., L.E. Eary, and S.O. Helgen. 1999. Assessing the efficacy of lime amendment to geochemically stabilize mine tailings. *Environ. Sci. Technol.* 33(15):2626–2632.
- Davis, A., S.O. Helgen, and C. Byrns. 1998. The relationship between waste rock geochemistry, age, and reactivity. Proceedings of 25th Anniversary and 15th Annual National Meeting of the American Society for Surface Mining and Remediation (ASSMR). St. Louis, MO.
- Helgen, S.O., and J.N. Moore. 1996. Natural background determination and impact quantification in trace metal-contaminated river sediments. *Environ. Sci. Technol.* 30(1):129–135.



Presentations/Posters

Helgen, S., M. Marietta, C. Hutchings, and E. Palko. 2018. Site-specific desorption testing of perfluorononanoic acid (PFNA) to assess potential soil leaching to groundwater. Platform presentation at Eleventh International Conference on Remediation of Chlorinated and Recalcitrant Compounds, Palm Springs, CA. April 8–12.

Hutchings, C., and S. Helgen. 2019. Identifying linear and branched isomers from standard PFAS analysis for source delineation. Platform presentation at Tenth International Conference on the Remediation and Management of Contaminated Sediments, New Orleans, LA. February 11–14.

Helgen, S., A. Nicholson, and B. Greer. 2013. Addition of a rate limit to a shrinking core model for predictive modeling of mine water quality. International Mine Water Association 2013 Annual Conference. August 6–9. Golden, CO.

Helgen, S.O., and J.E. Vondracek. 2010. Isotopic analysis of carbon sources and degradation pathways in soil vapor and groundwater. Battelle 7th International Conference on Remediation of Chlorinated and Recalcitrant Compounds. May 24–27. Monterey, CA.

Helgen, S.O., and J.E. Vondracek. 2010. Evidence of biosurfactant-enhanced soil vapor extraction recovery associated with biostimulation. Battelle 7th International Conference on Remediation of Chlorinated and Recalcitrant Compounds. May 24–27. Monterey, CA.

Helgen, S.O., and A.N. Nicholson. 2007. The nexus of litigation, remediation, and good science in equitable allocation. American Bar Association 36th Annual Conference on Environmental Law. March 8–11. Keystone Resort and Conference Center, Keystone, CO.

Helgen, S.O., and A.M. Mitzi. 2006. Environmental forensics: Discriminating between sources and allocating responsibility in multi-party disputes. American Bar Association 35th Annual Conference on Environmental Law. March 9–12. Keystone Resort and Conference Center, Keystone, CO.

Helgen, S.O., and A. Davis. 1999. Source identification, discrimination, and apportionment. IBC's 2nd Annual Executive Forum Environmental Forensics Integrating Advanced Scientific Techniques for Unraveling Site Liability, Washington, DC.

Helgen, S.O. 1995. Natural background determination and impact quantification in trace metal-contaminated river sediments. American Water Resources Association Meeting, Missoula, MT.

Helgen, S.O., and J.N. Moore. 1994. Determining natural background and quantifying the impact of mining in contaminated river sediments. American Geophysical Union Fall Meeting, San Francisco, CA.

