



PFAS IN CALIFORNIA

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PAST: WHAT ARE PFAS – WHY DO WE CARE?

Panel 1: History, Use, Nomenclature, Chemistry, Toxicology

Erica Kalve, P.G., San Francisco Bay Regional Water Quality Control Board



Erica has nearly twenty years of experience in the environmental field overseeing site investigation and remediation of soil, soil gas, and groundwater. Erica spent several years serving as the Emerging Contaminants Focus Group Leader and team coordinator for an international Per- and Polyfluoroalkyl substances (PFAS) team at Arcadis. As part of that experience, she had the opportunity to edit an emerging contaminants handbook for practitioners and co-authored the chapter on PFAS. She recently joined the Region 2 Water Board and provides regulatory oversight of several cases including two airport sites that are responding to the 13267 Order for a one-time preliminary site investigation of PFAS impacts to groundwater and soil. She is a key member of the State Boards PFAS team for implementing the PFAS Source Investigations.

Presentation Title: Intro to PFAS - What are they and why do we care?

Abstract: PFAS are a broad class of over 6,000 compounds that have been widely used in industrial and consumer applications since the 1940s. For example, PFAS have been used for coating fabrics and textiles, in non-stick surfaces, in some firefighting foams, some paints, polishes, and waxes, and electronic devices. Certain PFAS have been detected ubiquitously in the environment. Major sources identified to date include manufacturing facilities such as fluoroplastics, class B fire response and training areas, metal plating facilities, leather tanneries, paper and fabric coatings producers, landfills, and biosolids derived from sewage sludges. This presentation will provide an overview of PFAS nomenclature, uses, and awareness regarding major source areas and distribution of PFAS in the environment.

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Taryn McKnight, Eurofins/TestAmerica



Taryn McKnight, Product Manager for Eurofins TestAmerica based in Sacramento, California, has 20 years of experience in the environmental testing industry. Ms. McKnight is the company's subject matter expert on PFAS and Vapor Intrusion. She has extensive experience with a wide variety of complex regulatory programs such as Department of Defense, Vapor Intrusion, and Emerging Contaminants. In her current role she is responsible for providing technical guidance and support to clients, agencies and industry personnel across the country.

Presentation Title: PFAS Chemistry and Fingerprinting

Abstract: PFAS are a family of synthetic compounds containing thousands of chemicals formed from carbon (C) chains with fluorine (F) attached to these chains. The C-F bond is the shortest and strongest bond in nature and is responsible for most of the unique and useful characteristics of these compounds. In this presentation, we will discuss the analytical method choices and how to apply them to complex matrices including air. We will also discuss how to interpret the analytical data and the potential for using this data for forensics.

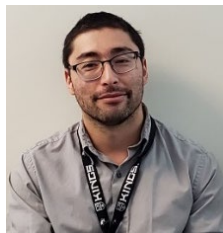
Melanie Marty, Ph. D. and Christopher Banks, Ph.D., Office of Environmental Health Hazard Assessment (OEHHA)



Melanie Marty is an Assistant Deputy Director for the Science Programs at the OEHHA, California Environmental Protection Agency. She has been at OEHHA for more than 30 years and previously served as Acting Deputy Director (2015-2016), Assistant Deputy Director for Scientific Programs (2012-2015), and Chief of the Air Toxicology and Epidemiology Branch (1998 – 2012). Her work has largely been in risk assessment of environmental contaminants, including developing guidance to adequately address

susceptible subpopulations such as children. Dr. Marty has served on a number of U.S EPA peer review committees including Science Advisory Board committees, and was the Chair of the U.S.EPA's Children's Health Protection Advisory Committee from 2001-2009. Dr. Marty

received her Ph.D. from the University of California, Davis in Pharmacology and Toxicology in 1983.



Chris Banks is a staff toxicologist at the Office of Environmental Health Hazard Assessment, who has been developing Public Health Goals in the Water Toxicology section since 2011. Chris received his bachelor's degree in biochemistry from the University of California, Los Angeles, and his Ph.D. in Environmental Toxicology from the University of California, Riverside.

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Presentation Title: Summary of current knowledge on the toxicological effects from PFAS in humans

Abstract: PFAS are persistent toxic chemicals ubiquitous in our environment, and a number of PFAS have been found in sources of drinking water. OEHHA has been evaluating available data on the toxicity of PFAS in the published toxicological and epidemiological literature, as well as from government agencies, to assess the risk of exposure to these chemicals. The most studied PFAS chemicals are perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS). These chemicals have a number of toxic effects associated with them, including effects on the liver and immune systems, reproductive and developmental toxicity, and cancer. In addition to PFOA and PFOS, OEHHA is exploring the potential toxicity of other PFAS chemicals, with an emphasis on chemicals that can be reliably detected in drinking water. Many PFAS chemicals have little to no available toxicity data from traditional whole animal studies, and OEHHA is exploring toxicity predictions based on chemical structure, toxicokinetics, biological activity and their similarity to other PFAS chemicals, using so-called “read-across” approaches.

PRESENT: WHAT IS THE CURRENT STATE OF KNOWLEDGE?

Panel 2: Drinking Water – Occurrence, Economic and Legal Impacts to Public Water Purveyors, and Testing Methods

Susan Glassmeyer, Ph.D., U.S. Environmental Protection Agency



Susan T. Glassmeyer is a research chemist in the US Environmental Protection Agency’s Office of Research Development, Center for Environmental Solutions and Emergency Response. Dr. Glassmeyer earned a Bachelor of Science in chemistry from Xavier University, and a Master of Science in Environmental Science and Doctor of Philosophy degrees from Indiana University. Dr. Glassmeyer’s research is focused on contaminants of emerging concern (CECs), both chemicals such as pharmaceuticals as well as microorganisms, in the water cycle. She has coordinated several projects examining the occurrence, fate and transport of CECs in wastewater, surface water, ground water and drinking water.

Presentation Title: Per- and Polyfluoroalkyl Substances in the United States: Occurrence, Fate, Transport, and Exposure

Abstract: PFAS are environmentally stable contaminants of emerging concern, frequently measured in environmental and drinking waters. This study analyzed for 17 PFAS in source-

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and treated-water samples collected at 25 drinking water treatment plants (DWTPs) across the United States collected between 2010 and 2012. PFAS were quantitatively detected in all 50 samples. Comparing the total PFAS concentration in source and treated water at each DWTP, only five locations demonstrated statistically significant differences (i.e. $P < 0.05$) between samples, indicating that removal of PFAS during drinking water treatment was not common. The environmental persistence of PFAS was evident at six DWTPs. Three DWTPs shared one large river in common as their drinking-water source, while a second set of three DWTPs shared another large river in common for their drinking-water source. The DWTPs in each river basin were separated by 100s to 1000s of kilometers. The PFAS composition at the DWTPs from one river was dominated by perfluorooctanoic acid (PFOA), while the PFAS composition at the DWTPs from the other river was dominated by perfluorobutyric acid (PFBA). Modelling gave further insights to the source of PFAS into the water cycle, pointing to environmental sources other than wastewater.

Matthew Small, Ph.D., P.G., U.S. Environmental Protection Agency, Region 9



Matthew C. Small is the Regional Science Liaison (RSL) for the Office of Research and Development (ORD) in EPA Region 9 (R9), San Francisco, California. As RSL, Matt works to facilitate communication, collaboration, and technical support between ORD and R9. He is one of the Region's hydrogeology experts. Matt led the effort to create national EPA OSWER directives and ASTM standards for remediation by natural attenuation and risk-based corrective action. Matt is also well versed in contaminant fate and transport evaluation, contaminated site remediation, long-term management of residual contamination, and evaluating cleanup goals/options. Matt spent five years in private geological consulting prior to joining EPA. B.S. in Geology from CSU Hayward, M. Eng. in Mineral Engineering and a Ph.D. in Civil and Environmental Engineering from UC Berkeley. He is also a licensed professional geologist in the State of California.

Presentation Title: U.S. EPA PFAS Action Plan Update and Data Analysis Tools Preview

Abstract: An update on the USEPA's PFAs Action Plan, such as actions being taken involving drinking water, surface water protections, monitoring, toxics, risk assessment, biosolids, risk communications, and research activities. Overview of vulnerability analysis performed at public water systems on the island of Guam. Introduction of new EPA PFAS National Data Explorer.

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Tim Sloane, Sher Edling, LLP



Tim Sloane is an attorney with Sher Edling LLP. He represents public entities in litigation directed at putting the costs of pollution on the large institutional entities responsible for it. His groundwater contamination cases focus on emerging contaminants, including PFAS, 1,4-dioxane, hexavalent chromium, and others. Tim's cases span the United States and address some of the most pressing water pollution issues facing public entities.

Presentation Title: PFAS: Legal and Economic Implications for Water Suppliers

Abstract: With increased public and regulatory attention to PFAS, public water suppliers across the country are asking two critical questions: (1) How will we fund the capital and operational costs of treatment; and (2) who should bear those costs? This presentation looks at the potential costs of treatment, and explains potential legal strategies for putting the costs of PFAS treatment on polluters, rather than ratepayers.

Panel 3: Exposure Pathways – Impact to Human Body and Effects on Aquatic Ecosystems

Jim Strandberg, C.Hg., Woodard & Curran



Jim Strandberg is a senior hydrogeologist and project manager with Woodard & Curran in Walnut Creek, California. He has over 30 years of environmental and groundwater resources experience in site investigation, assessment of human health and ecological risk, and remediation of soil, soil vapor, and groundwater impacted by petroleum hydrocarbons, volatile and semi-volatile organics, metals, pesticides, and/or polychlorinated biphenyls. He is a member of Woodard & Curran's emerging contaminants

group and is currently managing the preliminary investigation of PFAS impacts of soil and groundwater at the San Jose International Airport. He is a Director and past President of the Groundwater Resources Association of California and Chair of the Events, Education, and Affiliates Committee. Jim has a BS degree in Geology from UC Davis and an MS degree in Water Resources Engineering from Stanford University.

Presentation Title: Overview of Exposure Pathways for PFAS to Humans

Abstract: PFAS historically have been used in numerous processes and products since the 1940s; over 4000 individual PFAS compounds have been manufactured to-date. While use of certain PFAS, such as PFOS and PFOA, has been phased out in the past couple of decades,

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alternative PFAS compounds have been employed. As a result of their widespread use and unique chemical characteristics, PFAS are now present throughout our environment on a global scale. Humans subsequently may encounter PFAS through a broad array of sources, including use of everyday household products, ingestion of contaminated groundwater, uptake and transfer via the diet, and by contact with impacted environmental media. This talk will present a synopsis of the various exposure pathways that are most relevant to human health and will discuss relative contribution to the overall exposure burden.

Kathleen Atfield, ScD., Center for Healthy Communities



Kathleen Atfield is an environmental epidemiologist and exposure assessment scientist with Biomonitoring California. She has 15 years of experience investigating a wide range of environmental and occupational exposures, including PFASs, pesticides, anesthetics, flame retardants, and various hormone disruptors. Dr. Atfield received her Doctor of Science in Environmental Health from the Harvard School of Public Health and recently completed Epidemiology Intelligence Service training with the Centers for Disease Control and Prevention.

Presentation Title: Update on Biomonitoring California's PFAS Biomonitoring

Abstract: Biomonitoring California is a multi-agency program charged with determining biological levels of environmental chemicals in Californians, establishing trends, and helping to assess the effectiveness of public health efforts and regulatory programs to decrease exposures to specific chemicals. PFAS biomonitoring has been conducted by the program since 2010 in different studies around the state. This talk will present data on current levels observed in Californians among different demographic groups in two parts of the state (the general population of Los Angeles County and Asian Americans in the San Francisco Bay Area) with comparison to national trends.



Rebecca Sutton, Ph.D., San Francisco Estuary Institute

Dr. Rebecca Sutton is a Senior Scientist with the San Francisco Estuary Institute and the Regional Monitoring Program for Water Quality in San Francisco Bay. She leads a team of scientists investigating microplastics and other contaminants of emerging concern in the San Francisco Bay and other regions of California. Dr. Sutton received her B.S. in Environmental Resource Science from the University of California, Davis and her Ph.D. in Environmental Chemistry from the University of California, Berkeley. She has been appointed to California's Green Ribbon Science Panel to aid in the implementation of the state's Safer Consumer Products Regulations.

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Presentation Title: PFAS occurrence and impacts in California's aquatic ecosystems.

Abstract: Widespread historical and current use of PFAS in diverse processes and products has resulted in ubiquitous detection of this class of persistent chemicals in the environment. Studies to characterize the toxicity of PFAS to aquatic organisms are available for only a small subset of the thousands of PFAS in use. In general, these studies indicate that PFAS are toxic to a variety of organisms at low levels, with impacts to metabolism, reproduction, growth, and development. Monitoring of aquatic organisms in California suggests exposures in some regions may pose risks to wildlife. Long-term monitoring indicates declines in PFOS for some species and settings, likely a result of recent phase-out. Significant data gaps remain with respect to the toxicity of individual data-poor PFAS, their occurrence in the environment and in wildlife, and the impacts of exposure to mixtures.

FUTURE: WHAT CAN WE DO FOR SOURCE CONTROL?

Panel 4: Approaches to Remediating, Treating, and Monitoring for PFAS

Rula Deeb, Ph.D., BCEEM, PMP, Senior Principal, Geosyntec



Dr. Rula Deeb is a senior principal civil and environmental engineer at Geosyntec Consultants in Oakland, California. She has more than 25 years of experience in private practice and academia addressing the cross-media fate and transport of environmental contaminants and the remediation of complex soil and groundwater sites impacted by non-aqueous phase liquids. Her focus on emerging contaminants over the last two decades has promoted awareness and improved the understanding of the sources, occurrence, fate and transport, and behavior of these compounds (including PFAS, 1,4-dioxane, MTBE and other fuel oxygenates, perchlorate, NDMA, EDCs, PPCPs, and others) in natural and treatment environments. Dr. Deeb is heavily engaged in the National Academy of Engineering Frontiers of Engineering program, which brings together emerging engineering leaders from industry, academia, and government to discuss pioneering technical work and leading-edge research in various engineering fields and industry sectors.

Dr. Deeb is heavily involved in research and development programs to design and advance practical and cost-effective remedial solutions and inform best-value management strategies for PFAS. She routinely provides litigation support services, including forensic investigations, source identification, and expert opinions regarding PFAS fate and transport, exposure, health effects and other adverse outcomes as well as cost allocation, remedial cost estimates. In addition, she has strongly advocated for advancing the state of knowledge on PFAS by

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organizing webinars and conferences with a strong PFAS focus including The Remediation Summit (RemTEC) and the Emerging Contaminants Summit. She served on the organizing committee of a 2019 National Academies of Sciences, Engineering and Medicine workshop titled “Understanding, Controlling, and Preventing Exposure to PFAS”.

Presentation Title: PFAS Remediation Approaches and Technologies: Research and Development Efforts to Advance the State of Practice

Abstract: This presentation will provide an overview of the factors that complicate the removal of PFAS from contaminated environmental media. This will be followed by a brief discussion on the limitations of conventional remediation technologies for PFAS. The majority of the presentation will focus on recent U.S. Department of Defense research and development efforts involving PFAS destruction technologies, the use of treatment trains to mitigate PFAS impacts, and a lines of evidence approach to demonstrate technology effectiveness in subsurface environments.

Eugene Leung, PE, Division of Drinking Water, State Water Resources Control Board



Eugene Leung is the Drinking Water Treatment Technical Specialist for the State Water Resources Control Board, Division of Drinking Water. He is responsible for providing technical support to the Division’s field offices, local primacy agencies and the water treatment devices registration program. He also serves as the co-chair of the Division’s Water Treatment Committee and is responsible for the review of new and innovative treatment technologies on behalf of the Division. He has served in the current position since 2010. Prior to his appointment as the Drinking Water Treatment Technical Specialist, he was an Associate Sanitary Engineer at the Santa Clara District office for 13 years. He had oversight responsibility for public water systems in the Bay Area that ranged in size from a single-well small water system to large regional systems. He is experienced with the review and permitting of treatment technologies that are used for treating nitrate, perchlorate, manganese, organic contaminants and surface water sources.

Eugene an MS and BS in Civil and Environmental Engineering from the UCLA. He is a registered Civil Engineer and a licensed T4 Water Treatment Operator in California.

Presentation Title: Drinking Water Treatment Options for per- and polyfluoroalkyl substances (PFASs)

Abstract: This presentation will provide a summary of treatment options available to public water systems and homeowners for the treatment of PFAS. The presentation highlights what

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we know and concerns about the three primary treatment technologies that could potentially be used at public water systems. It also provides the latest information on certification standards for point-of-use treatment devices and how to navigate and find the listing of certified devices from two of the primary product certifiers.

Kavitha Dasu, Ph.D, Battelle



Kavitha Dasu is principal research scientist at Battelle. Dr. Dasu has over 8 years of experience in studying the fate of emerging organic contaminants such as PFAS and other emerging contaminants in complex environmental matrices. At Battelle, Dr. Dasu has been providing subject matter expertise and technical lead for project areas in developing novel analytical methods for total PFAS, fate and transport assessment and development of remediation technologies for PFAS contaminated sites. Other areas of expertise include development of high-resolution mass spectrometry tools

for the PFAS forensic analysis to understand the fate and transport and source contributions of PFAS at contaminated sites. Dr. Dasu has published several peer-reviewed studies and book chapter on PFAS analytical methods, fate, and biodegradability and serves as a peer reviewer for scientific journals. Dr. Dasu is a current member of Interstate Technology and Regulatory Council [ITRC] PFAS team. Dr. Dasu holds a Ph.D. in Environmental Chemistry from Purdue University, IN; M.Sc. in Organic Chemistry; and B.Sc. in Chemistry from Osmania University, India.

Presentation Title: Development of High-Resolution Spectrometric Method for analysis of PFAS Contaminated Environmental Samples

Abstract: There are more than 4,700 per- and polyfluoroalkyl substances (PFAS) reported to be in the market. Out of these only a very small fraction of PFAS chemicals are known, with many PFAS unknown. There is a need for the identification and characterization of these unknown chemicals to fully understand the environmental fate and for making risk management decisions. To identify these unknown PFAS in contaminated environmental samples, a high-resolution mass spectrometric method is being developed using Ultrahigh Pressure Liquid Chromatograph (UHPLC) coupled to a Quadrupole Time-of-Flight (QTOF) high resolution mass spectrometer (HRMS). A suspect screening list, structure-based library containing over 400 PFAS compounds has been custom built to aid in the analysis. The presentation will discuss the data reduction approaches, and the application of suspect list screening and non-targeted screening approaches for the identification of PFAS in contaminated environmental samples. Results from the HRMS analysis in combination with statistical analysis will help chemical forensics in PFAS source differentiation and tracking.

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Panel 5: Regulatory Approaches in Reducing PFAS in Consumer Products and Packaging

Simona Bălan, Ph.D., Department of Toxics Substances Control (DTSC)



Simona Bălan is a Senior Environmental Scientist at DTSC, where she leads the Safer Consumer Products team working on PFASs. Before joining DTSC, she was Senior Scientist at the Green Science Policy Institute, managing international projects on the use of flame retardants and PFASs in consumer products. In 2017, she was selected as one of 20 Pioneers Under 40 in Environmental Public Health by the Collaborative on Health and the Environment. She has a Ph.D. in Environmental Science, Policy and Management from UC Berkeley and a B.Sc. in Earth and Planetary Sciences from Jacobs University Bremen, Germany.

Presentation Title: A Chemical-Class Approach to Regulating Perfluoroalkyl and Polyfluoroalkyl Substances (PFASs) in Certain Consumer Products

Abstract: The California Department of Toxic Substances Control (DTSC), which runs the state's innovative Safer Consumer Products program, has been researching and engaging with stakeholders regarding perfluoroalkyl and polyfluoroalkyl substances (PFASs) in consumer products since early 2016. Rather than focusing on individual PFAS compounds, DTSC has taken a chemical class approach. The available information indicates that all PFASs have hazard traits of concern to the state of California and have the potential to harm humans, biota, and the environment. This presentation will explain California's Safer Consumer Products regulatory framework and the rationale behind DTSC's decision to regulate certain consumer products with any member of the class of PFASs.

Robert Contreras, California Department of Resources Recycling and Recovery (CalRecycle)



Robert Contreras is an environmental scientist at CalRecycle who's work focuses on end-of-life issues relating to degradable plastics. He is a member of the ASTM International subcommittee on environmentally degradable plastics and biobased products where he assesses proposed modifications to standard test methods. Robert additionally manages a contract that funds research measuring total fluorine in compostable plastics. Before moving into his current role, Robert assisted in the regulatory implementation of

California's single-use bag ban.

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Presentation Title: CalRecycle's inquiry on PFASs in compostable plastic food service ware and an exploratory remediation technique to remove PFASs from compost leachate

Abstract: The California Department of Resources Recycling and Recovery (CalRecycle) manages a contract with the University of California, Davis to investigate the degradation of compostable plastics in industrial composting environments. Compostable food service ware has become increasingly popular because of its potential to divert food waste from landfills but may contain residual PFASs from the product manufacturing process. CalRecycle is performing this study to determine if industrial composting conditions can be improved to realistically degrade these products. This study will also sample compostable food service ware for total fluorine and examine a technique to remediate total fluorine from compost leachate. This presentation will give an overview of the scope of work and the preliminary findings.

Jen Jackson, San Francisco Department of the Environment



Jen Jackson manages the Toxics Reduction & Healthy Ecosystems Program at the San Francisco Department of the Environment. She and her team lead a variety of programs and implement policies that reduce the use of toxic chemicals to improve environmental and human health. These initiatives include an ordinance banning the use of food service ware containing fluorinated chemicals, an award-winning integrated pest management program, a municipal Green Purchasing Program, an urban biodiversity program, and an extensive residential household hazardous waste disposal program.

Prior to joining San Francisco in 2015, Jen worked in wastewater pollution prevention at the East Bay Municipal Utility District, stormwater pollution prevention for the City of San Pablo, and began her environmental career in the non-profit sector at Sierra Club and Save The Bay. Jen earned her master's degree in Geography, Resource Management & Environmental Planning and wrote her thesis on the sources of endocrine disrupting chemicals in wastewater.

Presentation Title: Municipal level efforts to address PFAS

Abstract: The City and County of San Francisco has been addressing several categories of products containing PFASs, including carpet, furniture, firefighting foam and food service ware, and are concerned about mist suppressants used in metal finishing. To address the multi-headed hydra of PFASs, San Francisco is employing a variety of tools, including purchasing regulations, public education and legislation.