# PFAS DESKBOOK

by

James B. Pollack

With Contributing Authors: Isabel Q. Carey and Victor Y. Xu

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# About the Author

James Pollack is an attorney at Marten Law LLP, where he leads the firm's consumer products regulatory practice. James counsels textile and apparel manufacturers, outdoor recreational product manufacturers, food product manufacturers, and retailers on a variety of sustainability issues. In recent years, his work has largely focused on emerging contaminants like PFAS. He has also works on litigation related to identification and cleanup of PFAS contamination in community water supplies. Prior to joining Marten, James clerked for Chief Judge Brian M. Morris of the U.S. District Court, District of Montana, in Great Falls, Montana. He graduated from Harvard Law School (*cum laude*) where he was Co-Editor-in-Chief of the *Harvard Environmental Law Review*. He also earned an MPP from the John F. Kennedy School of Government.

# Contributing Authors

Isabel Carey is an attorney at Marten Law LLP, where she counsels clients on a variety of energy, climate, waste management, and permitting issues. As part of Marten's litigation practice, she also assists municipal water districts with claims against PFAS manufacturers and the U.S. Department of Defense for contamination of public water systems. Prior to joining Marten Law, Isabel clerked for Justice Willcock and Justice DeWitt-Van Oosten of the British Columbia Court of Appeal, and completed a fellowship focusing on environmental and administrative law with the Institute for Policy Integrity. She graduated from New York University School of Law (*magna cum laude*), where she served on the *Review of Law and Social Change*.

Victor Xu is an attorney at Marten Law LLP, where his practice focuses on natural resources and remediation in both the regulatory and litigation spheres. He helps consumer-products brands achieve compliance with various state and federal regulations. In addition, he represents water providers in complex litigation related to PFAS contamination in groundwater, as well as clients involved in natural-resources disputes implicating an array of federal environmental laws. Before joining Marten Law, Victor clerked for Judge James R. Sweeney II of the U.S. District Court for the Southern District of Indiana and Judge Harris L Hartz of the U.S. Court of Appeals for the Tenth Circuit. He graduated from Stanford Law School, where he was a public interest fellow and leader of a community law pro bono project.

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# Online Materials

To stay current of the latest PFAS-related developments, supplementary materials can be found on the Deskbook's website at www.eli.org/pfas-deskbook.

# Glossary of Acronyms

AAI: all appropriate inquiries
AFFF: aqueous film-forming foam
AG: attorney general
ASTM: American Society for Testing and Materials
CAA: Clean Air Act
CCL: Contaminant Candidate List
CDC: Centers for Disease Control and Prevention
CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act
CIC: combustion ion chromatography
CWA: Clean Water Act
DOD: U.S. Department of Defense
DWSWA: Dalton-Whitfield Solid Waste Authority
ECF: electrochemical fluorination
EHS: extremely hazardous substances
ELGs: Effluent limitation guidelines
EOF: extractable organic fluorine
EPA: U.S. Environmental Protection Agency
EPCRA: Emergency Planning and Community Right-to-Know Act
ESA: environmental site assessment
FAA: Federal Aviation Administration
FDA: Food and Drug Administration
FDCA: Federal Food, Drug, and Cosmetic Act
FIFRA: Federal Insecticide, Fungicide, and Rodenticide Act
FTC: Federal Trade Commission
FTCA: Federal Tort Claims Act
GAC: granular activated carbon
GAO: U.S. Government Accountability Office
GenX: hexafluoropropylene oxide (HFPO) dimer acid
HAP: hazardous air pollutant
HDPE: high-density polyethylene
HFPO: hexafluoropropylene oxide
INAA: instrumental neutron activation analysis
ITRC: Interstate Technology Regulatory Council
LAS: land application system
LCPFAC: long-chain perfluoroalkyl carboxylate
MCL: maximum contaminant level
MCLG: maximum contaminant level goal
MDL: multidistrict litigation
NAAQS: national ambient air quality standards
NAICS: North American Industry Classification System
NCP: National Oil and Hazardous Substances Pollution Contingency Plan
NDAA: National Defense Authorization Act
NESHAP: national emission standards for hazardous air pollutants
NHANES: National Health and Nutrition Examination Survey
NOI: net operating income
NPDES: national pollutant discharge elimination system

NPDWR: national primary drinking water regulation
OCPSF: organic chemicals, plastics, and synthetic fibers
OECD: Organisation for Economic Co-operation and Development
OMP: White House Office of Management and Budget
PCB: polychlorinated biphenyl
PFAA: perfluoroalkyl acid
PFAS: per- and polyfluoroalkyl substances
PFBS: potassium perfluorobutane sulfonate
PFCs: perfluorinated chemicals
PFDA: perfluorodecanoic acid
PFHpA: perfluoroheptanoic acid
PFHxA: perfluorohexanoic acid
PFHxS: perfluorohexanesulfonic acid
PFNA: perfluorononanoic acid
PFOA: perfluorooctanoic acid
PFOS: perfluorooctanesulfonic acid
PFPE: perfluoropolyether
PFUnDA: perfluoroundecanoic acid
PIGE: particle-induced gamma-ray emission
PMN: premanufacture notice
POTW: publicly owned treatment works
PRP: potentially responsible party
PTFE: polytetrafluoroethylene resin
PWS: public water system
RCRA: Resource Conservation and Recovery Act
RD: regulatory determination
REC: recognized environmental condition
RQ: reportable quantity
SAB: Science Advisory Board
SDWA: Safe Drinking Water Act
SIP: state implementation plan
SNUN: significant new use notice
SNUR: significant new use rule
TCE: trichloroethylene
TF: total fluorine
TOF: total organic fluorine
TRI: Toxics Release Inventory
TSCA: Toxic Substances Control Act
TSDF: treatment, storage, and disposal facilities
UCMR: Unregulated Contaminant Monitoring Rule
WQS: water quality standards

# Foreword

Recent years have witnessed rapidly growing awareness and understanding of the risks and harmful effects of per- and polyfluoroalkyl substances, more commonly known as PFAS, to human health and the ecosystems around us. But while the toxicity of these "forever chemicals" is now better understood, the myriad uses of and current ubiquity of PFAS in products mean we are still wrestling with effective action. In many ways, federal and state movement on PFAS is just beginning, and the regulatory landscape is changing quickly. As the landscape evolves in efforts to address this increasingly vital challenge, the Environmental Law Institute is pleased to offer the *PFAS Deskbook* as a valuable resource in this emerging and highly complex area of environmental law and policy.

The *PFAS Deskbook* aims to provide a comprehensive, objective overview of the PFAS journey from the time they were created to the evolving governance landscape today. It includes an historical overview of PFAS then delves into the chemical complexities of PFAS, its varied uses in products today, risks associated with it, and current testing, cleanup, and disposal techniques. Most ELI Deskbooks spotlight a particular law and provide resources and insights associated with its implementation; the *PFAS Deskbook*, however, centers on a contaminant and then pulls in the laws, regulations, and litigation associated with each stage of its life cycle. We believe this to be the most useful structure for this rapidly changing area of law. Our hope is that by looking at the entirety of where the laws and regulations are today, the *Deskbook* will provide clarity about the areas of greater and lesser certainty in the current legal landscape; and by showing how we got here, it will become clearer where the framework could go next.

The *PFAS Deskbook* is part of Environmental Law Institute's Deskbook series, which combines the invaluable experience of top practitioners in the field with the encyclopedic coverage and keen insight provided by ELI's expert editors. The series currently includes Deskbooks on Wetlands, Climate Change, Environmental Crimes, RCRA, NEPA, and many more topics, combining in-depth analysis with necessary reference materials such as regulations, guidance documents, and forms.

The Deskbooks are natural partners to ELI's flagship resource, *ELR—The Environmental Law Reporter*. *ELR* is an attorney-edited gateway to researching and understanding environmental law and policy, with coverage since 1971 available online and easily searchable. *ELR* couples thousands of insightful articles on environmental law and policy with the most important updates, decisions, statutes, regulations, and agency documents; all supported by a cumulative index and bibliography to help you navigate this highly complex area of law.

The Environmental Law Institute makes law work for people, places, and the planet. With its nonpartisan, independent approach, ELI informs the public debate around and promotes solutions to tough environmental problems. We hope the *PFAS Deskbook* helps improve understanding in this important area of environmental law and regulation.

— Jordan Diamond
President
Environmental Law Institute

# Introduction

*by James Pollack*

PFAS, or per- and polyfluoroalkyl substances, are a family of thousands of synthetic chemicals. These so-called "forever chemicals" have a variety of unique qualities that make them useful in industrial and consumer product applications. PFAS can resist extreme temperatures. They can simultaneously repel grease, water, and stains. They are also incredibly persistent and can remain in their stable chemical form—as their nickname suggests—forever. It doesn't take a materials scientist to see the incredible potential for PFAS.

Unfortunately, there is a growing scientific recognition that many PFAS come with a cost to public health and the environment. Although PFAS have been around since the 1940s, they have only recently gained public attention for their potential health effects. A growing body of scientific research links many PFAS to a variety of health concerns, including multiple types of cancer, developmental and fertility issues, heightened blood pressure, and other disease risk.

Several months into my own work on PFAS, my spouse asked how we could phase out or reduce our exposure to the chemicals in our day-to-day lives. It was hard to choose the best place to start. PFAS exposure can come in many forms, from drinking water and dust ingestion to skin exposure.[1] I knew that many communities in Massachusetts—where we live—were discovering PFAS contamination in their drinking water.[2] In fact, months later, our own drinking water supply would be identified as contaminated.[3] I knew our state had developed drinking water standards for six PFAS, but that didn't cover the thousands of other potential PFAS we could consume each day.[4] And no federal PFAS drinking water requirements applied to our taps. Drinking water aside, I couldn't account for the potential PFAS exposure from our nonstick cookware, our too-frequent to-go salad and burrito bowls, the raincoats that kept us dry in the rain, and the boots that mercifully protected our feet in the northeastern winter.

Try as I might to decrease our own family's exposure, the growing body of evidence shows that PFAS is everywhere. It seems that whenever scientists search for PFAS, they find it. The Centers for Disease Control and Prevention (CDC) identified PFAS in the blood of 98% of the American population.[5] Researchers have found PFAS at far-flung locations including Mount Everest base camps, remote Arctic basins, and the Tibetan Plateau.[6] The chemicals circulate throughout planetary ecosystems, appearing in the bodies of people, fish, and wildlife of all kinds from across the globe.[7]

Much like climate change, PFAS represents a "super wicked problem."[8] That is because our ability to deal with PFAS contamination is in many ways limited by the characteristics of PFAS itself:

1. Junjie Ao et al., *Characteristic and Human Exposure Risk Assessment of Per- and Polyfluoroalkyl Substances: A Study Based on Indoor Dust and Drinking Water in China*, 254 Env't Pollution 112873 (2019); Matthew Lorber & Peter P. Egeghy, *Simple Intake and Pharmacokinetic Modeling to Characterize Exposure of Americans to Perfluorooctanoic Acid, PFOA*, 15 Env't Sci. & Tech. 8006 (2011); Somrutai Poothong et al., *Multiple Pathways of Human Exposure to Poly- and Perfluoroalkyl Substances (PFASs): From External Exposure to Human Blood*, 134 Env't Int'l 105244 (2020); Elsie M. Sunderland et al., *A Review of the Pathways of Human Exposure to Poly- and Perfluoroalkyl Substances (PFASs) and Present Understanding of Health Effects*, 29 J. Exposure Sci. & Env't Epidemiology 131 (2019).
2. Barbara Moran, "*Forever Chemicals" Widespread in Mass. Surface and Ground Water, Says New Report*, WBUR (Oct. 29, 2021), https://www.wbur.org/news/2021/10/29/pfas-chemicals-massachusetts-water-sources-report.
3. Associated Press, *Cambridge Finds "Forever Chemicals" in Its Water*, WBUR (Aug. 29, 2022), https://www.wbur.org/news/2022/08/29/cambridge-water-pfas-above-standard-water-supply.
4. Massachusetts Department of Environmental Protection, *Per- and Polyfluoroalkyl Substances (PFAS)*, https://www.mass.gov/info-details/per-and-polyfluoroalkyl-substances-pfas (last visited Jan. 31, 2023).
5. Atonia M. Calafat et al., *Polyfluoroalkyl Chemicals in the U.S. Population: Data From the National Health and Nutrition Examination Survey (NHANES) 2003-2004 and Comparisons With NHANES 1999-2000*, 115 Env't Health Persps. 1596 (2007).
6. Ian T. Cousins et al., *Outside the Safe Operating Space of a New Planetary Boundary for Per- and Polyfluoroalkyl Substances (PFAS)*, 56 Env't Sci. & Tech. 11172 (2022).
7. CDC, *Biomonitoring Summary: Perfluorochemicals*, https://www.cdc.gov/biomonitoring/PFAS_BiomonitoringSummary.html (last reviewed Apr. 7, 2017).
8. *See* Richard Lazarus, *Super Wicked Problems and Climate Change: Restraining the Present to Liberate the Future*, 94 Cornell L. Rev. 1153, 1160-61 (2009).

- *PFAS are artificial*. PFAS do not occur naturally in the environment. They are synthesized with an eye toward persistence, mobility, and the ability to repel oil and water. These same properties mean there is no broadly accepted way to safely filter, store, or destroy all PFAS.
- *PFAS are ubiquitous*. PFAS have been found just about anywhere in the environment that scientists have searched for them. They are used in countless industrial and consumer product applications. They are also used in essential medical and firefighting applications. From those varied uses, they easily spread into and throughout the environment.
- *PFAS are varied*. Depending on how one counts, there are anywhere from 9,000 to 13,000 chemicals in the PFAS family, with more synthesized each year. The sheer number of chemicals can make research, testing, and regulation challenging. Many of our environmental laws are set up to regulate chemicals on a per-chemical basis—not by family.
- *PFAS can affect public health*. Scientific research has linked some PFAS with an array of environmental and public health harms—even at incredibly small quantities that stretch the limits of current technological measurement capability. PFAS do not degrade naturally, and they can bioaccumulate.
- *PFAS can spread through any media*. Although water contamination is most common, PFAS can also spread through air, dirt, food, and any number of other media. Our largely medium-based statutes must each deal with PFAS separately.

The characteristics of PFAS make the chemicals particularly challenging to deal with from both legal and regulatory perspectives. In many ways, the challenges posed by PFAS represent the quintessential environmental problem.

The law has been slow to respond to the PFAS problem as a result of the chemical family's wicked characteristics. Legal activities around PFAS began with plaintiff-side litigation. State policymakers took the baton through the enactment of new state laws to deal with PFAS. And only recently, the slow-moving ship that is the federal government has begun its own effort to regulate PFAS. But that effort still remains largely on the horizon. As the law continues to deal with the PFAS problem, the *PFAS Deskbook* will stand as a resource to understand where we are, how we got there, and where we are going.

## I. *PFAS Deskbook* Purpose

The *PFAS Deskbook* is intended to provide lawyers and policymakers with an introduction to the complicated world of PFAS. Our aim is to provide a comprehensive, nonpartisan, objective overview of the PFAS journey from their inception to today.

Most Environmental Law Institute deskbooks spotlight a law and provide practitioners with an opportunity to understand the major issues posed when that particular law gets applied. The *PFAS Deskbook* works in reverse, centering on a contaminant and presenting how regulations and litigation have together shaped the way that the pollutant enters, moves through, and ultimately exits the environment.

The world of PFAS regulation and litigation is constantly evolving. As a result, the publication of a book may seem puzzling—after all, the contents will be out of date as soon as proofs get sent to the printer. But the same could be said for any book on the law. New cases, laws, and regulations will always disrupt the legal status quo. Those developments require parallel updates in the scholarship. This deskbook will work in much the same way.

The *PFAS Deskbook* will provide the reader with a regulatory and litigation snapshot at a moment in time. Even that brief snapshot can provide practitioners with an idea of where to look next and what kinds of questions to ask as they address the PFAS problems occupying their desk.

## II. *PFAS Deskbook* Content

### *A. Chapters*

The *PFAS Deskbook* is divided into five chapters. Other than the initial background chapter, the chapters are laid out to largely follow the path of PFAS chemicals as they move through the supply chain. Each chapter highlights the regulations and litigation related to that stage in the PFAS life cycle.

Chapter 1 provides a general background on PFAS, beginning with the history of the development of PFAS chemicals in the 1940s through their proliferation across manufacturing sectors and modern-day ubiquity. The chapter delves into the chemical complexities of PFAS, discussing the chemical makeup and characteristics of the most common types and major categories of compounds. It provides a summary of the varied uses of PFAS in products today. It then reviews scientific research regarding the risks PFAS poses to individual, public, and environmental health. The chapter concludes with a discussion of testing, cleanup, and disposal techniques.

Chapter 2 starts at the beginning of the PFAS chemical journey: at their creation, import, and initial use in industrial facilities. The chapter highlights the various legal frameworks that apply to the manufacture, import, and industrial application of PFAS. The chapter covers regulations under the Toxic Substances Control Act (TSCA), Emergency Planning and Community Right-to-Know Act, Clean Water Act (CWA), Clean Air Act, Resource Conservation and Recovery Act, and a variety of other federal and state laws. The chapter also highlights the cleanup litigation involving manufacturing facilities.

Chapter 3 covers the statutory and regulatory frameworks relevant to consumer products, with a separate emphasis on aqueous film-forming foam (AFFF). The chapter specifically highlights consumer product regulations; however, many of these same regulations also cover industrial or commercial products as well. The one exception is that this chapter covers the regulation of AFFF. As one of the most well-documented sources of PFAS contamination, there are many AFFF-specific regulations in place that require their own coverage separate from more general consumer product regulations. The chapter features the application of TSCA, the Federal Insecticide, Fungicide, and Rodenticide Act, state PFAS consumer product regulations, marketing claim regulations, and AFFF-specific regulations. It also covers the rise of consumer product and AFFF litigation.

Chapter 4 tracks PFAS once it has entered drinking water and wastewater systems. This represents the next stage in the PFAS life cycle, as it enters the environment following industrial uses or the disposal of products. Once in the environment, PFAS can easily contaminate water resources. This chapter covers the Safe Drinking Water Act, CWA, and the variety of state drinking water standards, guidelines, and notification requirements that have developed around PFAS.

Chapter 5 covers PFAS contamination and cleanup. Once PFAS is in the environment, a variety of federal and state statutes can apply to the contaminated soil, air, and water. Those statutes govern the sale of contaminated property, and ultimate cleanup of any contamination. They include the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)—the federal Superfund law—and state cleanup laws. These laws provide the potential for decades of litigation as the U.S. Environmental Protection Agency designates new Superfund sites for PFAS contamination and old Superfund sites reopen when PFAS is later found following the cleanup of legacy pollutants. The chapter covers emerging litigation to that end.

The decision to split the deskbook into these topical chapters created several challenges. The artificial distinctions lead to some degree of overlap between chapters in both the laws covered and the cases discussed. That is because the same federal and state laws may govern several different points in the life cycle of PFAS chemicals. Further, a case study at a particular facility may prove relevant to both the manufacturing of PFAS and cleanup of sites contaminated with PFAS. We have drafted the chapters to refer to one another, and to split relevant content between the chapters as necessary to fit within the chapter divisions we established. We found this to be the most logical way we could organize the deskbook.

The *PFAS Deskbook* can be read in two ways. First, it can be read in a way that responds to a particular need. If your client spills PFAS at a manufacturing facility, you may wonder what your reporting obliga-

tions will be—there is a chapter section to give you the tools needed to start answering that question. There is also a chapter section on potential cleanup liability from that spill. You might provide drinking water to a community—there is a chapter just for you and your compliance obligations and the history of regulation in the drinking water sector. You may want to go back and read the background for more information on PFAS, but we hope that those sections that address your question will provide you with the stand-alone information needed to give you a place to start. Second, this book can be read straight through to provide a full picture of PFAS regulation and litigation throughout the life cycle of the chemical. No matter how you use the *PFAS Deskbook*, we hope that this layout provides you with the flexibility to efficiently answer questions as needed.

## *B. Themes*

The *PFAS Deskbook* covers many topics in PFAS regulation and litigation, but several themes will come up repeatedly throughout the book across that spectrum of subjects.

### 1. The "pfamily" of PFAS chemicals

Depending upon how one counts, there are thousands of individual PFAS chemicals. This number continues to increase as our understanding of the nuances of PFAS evolves and chemists create more variations of the chemicals. The larger group of PFAS chemicals is sometimes referred to under the umbrella term of "the PFAS family," which will be used throughout the *PFAS Deskbook* when referring to all types of PFAS in general.

The vastness of the PFAS family, in addition to the complexity of its subfamilies and classes, has complicated efforts to understand, regulate, and treat these chemicals. Many of our traditional environmental laws were drafted to target individual chemicals or pollutants. Similarly, research has focused on individual PFAS chemicals, and regulations have targeted individual PFAS for regulation. But some scientists and regulators are beginning to argue for family-wide regulation as a more effective mechanism for addressing the wide array of challenges PFAS present. Some state laws have pursued this family-wide regulation style, but these kinds of regulations also raise questions about how exactly to define and test for PFAS.

### 2. Scientific challenges

Although research on PFAS chemicals first began in the 1950s, many aspects of the PFAS family are still largely unknown. The staggering number of individual chemicals that fall within the family, as discussed above, has presented a significant challenge for researchers attempting to define their various impacts on human health and the ways that they interact with the environment. Put simply, it is not always clear how research on one chemical can apply to another—multiplying that challenge across thousands of chemicals provides a snapshot of the problem.

Similarly, testing and detection techniques for PFAS are still extremely limited in scope and capability, with many tests still unable to distinguish between specific PFAS chemicals, unable to test across multiple media or provide quantifiable details for more than a select few compounds. This lack of comprehensive testing methods creates further challenges for addressing PFAS contamination in the environment. Cleanup methods are also still largely in development, as most current practices related to filtration, storage, and disposal can be imperfect and inefficient. The background chapter of this book will provide some context on the limitations of current PFAS research and subsequent implications for the legal landscape.

### 3. The precautionary principle

The tension between regulating PFAS chemicals individually or as a class represents a conflict over what is known as the precautionary principle. This philosophical approach provides that under conditions of uncertain or disputed impacts, new products or processes should be heavily regulated to prevent any poten-

tial harms. There is broad scientific consensus that certain PFAS chemicals are harmful to human health and the environment. Although the scientific and public health understanding of many other PFAS chemicals are still in the early stages, many public advocacy campaigns and regulations target PFAS chemicals as a class. Advocacy groups and policymakers are motivated by the precautionary principle.

### 4. Federalism

The PFAS legal landscape has thus far been characterized by the interplay of federal and state regulations. The federal government has been slow to regulate PFAS under traditional environmental laws. In part, this has been the result of a relatively new set of chemical regulatory frameworks adopted as revisions to TSCA in 2016. In the absence of federal activity, states have adopted their own laws and regulations related to PFAS. This patchwork regulatory approach has created pressure for uniform federal regulation that may preempt these various state measures. As public and political pressure mounts, it is likely that we will see more and more federal action addressing the PFAS crisis—and increased conflict over what has or has not been preempted at the state level.

### 5. Regulation and litigation

The interplay of regulation and litigation has been a key dynamic shaping the PFAS landscape in the United States. Litigation in the form of class actions, cleanup enforcements, and declaratory actions to apply traditional environmental laws to PFAS has created pressure for regulators to act. In turn, regulation has upturned new evidence to support those same litigation efforts. In that way, litigation and regulation spur one another through a positive feedback loop that forces the regulatory structure forward.

## III. Editorial Notes

A (brief) note on terminology: the *PFAS Deskbook* will use the term "PFAS" to refer to per- and polyfluoroalkyl substances. A variety of terms have been applied to the PFAS family, including perfluorochemicals (PFCs) or the plural PFASs. The term "PFC" has largely fallen into disfavor. Some writers use the term "PFASs" to emphasize the plural nature of the family. We have opted for the contemporary—and already plural—term "PFAS." Additional abbreviations are detailed in the Glossary of Acronyms.

The *PFAS Deskbook* is in many ways a living document. The editors look forward to publishing new editions as the PFAS landscape continues to evolve. In the meantime, between editions, the editors will work with the Environmental Law Institute to maintain and update an online database of PFAS regulations that can be found on the Environmental Law Institute's website at www.eli.org/pfas-deskbook. In addition, the editors will continue to publish articles on new laws, regulations, and litigation on Marten Law's website: www.martenlaw.com. Interested readers can subscribe to the Marten Law Newsletter for updates.

The editors of and contributors to the *PFAS Deskbook* represent clients who are engaged in litigation around PFAS and who are building compliance plans to navigate the quickly developing regulatory regimes around PFAS. Those representations did not alter the content of this book. Further, none of the *PFAS Deskbook* constitutes legal advice.