



**Exponent**<sup>®</sup>  
Engineering & Scientific Consulting

## Brian D. Drollette, Ph.D.

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### Professional Profile

Dr. Drollette is a senior environmental scientist in Exponent's Environmental & Earth Sciences practice. He specializes in complex environmental chemistry problems at the nexus of empirical data and fate models. He leverages his background in environmental analytical chemistry and contaminant fate and transport analysis in a wide range of consulting areas. From contaminated site assessment to historical site reconstruction, and emerging contaminant liability evaluation to cost allocation, he advises clients on risk mitigation, regulatory compliance, and litigation matters.

Dr. Drollette applies his expertise in chemical forensics across many industries and contaminant classes, including petroleum and polycyclic aromatic hydrocarbons (PAHs), natural gas, chlorinated solvents (PCE, TCE, and degradation products), polychlorinated biphenyls (PCBs), dioxins and furans, per- and polyfluoroalkyl substances (PFAS), and metals. He has worked on cases involving large contaminated sediment CERCLA sites, petroleum refineries, offshore oil spills, manufactured gas plants (MGPs), coal ash basins, military sites, dry cleaners, and chemical distributors, among others. He also has experience applying and interpreting chemical forensic techniques paired with contaminant fate and transport models for groundwater (MODFLOW-MT3D) and oil spills (OSCAR, ADIOS).

Additionally, Dr. Drollette is an expert in advanced analytical chemistry techniques used for forensic investigations. He applies and evaluates novel analytical methods for contaminant identification in various materials such as marine fuels, drilling additives, and bulk fertilizers. He is certified in the operation and data interpretation of comprehensive two-dimensional gas chromatography (GCxGC).

### Academic Credentials & Professional Honors

Ph.D., Engineering and Applied Science, Yale University, 2018

M.S., Engineering and Applied Science, Yale University, 2016

M.S., Civil and Environmental Engineering, Duke University, 2014

B.S., Environmental Science, State University of New York College at Plattsburgh, 2013

### Licenses and Certifications

OSHA 40-Hour HAZWOPER Certification #754958728

LECO Pegasus 4D GC&times;GC-TOFMS

## Prior Experience

Teaching Fellow, Yale University, 2015-2017

Environmental Lab Assistant, William H. Miner Agricultural Research Institute, 2012-2013

## Professional Affiliations

Environmental Business Council of New England

American Chemical Society

American Geophysical Union

## Publications

Cook, L.L.; Drollette, B.D.; Edwards, M.R.; Benton, L.D.; Boehm, P.D. (2020) A data-driven framework for defining stages of oil weathering. *Marine Pollution Bulletin*.  
<https://doi.org/10.1016/j.marpolbul.2020.111091>.

Drollette, B.D.; Brenneis, R.J.; Plata, D.L. (2018) Oligomer-specific, short chain linear alcohol ethoxylate quantification via comprehensive two-dimensional gas chromatography. *Environmental Science & Technology Letters*. 5(9):539-545.

Liggio, J.; Li, S-M; Hayde, K.; Taha, Y.M.; Stroud, C.; Darlington, A.; Drollette, B.D.; Gordon, M.; Lee, P.; Liu, P.; Leithead, A.; Moussa, S.G.; Wang, D.; O'Brien, J.; Mittermeier, R.L.; Brook, J.; Lu, G.; Staebler, R.; Han, Y.; Tokarek, T.T.; Osthoff, H.D.; Makar, P.A.; Zhang, J.; Plata, D.L.; Gentner, D.R. (2016) Oil sands operations as a large source of secondary organic aerosols. *Nature*. 534(7605):91-94.

Dasgupta, S.; Di Guilio, R.T.; Drollette, B.D.; Plata, D.L.; Brownawell, B.J.; McElroy, A.E.; (2016) Hypoxia depresses CYP1A induction and enhances DNA damage, but has minimal effects on antioxidant responses in sheepshead minnow (*Cyprinodon variegatus*) larvae exposed to dispersed crude oil. *Aquatic Toxicology*. 177:250-260.

Hoelzer, K.; Sumner, A.J.; Nelson, R.K.; Karatum, O.; Drollette, B.D.; O'Connor, M.P.; D'Ambro, E.; Getzinger, G.J.; Ferguson, P.L.; Reddy, C.M.; Elsner, M.; Plata, D.L. (2016) Indications of transformation products from hydraulic additives in shale gas wastewater. *Environmental Science & Technology*. 50(15):8036-8048.

Kekacs, D.; Drollette, B.D.; Brooker, M.; Plata, D.L.; Mouser, P.J. (2015) Aerobic biodegradation of organic compounds in hydraulic fracturing fluids. *Biodegradation*. 26(4):271-287.

Drollette, B.D.; Plata, D.L. (2014) Organic compounds associated with hydraulic fracturing: groundwater composition and natural attenuation potential. Thesis. Duke University.

## Presentations

Drollette, B.D.; O'Reilly, K.T.; Plata, D.L. Towards Increased Confidence in Compound Identification Using Comprehensive Two-Dimensional Gas Chromatography for Environmental Forensics. AEHS Foundation 35th Annual International Conference on Soils, Sediments, Water, and Energy. Amherst, MA. October 21-24, 2019. Poster Presentation.

O'Reilly, K.T.; Karatum, O.; Drollette, B.D.; Pietari, J. Next Generation Analytical Approaches: Implication for Contaminated Sediment Sites. Battelle International Conference on Remediation and Management of Contaminated Sediments. New Orleans, LA. February 11-14, 2019. Poster Presentation.

Gilman, L.; Drollette, B.D.; O'Reilly, K.T.; Skancke, J. Improving oil fate and transport models with GCxGC acquired data: enhanced component property characterization over time. Gulf of Mexico Oil Spill and Ecosystem Science Conference. New Orleans, LA. February 4-7, 2019. Poster Presentation.

Drollette, B.D.; Karatum, O.K.; Plata, D.L. Enhancing unknown compound identification in comprehensive two-dimensional gas chromatography using computer-predicted retention indices and spectral matching. EPA ENACT Workshop. Durham, NC. August 13-15, 2018. Poster Presentation.

Karatum, O.; Drollette, B.D.; Pietari, J.P.; O'Reilly, K.O. Next generation analytical approaches for non-targeted analysis. EPA ENACT Workshop. Durham, NC. August 13-15, 2018. Poster Presentation.

Drollette, B.D.; Gentner, D.R.; Plata, D.L. Understanding the role of oil sands extraction and wastewater storage on regional air quality in Alberta, CA. Yale University School of Forestry and Environmental Studies Natural Resource Extraction Panel. New Haven, CT. August 21, 2017. Invited Talk.

Gentner, D.R.; Drollette, B.D.; Marcotte, A.; Sheu, R.; Li, S-M; Liggio, J.; Plata, D.L. Deciphering complex organic mixtures with very-high resolution tandem mass spectrometry: a case study on intermediate and semi-volatile organic compounds from oil sands processing. EGU General Assembly Conference. Vienna, Austria. April 23-27, 2017. Oral Presentation.

Plata, D.L.; Mouser, P.J.; Elsner, M.; Drollette, B.D.; Sumner, A.J. Chemical transformations in high volume hydraulic fracturing fluids. 253rd American Chemical Society National Meeting & Exposition. San Francisco, CA. April 6, 2017. Oral Presentation.

Plata, D.L.; Mouser, P.J.; Elsner, M.; Drollette, B.D.; Sumner, A.J. Chemical transformations in high volume hydraulic fracturing fluids. Lawrence Livermore National Laboratory. Livermore, CA. April 5, 2017. Oral Presentation.

Plata, D.L.; Sumner, A.J.; Drollette, B.D. Unconventional oil and gas development: predicting impacts on air and water through detailed chemical analysis. McMaster University. Hamilton, Canada. November 29, 2016. Oral Presentation.

Drollette, B.D.; Gentner, D.R.; Plata, D.L. What goes in must come out: organic compounds in oil sands, their extraction products, and environmental implications. 252nd American Chemical Society National Meeting & Exposition. Philadelphia, PA. August 21, 2016. Oral Presentation.

Plata, D.L.; Sumner, A.J.; Drollette, B.D. Unconventional oil and gas development: predicting impacts on air and water through detailed chemical analysis. Helmholtz Zentrum Munchen. Munich, Germany. July 19, 2016. Oral Presentation.

Drollette, B.D.; Gentner, D.R.; Plata, D.L. What goes in must come out: organic compounds in oil sands, their extraction products, and environmental implications. Gordon Research Seminar, Environmental Sciences: Water. Holderness, NH. June 26, 2016. Invited Talk.

Elsner, M.; Hoelzer, K.; Sumner, A.J.; Karatum, O.; Nelson, R.K.; Drollette, B.D.; O'Connor, M.P.; D'Ambro, E.; Getzinger, G.J.; Ferguson, P.L.; Reddy, C.M.; Plata, D.L. Indications of transformation products from hydraulic fracturing additives in shale gas wastewater. EGU General Assembly Conference. Vienna, Austria. April 17-22, 2016. Oral Presentation.

Liggio, J.; Li, S-M; Hayde, K.; Taha, Y.M.; Stroud, C.; Darlington, A.; Drollette, B.D.; Gordon, M.; Lee, P.; Liu, P.; Leithead, A.; Moussa, S.G.; Wang, D.; O'Brien, J.; Mittermeier, R.L.; Brook, J.; Lu, G.; Staebler, R.; Han, Y.; Tokarek, T.T.; Osthoff, H.D.; Makar, P.A.; Zhang, J.; Plata, D.L.; Gentner, D.R. Oil sands operations in Alberta, Canada: a large source of secondary organic aerosol. AGU National Meeting. San Francisco, CA. December 14-18, 2015. Oral Presentation.

Drollette, B.D.; Hoelzer, K.; Elsner, M.; Warner, N.R.; Darrah, T.H.; O'Connor, M.P.; Karatum, O.; D'Ambro, E.; Vengosh, A.; Jackson, R.B.; Plata, D.L. Trace levels of diesel range organic compounds in shallow groundwater wells in northeastern Pennsylvania elevated near Marcellus shale gas wells. 249th American Chemical Society National Meeting & Exposition. Denver, CO. March 23, 2015. Oral Presentation.

Sumner, A.J.; Drollette, B.D.; Plata, D.L. Exploring the relevant parameter space in shale rock geochemistry: organic transformations at temperature and pressure. 249th American Chemical Society National Meeting & Exposition. Denver, CO. March 23, 2015. Oral Presentation.

Drollette, B.D.; Hoelzer, K.; Elsner, M.; Warner, N.R.; Darrah, T.H.; O'Connor, M.P.; Karatum, O.; D'Ambro, E.; Vengosh, A.; Jackson, R.B.; Plata, D.L. Hydrophobic organic compounds in Pennsylvania groundwater do not show influence of deep shale brines. AGU National Meeting. San Francisco, CA. December 18, 2014. Oral Presentation.

Plata, D.L.; Schreglmann, K.; Elsner, M.; Getzinger, G.J.; Ferguson, P.L.; Drollette, B.D.; Karatum, O.; Nelson, R.K.; Reddy, C.M. Hydrophobic organic compounds in hydraulic fracturing flowback waters: identification and source apportionment. AGU National Meeting. San Francisco, CA. December 2014. Poster Presentation.

Drollette, B.D.; Hoelzer, K.; Elsner, M.; Warner, N.R.; Darrah, T.H.; O'Connor, M.P.; Karatum, O.; D'Ambro, E.; Vengosh, A.; Jackson, R.B.; Plata, D.L. Organic compounds in shallow groundwater near shale gas wells of Northeastern Pennsylvania. Robert M. Langer Graduate Student Symposium. Yale University. New Haven, CT. December 5, 2014. Oral Presentation.

## Project Experience

### Cost Allocation

Northeastern U.S. Sediment Site (CERCLA): Used chemical forensic techniques coupled with historical operational information to identify and prioritize responsible parties along a contaminated waterway and implement contribution into a cost allocation model.

Midwestern U.S. Petroleum Refinery (CERCLA): Reviewed operational history and subsurface contaminant (refined petroleum) data to incorporate relative contribution into a cost allocation model.

Michigan Former Manufactured Gas Plant (MGP): Evaluated relative impact of coal tar contamination at a former MGP from various gas manufacturing processes to assign responsible party share in a cost allocation model.

### Emerging Contaminants (PFAS, 1,2,3-Trichloropropane, 1,4-Dioxane)

California Agricultural Supply Distributor: Assessed historical groundwater contamination of 1,2,3-trichloropropane for past contributors at an agricultural supply distributor. Demonstrated that the client's past operations did not include manufacturing or handling 1,2,3-TCP based on registered chemical disclosures.

California DOD Site: Investigated potential sources of 1,2,3-trichloropropane in groundwater near a former U.S. Air Force Base. Involved significant research into mil-spec products and materials used in runway construction for additives including 1,2,3-TCP.

Massachusetts PFAS Groundwater Contamination: Prepared a client response to a MA DEP Request for Information. Client was identified as a potential source of PFAS in a groundwater aquifer used for municipal water supply. Response included historical research into company's prior operations and

manufacturing, and a hydrogeological analysis of the area with respect to the company's site and the area of contamination.

Apparel Manufacturer PFAS Literature Support: Reviewed and summarized recent peer-reviewed journal articles on analytical advances in PFAS testing for materials.

Trade Association: Evaluated risk and acceptable thresholds for PFOS and PFOA in biosolids applied to croplands for beneficial reuse.

Northeastern U.S. Contaminated Aquifer: Prepared presentation and reference materials to a client potentially responsible for 1,4-dioxane contamination in a large groundwater aquifer. Materials included manufacturing, uses, and fate and transport properties of 1,4-dioxane related to client's historical operations and location.

### **Petroleum Chemistry**

Midwestern U.S. Petroleum Refinery (CERCLA): Applied refined petroleum forensic techniques to identify areas impacted by RCRA hazardous wastes. Evaluated extent of leaded gasoline soil contamination through weathering modeling.

International Oil Spill: Applied crude oil petroleum forensic techniques to confirm sample origin for use in toxicity modeling in a large international surface oil spill.

### **Hydraulic Fracturing**

Northeastern U.S. Natural Gas Extraction: Investigated a house explosion allegedly caused by migrating natural gas. Performed gas forensic analysis to demonstrate source methane was not related to nearby hydraulically fractured wells.

Northeastern U.S. Salt Mining Operation: Investigated claim of subsurface connectivity between a salt mining operation and nearby natural gas extraction activity.

### **Chlorinated Solvents**

California Former Metalworking Facility: Evaluated efficacy of a soil vapor extraction (SVE) system for chlorinated solvent remediation and claims of offsite migration at a former manufacturing facility. Analysis included preparing demonstratives for trial indicating the SVE system was effective and had little influence on offsite TCE migration.

California Manufacturing Facility: Performed historical site reconstruction to understand and identify potential parties responsible for TCE contamination beneath a large manufacturing complex. Used multiple lines of evidence from parties' other nationwide manufacturing operations to support opinions at the site in question.

New Jersey Warehousing Operation: Investigated sources of TCE at a former warehousing facility through historical reconstruction of site activities and corresponding information from other sites operated by the parties.

Ohio Pipeline Drilling Operation: Investigated claim of PCE contamination from a horizontal drilling operation. Performed forensic analysis of drilling additives and mathematical modeling to understand potential artifacts in the drilling process contributing to alleged contamination.

### **Water Treatment**

California Hospital Water Distribution System: Assisted in a root-cause analysis of an in-house copper-

silver ionization water treatment system failure. Analyzed time series data for failure patterns and to identify risks and solutions.

International Medical Device Company: Evaluated the landscape of water treatment technologies for point-of-care use of an in-home medical device. Identified and prioritized technologies including reverse osmosis (RO), ion-exchange, and distillation for treatment of tap water to United States Pharmacopeia (USP) specifications.

International Oil and Gas Producer: Conducted a review of in-line sensors for oil and grease measurements in produced water from offshore oil platforms. Provided recommendations for the technology and application of the sensors in the onboard produced water treatment system prior to discharge.

U.S. Natural Gas Producer: Investigated claims of an improperly designed treatment facility for produced water. Assisted with the review and presentation of effluent data and system design.

### **Fate and Transport Modeling**

Southeastern U.S. Coal Ash Impoundments: Reviewed groundwater fate and transport models (MODFLOW – MT3D) built to understand contaminant distribution from six coal ash impoundments. Investigated claims of improper use of contaminant leaching properties and hydraulic head distribution through analyses of the transport code under various conditions required by regulators.

California Oil Spill: Supported an expert report opinion regarding the volume and distribution of oil released from a pipeline break. Reviewed the underlying Python code of an oil spill fate and trajectory model to understand its assumptions and algorithms used to track oil.

U.S. Oil and Gas Producer: Prepared and presented explanation of various major oil spill fate and trajectory model algorithms to simulate oil-water emulsification. Compared model results to help identify the best choice under various conditions in an open-water oil release scenario.

Alberta, CA Oil Sands Emissions: Modeled hydrocarbon emissions from oil sand tailing impoundments using GCxGC for input into secondary organic aerosol (SOA) formation models.

### **Data Integrity and Analytical Chemistry**

U.S. Oil and Gas Producer: Evaluated potential integrity of samples collected from the Deepwater Horizon event for future analyses. Potential was based upon sample collection and preservation method, storage method, and time elapsed since collection for various matrices and analytes.

Fertilizer Insurance Claim: Provided consulting support on sample collection and analysis of a bulk fertilizer allegedly contaminated with airborne dust from nearby cement production.

Marine Fuel Contamination Evaluation: Provided chemistry data interpretation and methodology support for an analysis of marine fuel allegedly contaminated with non-native fuel components.

## **Peer Reviewer**

Atmospheric Chemistry and Physics

Journal of Contaminant Hydrology

Environmental Science and Technology

Environmental Science: Processes and Impacts

