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Craig Davis, Ph.D.

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Professional Profile

Dr. Davis specializes in modeling the distribution, fate, transport, and ecotoxicity of complex environmental pollutants. He has over 7 years of experience in ecological risk assessments for complex substances including petroleum streams and products (UVCBs), industrial process chemicals, per- and polyfluorinated (PFAS) substances, polymers, plastic additives, and microplastics. Dr. Davis supports products, companies, and industry trade associations in chemical management, including regulatory compliance, research program development, and technical advocacy at local, national, and regional levels. He works at the intersection of science, regulation, and policy, developing solutions to complex problems and constructively engaging diverse groups of stakeholders.

Dr. Davis integrates his expertise in aquatic chemistry, thermodynamics, computational modeling, and database managements to simplify complex problems and create scalable solutions across the value chain. He has developed several models in collaboration with industry and academic partners to streamline and minimize toxicity testing for aquatic organisms (grouped Target Site (g-TSM) model) as well as persistence testing for petroleum hydrocarbons in water, soil, and sediment (HC-BioSIM models). He has also applied existing tools and models within integrated weight of evidence approaches to support categories of chemicals for regulatory approval (e.g., US EPA safer choice / ingredient designation for alcohol ethoxylate-based surfactants). He has successfully engaged with US EPA to review and amend PMN consent orders to unlock market access and reduce capital costs for manufacturers and downstream users.

In addition to his work on petrochemical products, Dr. Davis has developed industry-wide research programs to address the challenge of plastic waste, microplastics, and plastic additives in the environment. Working with the International Chemical Council Association (ICCA), the American Chemistry Council (ACC), the European Chemical Industry Council (CEFIC), the Japanese Chemical Industry Council (JCIA), and European Plastics Manufacturers (Plastics Europe) he established a 5-year, $15 million dollar research program aimed at developing risk-based tools and frameworks for evaluating environmental and human health risks associated with microplastics. Dr. Davis also worked with ICCA, CEFIC, and Plastics Europe to develop the first industry-sponsored public global database of chemicals in plastic, increasing transparency and supporting evidence-based prioritization of plastic chemicals.

Dr. Davis has supported various corporations and specific sites in the transition away from PFAS, including fluorinated firefighting foams (AFFF), fluoropolymer processing aids, and fluorinated additives in functional fluids. He has supported European and US trade associations in evaluating the scientific validity and regulatory standing for human health and ecological criteria development and grouping / read-across techniques. Dr. Davis served as an industry expert representative for the EU Joint Research Centre (JRC) Expert group for PFAS Environmental Quality Standard Development in 2021 and 2024.

Dr. Davis continuously engages as a member of the broader scientific community through professional societies (e.g., Society of Environmental Toxicology and Chemistry), tri-partite scientific organizations including the European Centre for Ecotoxicology and Toxicology of Chemicals (ECETOC) and the Health and Environmental Sciences Institute (HESI), as well as academic partnerships. He is deeply committed to training the next generation of scientists and engineers and serves as an adjunct faculty member in the Civil and Environmental Engineering department at the University of Delaware.

Dr. Davis's academic background and areas of focus include the quantitative modeling of chemical partitioning of neutral, ionized, and surfactant-like organic compounds to soil, sediment, and technical sorbents (e.g., GAC, biochar, and petroleum coke) as well as the derivation of water quality criteria using both traditional in vivo, in vitro, and in silico models to support the high-throughput screening and prioritization of thousands of chemicals. This work has been applied broadly including applications to oil-sands produced water (OSPW), hydraulic fracturing produced water, plastic additives, petroleum hydrocarbons, per- and polyfluorinated (PFAS), and surfactant chemistries.

Academic Credentials & Professional Honors

Ph.D., Environmental Engineering, University of Delaware, 2016

B.Eng., Environmental Engineering, University of Delaware, 2011

Citation for Outstanding Achievement, Department of Civil & Environmental Engineering, University of Delaware, 2024

US Department of Education GAANN Fellow, University of Delaware, 2012

Academic Appointments

Adjunct Professor, Civil & Environmental Engineering, University of Delaware, 2023

Prior Experience

Senior Environmental Scientist, ExxonMobil Biomedical Sciences Inc., 2017-2024

Postdoctoral Research Fellow, University of Minnesota, 2016-2017

Environmental Engineer, Mutch & Associates LLC., 2016

Graduate Research & Teaching Assistant, University of Delaware, 2011-2016

Professional Affiliations

Society of Environmental Chemistry & Toxicology (SETAC)

Publications

Cross, R. K., et al. (In Press) "The importance of ensuring representative sample volumes in microplastic monitoring-A predictive methodology." (2024).

Verdonck, F.A.M., et al. (In Press). REACH assessment of humans exposed to chemicals indirectly via the environment: screening modelling in EUSES vs. state of the science. Integrated Environmental Assessment & Management. (2025)

de Jourdan, Benjamin, et al. "Microplastic biomonitoring studies in aquatic species: A review & quality

assessment framework." Science of The Total Environment 957 (2024): 177541.

Davis, Craig W., et al. "Predicting Hydrocarbon Primary Biodegradation in Soil and Sediment Systems Using System Parameterization and Machine Learning." Environmental Toxicology and Chemistry (2024).

Boone, Kathleen S., et al. "In Silico Acute Aquatic Hazard Assessment and Prioritization Using a Grouped Target Site Model: A Case Study of Organic Substances Reported in Permian Basin Hydraulic Fracturing Operations." Environmental Toxicology and Chemistry (2024).

Burgess, Robert M., et al. "A Review of Mechanistic Models for Predicting Adverse Effects in Sediment Toxicity Testing." Environmental Toxicology and Chemistry (2023).

Prosser, Christopher M., et al. "Using weight of evidence to assess degradation potential of UVCB hydrocarbon solvents." Integrated Environmental Assessment and Management 19.4 (2023): 1120-1130.

Ruffle, Betsy, et al. "US and International Per-and Polyfluoroalkyl Substances Surface Water Quality Criteria: A Review of Current Status, Challenges, and Implications for Use in Chemical Management and Risk Assessment." Integrated Environmental Assessment and Management (2023).

Davis, C. W., Camenzuli, L., & Redman, A. D. (2022). Predicting Primary Biodegradation of Petroleum Hydrocarbons in Aquatic Systems: Integrating System and Molecular Structure Parameters using a Novel Machine-Learning Framework. Environmental Toxicology and Chemistry, 41(6), 1359-1369.

Scott, A. C., Zubot, W., Davis, C. W., and Brogly, J. (2020). Bioaccumulation potential of naphthenic acids and other ionizable dissolved organics in oil sands process water (OSPW)–A review. Science of the Total Environment, 712, 134558.

Bragin, G. E., Davis, C. W., Kung, M. H., Kelley, B. A., Sutherland, C. A., and Lampi, M. A. (2020). Biodegradation and ecotoxicity of branched alcohol ethoxylates: Application of the target lipid model and implications for environmental classification. Journal of Surfactants and Detergents, 23(2), 383-403.

Camenzuli, L., Davis, C. W., Parkerton, T. F., Letinski, D. J., Butler, J. D., Davi, R. A., ... and Lampi, M. A. (2019). Bioconcentration factors for hydrocarbons and petrochemicals: Understanding processes, uncertainty, and predictive model performance. Chemosphere, 226, 472-482.

Davis, C. W., and Di Toro, D. M. (2016). Predicting solvent-water partitioning of charged organic species using quantum-chemically estimated Abraham pp-LFER solute parameters. Chemosphere, 164, 634-642.

Davis, C. W., and Di Toro, D. M. (2015). Modeling nonlinear adsorption with a single chemical parameter: Predicting chemical median Langmuir binding constants. Environmental science & technology, 49(13), 7818-7824.

Davis, C. W., and Di Toro, D. M. (2015). Modeling nonlinear adsorption to carbon with a single chemical parameter: a lognormal Langmuir isotherm. Environmental science & technology, 49(13), 7810-7817.

Presentations

Deglin, S.A., Davis, C.W., Beking, M., Coffin, S. "Bridging the Gap Between Science Development and Policy, Regulatory, and Technology (PRT) Needs for Complex Substances - Supporting Data-Driven Decision-Making in Heath & Environmental Risk Assessment and Management". Organized Session, Society of Environmental Toxicology and Chemistry, Ft. Worth, TX, 2024.

Davis, C.W., et al. "A Framework and Case Study in Support of Risk-Based Prioritization of Additives and Polymer-Associated Chemistries (APAC)". Oral Presentation, Society of Environmental Toxicology and Chemistry, Ft. Worth, TX, 2024.

Cross, R., et al. "The RSVP Tool - Representative Sample Volume Predictions for Monitoring Microplastics". Oral Presentation, Society of Environmental Toxicology and Chemistry, Ft. Worth, TX, 2024.

Davis, C.W., et al. "A Draft Framework for Risk-Based Prioritization & Evaluation of Additives & Polymer-associated Chemistries (APAC)". Oral Presentation, Society of Environmental Toxicology and Chemistry, Seville, ES, 2024.

Davis, C.W., Hu, J., Norman, J., Mori, T., Almeida, P., Carteny, C., "Closing the Microplastic Information Gap – Webinar 1: Introduction to MARII" Webinar Series, ECETOC, Online, April 2024.

Davis, C.W., Doskey, C. Expert Workshop: Risk Assessment Framework for Chemical Additives in Plastics. Panel Discussion. Microplastics Advanced Research and Innovation Initiative (MARII) 2nd Annual Meeting, Seattle, WA, 2023.

Hu, J., Duhaime, M., Davis, C.W. "Fate of Plastics in the Environment: Towards Unifying Laboratory Experiments, Field Observations, and Modelling". Organized Session, Society of Environmental Toxicology and Chemistry, Ft. Worth, TX, 2024.

Davis, C.W. "Occam's Razor – Simplifying Toxicity Estimation for Neutral and Ionizable Surfactant Compounds and Mixtures Using the Target Lipid Model & Abraham pp-LFER Descriptors" Poster Presentation. Society of Environmental Toxicology and Chemistry, Louisville, KY, 2023.

Davis, C.W., et al. "Towards a Transparent & Reproducible Framework for Risk Assessment and Evaluation of Produced Water for Beneficial Reuse" Poster Presentation. Society of Environmental Toxicology and Chemistry, Louisville, KY, 2023.

Ruffle, B., et al. "Surface Water Quality Criteria for PFAS: Variation in International Approaches and Risk Management Challenges" Poster Presentation. Society of Environmental Toxicology and Chemistry, Louisville, KY, 2023.

Hjort, M., et al. "Progressing Modeling of PFAS Bioavailability to Support Water Permitting and Effluent Monitoring Regulations" Poster Presentation. Society of Environmental Toxicology and Chemistry, Dublin, IE, 2023.

Davis, C.W., et al. "Evaluating Migration of Polymer Additives Under Environmentally Relevant Conditions – Validation of Modeling Approaches and Application for Product Classification & Labeling under EU CLP & UN GHS" Poster Presentation. Society of Environmental Toxicology and Chemistry, Dublin, IE, 2023.

Project Experience

Provided global regulatory compliance technical and strategic support (e.g., EU REACH, US PMN, Canada NSN), including development of QSAR, read across, and weight of evidence alternatives to animal testing.

Created chemical inventory fitness tools to drive proactive, efficient, and continuous improvement in supporting responsible care commitments throughout all areas of corporate chemical management and risk evaluation.

Developed testing, data collection and communication strategies to support new and expand existing market applications in Europe (harmonized testing strategies for Petroleum Consortia (PetCo) working group), the US (US EPA Safer Choice, US EPA Safer Ingredient), Canada (CEPA Risk Assessment(s)), and China (MEE guidance on PBT chemical risk assessment) engaging directly with regulators and policymakers.

Worked with industry partners and trade associations to develop the first public industry-sponsored inventory of global plastic additives chemistries, including their applications, use, and regulatory status.

Provided global regulatory compliance technical and strategic support (e.g., EU REACH, US PMN, Canada NSN), including development of QSAR, read across, and weight of evidence alternatives to animal testing.

Worked with academic partners to expand functionality and user access to metals fate and transport models (TICKET-UWM) to include scenarios relevant for the beneficial reuse of treated produced water in Texas and New Mexico. This included the development of re-use scenarios, emission factors, and conditions of use to support quantitative risk assessment of discharged treated produced waters.

Served as subject matter expert for European Joint Research Commission (JRC) for the development and review of PFAS environmental quality standards in 2021 and 2024.

Served as co-chair of the International Chemical Consortia Association's (ICCA) Microplastic Advanced Research and Innovation Initiative (MARII) and Joint Microplastics Science groups.

Organized multi-partite stakeholder science workshops under my role as ICCA MARII co-chair, bringing industry, regulatory, policy, and academic stakeholders together in a cooperative, constructive forum.

Peer Reviews

Environmental Science & Technology (ES&T)

Environmental Science & Technology Letters

Microplastics & Nanoplastics

Chemosphere

Science of the Total Environment (STOTEN)

Environmental Toxicology & Chemistry (ET&C)

Integrated Environmental Assessment & Management (IEAM)