TOO LITTLE TOO LATE: UNDERREGULATION OF CONTAMINANTS OF EMERGING CONCERN

by Emma Schwartz

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SUMMARY

Underregulation is a common and persistent environmental law problem, with recent scholarly focus on individual contaminants of emerging concern (CECs), whose harm is not fully known. But little attention has been given to the general trend of underregulation with respect to these chemicals, or explaining why this systematic underregulation occurs. This Article posits that federal agencies have been unacceptably slow to initiate protective regulations, and even once regulations are promulgated, they leave regulatory gaps that continue to expose populations to harmful effects. It further argues that the scientific uncertainty that defines CECs as a class is responsible for this particularly significant pattern of underregulation, and obscures the existence and scope of the problem from the public and from regulators themselves. The Article concludes with recommendations to address these shortfalls.

In January 2020, the *Los Angeles Times* ran a story describing the plight of Wendy Rash, who in 2005 was diagnosed with thyroid disorder and chronic fatigue, and more than 10 years later discovered that her unexplained illnesses could be attributed to a class of toxic chemicals, per- and polyfluoroalkyl substances (PFAS), that the U.S. Environmental Protection Agency (EPA) had just recognized as a major drinking water hazard.[1] Wendy was largely without relief: at the time of her illness, EPA had no enforceable PFAS drinking water standard, so while the government recognized that the chemicals were dangerous, there was little that Wendy could argue to justify support.

Underregulation like Wendy experienced is a common and persistent environmental law problem. Examples run the gamut of issues; Prof. Arthur Pugsley has identified underregulation in discharges from logging, agricultural, construction, and development industries into jurisdictional waters under the Clean Water Act (CWA).[2] Prof. William Buzbee has identified underregulation with respect to climate change under the Clean Air Act (CAA),[3] and the endangered species problem of aquaculture under various environmental statutes.[4]

Author's Note: I would like to thank Prof. Sheila Foster for her excellent guidance during the writing process, Prof. William Buzbee for his expertise and recommendations regarding scholarship on regulation, and Prof. Lydia Slobodian for her coordination of the Environmental Research Workshop course.

1. David S. Cloud, *"Our Voices Are Not Being Heard": Colorado Town a Test Case for California PFAS Victims*, L.A. Times (Jan. 30, 2020), https://www.latimes.com/politics/story/2020-01-30/california-pfas-water-contamination-colorado.
2. Arthur Pugsley, *The Myth of EPA Overregulation*, 39 Ecology L.Q. 475 (2012); 33 U.S.C. §§1251-1387, ELR Stat. FWPCA §§101-607.
3. 42 U.S.C. §§7401-7671q, ELR Stat. CAA §§101-618.
4. William W. Buzbee, *Recognizing the Regulatory Commons: A Theory of Regulatory Gaps*, 89 Iowa L. Rev. 1 (2003) (identifying climate change, urban sprawl, and aquaculture as underregulated areas of environmental law). *See*, *e.g.*, Pugsley, *supra* note 2 (identifying greenhouse gas emissions and discharges into jurisdictional waters as areas of persistent underregulation); A. Dan Tarlock, *Land Use Regulation: The Weak Link in Environmental Protection*, 82 Wash. L. Rev. 651 (2007) (identifying land use as being consistently underregulated); Carter H. Strickland Jr., *Revitalizing the Presumption Against Preemption to Prevent Regulatory Gaps: Railroad Deregulation and Waste Transfer Stations*, 34 Ecology L.Q. 1147 (2007) (recognizing waste from railroads as an underregulated area of environmental law).

Especially in recent years, scholars have honed in on the underregulation problem in toxic contaminants. Scholars have identified numerous instances of contaminant underregulation, particularly after the 2015 Flint water crisis that drew attention to the government's disregard for the harms of lead exposure.[5] This research has highlighted underregulation of individual contaminants of emerging concern (CECs), contaminants whose harm is not fully known, such as pharmaceutical and personal care products.[6]

Despite the focus in environmental scholarship on identifying instances of underregulation of individual CECs, little attention has been given to recognizing a general trend of underregulation with respect to these chemicals, or explaining *why* this systemic underregulation occurs. This Article fills this gap by positing that the federal government has consistently underregulated CECs. Over time and across all kinds of CECs, federal agencies have been unacceptably slow to initiate protective regulations, and even once they are promulgated, agencies leave regulatory gaps that continue to expose populations to the harmful effects of these chemicals. The Article further argues that the scientific uncertainty that defines CECs as a class is responsible for its particularly significant pattern of underregulation, even in comparison to other problems in environmental law. And it is this same uncertainty that obscures the existence and scope of the problem from the public and from agency regulators themselves.

Part I provides background on CECs and their dangers to human health and the environment, by defining terms and identifying the scope of environmental justice threats that various unregulated CECs pose. In considering environmental justice threats, the Article examines three example CECs: asbestos, chlorpyrifos, and PFAS. These three provide a representative sample of the great range of contaminants that fall within the category, as they are all used for different purposes and impact human health via different mechanisms.[7]

Part II synthesizes existing theories to provide a comprehensive framework for underregulation in environmental law, then explains how underregulation is particularly virulent with respect to CECs. Part III uses the three representative CECs considered in Part I to demonstrate the validity of the underregulation framework in practice across the diverse spectrum of CECs over time. Finally, Part IV proposes a series of recommendations for addressing the persistent problem of CEC underregulation. Part V concludes.

I. Background

A. *CECs Generally Defined*

CECs are a group of "synthetic or naturally occurring chemical[s] or . . . microorganism[s] that [are] not commonly monitored in the environment but [have] the potential to enter the environment and cause known or suspected adverse ecological or human health effects."[8] As such, CECs are identified not by their inherent chemical properties, but by their scientific uncertainty.

Currently and in recent years, the government has been faced with researching and regulating numerous CECs that range greatly in their uses, from consumer products like food packaging and Teflon pans (PFAS) to disinfection products (chlorinated biphenyls) to gasoline (methyl tertiary butyl ether (MBTE)) to quantum computing (nanomaterials) to pharmaceuticals (propranolol).[9] But the problem of CECs is not a recent one; as long as the government has been regulating hazardous materials it has faced contaminants where harm was apparent but scientific explanations were lacking.

For example, some of EPA's first actions included addressing contaminants like dichloro-diphenyl-trichloroethane (DDT) and lead that had plagued the American public.[10] Instead of a temporal problem, CECs can be viewed as a revolving door: as society expands and technology advances, new chemicals and materials are constantly being discovered, synthesized, and utilized, forcing the government to constantly assess the impact that these CECs have on human health and the environment, and how these CECs should be regulated.

B. *Background on Case Study CECs*

This Article focuses on three CECs—asbestos, chlorpyrifos, and PFAS—as a representative sample of the class as a whole. Asbestos, a biological material most commonly found in construction, was one of the first CECs regulated by the federal government beginning in the early 1970s. Chlorpyrifos, a common insecticide, was substantially regulated by the federal government recently, as of 2020. PFAS, a class of thousands of chemicals used for waterproofing, is currently being considered for federal regulation.

5. Eric Moorman, *"A Greater Sense of Urgency": EPA's Emergency Authority Under the SDWA and Lessons From Flint, Michigan*, 47 ELR 10786 (Sept. 2017); David A. Dana & Deborah Tuerkheimer, *After Flint: Environmental Justice as Equal Protection*, 111 Nw. U. L. Rev. 93 (2017); Robert A. Michaels, *Legacy Contaminants of Emerging Concern: Lead (Pb), Flint (MI), and Human Health*, 32 Env't Claims 6 (2019).
6. John Wood, *Can We Teach Old Laws a New Risk? Federal Environmental Law, Risk Management Theory, and Contamination of U.S. Water Supplies With Pharmaceutical and Personal Care Products*, 21 N.Y.U. Env't L. Rev. 193 (2014); William Wombacher, *There's Cologne in the Water: The Inadequacy of U.S. Environmental Statutes to Address Emerging Environmental Contaminants*, 21 Colo. J. Int'l Env't L. & Pol'y 521 (2010); Jeff B. Kray & Sarah J. Wightman, *Contaminants of Emerging Concern: A New Frontier for Hazardous Waste and Drinking Water Regulation*, 32 Nat. Res. & Env't 36 (2018).
7. See discussion *infra* Section I.B.
8. Shabana Siddique et al., *A Review of the Role of Emerging Environmental Contaminants in the Development of Breast Cancer in Women*, 2 Emerging Contaminants 204 (2016).
9. Meng Lei et al., *Overview of Emerging Contaminants and Associated Human Health Effects*, 2015 BioMed Rsch. Int'l 1 (2015).
10. The U.S. Congress passed the Lead-Based Paint Poisoning Prevention Act just one month after EPA was officially formed by President Richard Nixon via Executive Order. 42 U.S.C. §§4801 et seq.; Reorganization Plan No. 3 of 1970, 35 Fed. Reg. 15623 (Dec. 2, 1970). Just two years after its formation, EPA banned DDT via an administrative order. 37 Fed. Reg. 13369 (July 7, 1972).

1. Asbestos

Asbestos is a naturally occurring silicate material.[11] Asbestos is nonflammable, noncombustible, and has a very high melting point and very low thermal conductivity.[12] As such, asbestos was most commonly used in building construction as an insulator and a fireproofer. Despite its utility, asbestos exposure is dangerous to human health: exposure can cause asbestosis, the chronic inflammation and scarring of the lungs.[13] Complications of asbestosis can be severe, including lung cancer and pulmonary heart disease.[14]

2. Chlorpyrifos

Chlorpyrifos is an organophosphate insecticide primarily used in agriculture. It was developed from a class of nerve agents that in turn were developed for use as chemical warfare agents in World War II.[15] Chlorpyrifos is regarded as one of the most widely used pesticides in the United States; studies have found that in agricultural use alone the United States used 10,000 tons of chlorpyrifos annually from 1987 to 1992, and use rose to 100,000 tons annually by 2017.[16]

The source of chlorpyrifos' derivation explains both its effectiveness as a pesticide and its danger to human health. Chlorpyrifos interferes with nerve pathways, and exposure thus can result in a variety of symptoms, including nausea, muscle spasms, impaired vision, seizures, paralysis, or suffocation from lung failure.[17] These symptoms are felt particularly strongly by infants and children exposed to chlorpyrifos.[18] Additionally, chlorpyrifos presents especially strong risk to pregnant women; studies have shown that children exposed to high levels of chlorpyrifos in utero were more likely to experience developmental delays and disorders than children not exposed.[19]

3. PFAS

PFAS are a class of compounds defined chemically as those compounds containing at least one fully fluorinated methyl or methylene carbon atom.[20] While there are currently more than 9,000 recognized PFAS chemicals, the most commonly used and therefore discussed PFAS are perfluorooctane sulfonic acid (PFOS) and perfluorooctanoic acid (PFOA).[21] Their chemical structure makes PFAS hydrophobic and degradation-resistant, making them ideal for use in water-resistant consumer products like food packaging, nonstick kitchenware, raingear, and carpets, and for use in firefighting foam used to put out grease and gasoline fires.[22]

These same chemical properties and the myriad of uses they compel make PFAS dangerous, however. PFAS are ubiquitous not only in their uses, but in contamination streams, particularly drinking water. Indeed, studies have estimated that 99% of Americans have some amount of PFAS in their blood.[23] Further, because PFAS is resistant to degradation, it persists in the environment and in human blood when ingested, resulting in higher exposure concentrations and prolonged human health effects.[24] These human health effects can be significant: studies have linked PFAS with several types of cancer, thyroid disease, and hypercholesterolemia.[25]

C. *Environmental Justice Implications of CEC Exposure*

Exposure to CECs disproportionately threatens environmental justice communities.[26] An examination of asbestos, chlorpyrifos, and PFAS as CECs that span time, use, and mode of exposure provide an illustration of the diverse

11. U.S. Geological Survey, *Asbestos*, https://pubs.usgs.gov/of/2001/ofr-01-0429/asbestos.html (last modified Dec. 7, 2016).
12. Different forms of asbestos have different melting points, which can reach up to 2,700°F, and thermal conductivity can be as low as 0.0004 calorie per second. Azar Parvizi-Majidi, *Whiskers and Particulates*, 1 Comprehensive Composite Materials 175 (2000); Hugh D. Young & Francis Weston Sears, University Physics (8th ed. 1992) (identifying thermal conductivity of asbestos).
13. Mayo Clinic, *Asbestosis*, https://www.mayoclinic.org/diseases-conditions/asbestosis/symptoms-causes/syc-20354637 (last visited Oct. 19, 2022).
14. *Id*.
15. Nir Waiskopf & Hermona Soreq, *Cholinesterase Inhibitors: From Molecular Mechanisms of Action to Current and Future Prospects*, *in* Handbook of Toxicology of Chemical Warfare Agents 761 (Ramesh C. Gupta ed., Elsevier 2d ed. 2015).
16. Ronald A. Hites, *The Rise and Fall of Chlorpyrifos in the United States*, 55 Env't Sci. & Tech. 1354, 1355 (2021). *See, e.g.*, Xindi Hu, *The Most Widely Used Pesticide, One Year Later*, Harv. Univ.: Sci. News (Apr. 17, 2018), https://sitn.hms.harvard.edu/flash/2018/widely-used-pesticide-one-year-later/.
17. National Pesticide Information Center, *Chlorpyrifos Technical Fact Sheet*, http://npic.orst.edu/factsheets/archive/chlorptech.html (last reviewed Aug. 2009).
18. *Id*.
19. *Id*.
20. Zhanyun Wang et al., *A New OECD Definition for Per- and Polyfluoroalkyl Substances*, 55 Env't Sci. & Tech. 15575, 15576 (2021).
21. Press Release, U.S. Senate Committee on Environment and Public Works, Chairman Carper's Opening Statement: Hearing on EPA's PFAS Response (Oct. 20, 2021), https://www.epw.senate.gov/public/index.cfm/press-releases-democratic?ID=5B8D6C9D-3D7C-4244-B666-739681CCC509.
22. Interstate Technology and Regulatory Council (ITRC), *PFAS—Per- and Polyfluoroalkyl Substances: Physical and Chemical Properties*, https://pfas-1.itrcweb.org/4-physical-and-chemical-properties/ (last updated June 2022) (explaining PFAS' hydrophobicity and thermal stability, which leads to degradation resistance); Agency for Toxic Substances and Disease Registry, *Per- and Polyfluoroalkyl Substances (PFAS) and Your Health*, https://www.atsdr.cdc.gov/pfas/health-effects/overview.html (last reviewed Sept. 9, 2022).
23. Environmental Working Group, *What Are PFAS Chemicals?*, https://www.ewg.org/pfaschemicals/what-are-forever-chemicals.html (last visited Oct. 19, 2022). *See also Report: Up to 110 Million Americans Could Have PFAS-Contaminated Drinking Water*, Env't Working Grp. (May 22, 2018), https://www.ewg.org/research/report-110-million-americans-could-have-pfas-contaminated-drinking-water.
24. Ian T. Cousins et al., *The High Persistence of PFAS Is Sufficient for Their Management as a Chemical Class*, 22 Env't Sci.: Processes & Impacts 2307 (2020) (identifying PFAS as "the most environmentally persistent substances among organic chemicals," and connecting this persistence with increased probabilities of effects).
25. 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).
26. For the sake of remaining within scope, this Article assumes a basic understanding of concepts of environmental justice. For its purposes, "environmental justice community" is defined in accordance with the congressional language in the Environmental Justice for All Act to mean "a community with significant representation of communities of color, low-income communities, or Tribal and Indigenous communities, that experiences, or is at risk of experiencing higher or more adverse human health or environmental effects." H.R. 2021, 117th Cong. §3 (2021).

ways in which CECs can threaten the health and welfare of the country's most vulnerable populations. They demonstrate that in total, exposure to CECs impacts nearly all designations of environmental justice populations, from low-income individuals to racial minorities to indigenous communities, in multiple aspects of life, from the homes they live in to the food they consume. This in turn demonstrates the urgent need to appropriately regulate CECs on a broad scale, a need that the federal government has not yet met.

1. Asbestos

In the wake of the asbestos regulation discussed in Section III.A, asbestos currently poses the most significant threat to people who live and work in buildings constructed before the 1970s, as these buildings are more likely to contain asbestos as a building material. In particular, this retained asbestos disproportionately has impacts on low-income individuals and families. Lower-income individuals and families are more likely to live in older homes.[27] Many public housing projects were also constructed before the 1970s and thus contain asbestos.[28]

These older, less valuable homes and housing projects not only are more likely to contain asbestos, but are more likely to expose residents to asbestos. Scholars suggest that landlords accepting Section 8 housing vouchers for these older homes lack incentive to maintain them, and as such residents are more likely to experience damage that results in asbestos aerosolization.[29] Environmental justice communities are thus more likely to face the consequences of unaddressed asbestos.

2. Chlorpyrifos

As an insecticide primarily used on crops, chlorpyrifos disproportionately impacts farming communities. Farmworkers are increasingly recognized as an environmental justice community because workers are disproportionately low-income and of minority descent—primarily Mexican.[30] Indeed, studies have confirmed that chlorpyrifos specifically disproportionately affects communities of Mexican descent.[31]

The harmful health effects of chlorpyrifos also most significantly impact children. Age is not as often considered a traditional metric defining environmental justice communities because of the diversity of experience that children across the country and world experience.[32] However, there is significant scholarship that posits that children should be considered as an environmental justice interest group because of children's unique pathways of biological exposure and their general inability to advocate for representation.[33]

With respect to chlorpyrifos specifically, toxicological studies show that in addition to the systems of chlorpyrifos exposure felt by adults, children exposed to chlorpyrifos in utero or early in life experience negative developmental effects.[34] And while these studies suggest that the developmental effects of chlorpyrifos are most pronounced in young children, significant amounts of older children are also likely prone to high chlorpyrifos exposure. As a result of labor laws that allow children to work in the farming industry as young as the age of 12, farms in the United States employ hundreds of thousands of child farmworkers.[35] These children likely experience greater exposure than adult farmworkers with whom they work, because children breathe more air and consume more food and water per pound of bodyweight than adults do.[36] Therefore, chlorpyrifos poses a particular threat to children of all ages and routes of exposure.

3. PFAS

PFAS' use in aqueous film-forming foam (AFFF) to put out fuel fires at military bases and commercial airports—one of the largest sources of the chemical's groundwater contamination—has disproportionate impacts on low-income communities and communities of color. Due to noise pollution, proximity to an airport is often considered a disamenity.[37] Environmental justice groups are therefore more likely to live in disproportionate proximity to air-

27. This is explained by the "filter process," a theory that suggests that as new, more expensive homes are constructed, people with more disposable income move, leaving older, less valuable housing available for people with lower incomes. National Low Income Housing Coalition, The Gap: A Shortage of Affordable Homes (2020), https://reports.nlihc.org/sites/default/files/gap/Gap-Report_2020.pdf.
28. Anu Paulose, *Economic Hazards of Environmental Justice for Lower-Income Housing Tenants*, 39 Wm. & Mary Env't L. & Pol'y Rev. 507 (2015).
29. *Id.*
30. Joan D. Flocks, *The Environmental and Social Injustice of Farmworker Pesticide Exposure*, 19 Geo. J. on Poverty L. & Pol'y 255 (2012).
31. Daniel J. Hicks, *Census Demographics and Chlorpyrifos Use in California's Central Valley, 2011-15: A Distributional Environmental Justice Analysis*, 17 Int'l J. Env't Rsch. & Pub. Health 2593 (2020).
32. Sharon Stephens, *Reflections on Environmental Justice: Children as Victims and Actors*, 23 Soc. Just. 66 (1996).
33. *Id.*
34. *See*, *e.g.*, Virginia A. Rauh et al., *Impact of Prenatal Chlorpyrifos Exposure on Neurodevelopment in the First Three Years of Life Among Inter-City Children*, 118 Pediatrics e1845 (2006) (finding that children who were prenatally exposed to chlorpyrifos were significantly more likely to experience developmental delays and attention problems by age three); Jianqiu Guo et al., *Associations of Prenatal and Childhood Chlorpyrifos Exposure With Neurodevelopment of 3-Year-Old Children*, 251 Env't Pollution 538 (2019) (finding similar effects in three-year-olds who were exposed in childhood after birth).
35. Association of Farmworker Opportunity Programs, Children in the Fields: An American Problem (2007), https://afop.org/wp-content/uploads/2010/07/Children-in-the-Fields-Report-2007.pdf (estimating as of 2007 that there were 400,000-500,000 child farmworkers in the United States); 29 C.F.R. §570.2(b) (establishing a minimum age of 12 for children working on any farm with parental permission and allowing children under 12 to work on farms where employees are exempted from the minimum wage).
36. Philip J. Landrigan & Joy E. Carlson, *Environmental Policy and Children's Health*, 5 Future Child. 34 (1995).
37. Robin R. Sobotta et al., *Aviation Noise and Environmental Justice: The Barrio Barrier*, 47 J. Regul. Sci. 125 (2007).

ports.[38] Military bases, too, are often home to low-income individuals and racial minorities.[39]

PFAS exposure also disproportionately impacts low-income communities due to its common presence in food packaging. Prepackaged and fast foods—the types of food more likely to be packaged in products containing PFAS—are on average less expensive than fresh foods.[40] As such, lower income individuals are more likely to consume prepackaged foods as a greater percentage of their diets.[41] Even beyond the price of food, many environmental justice communities have no choice but to consume high levels of packaged food. Environmental justice communities are more likely to be food deserts, and therefore without access to grocery stores providing fresh food.[42] Further, these PFAS-containing products are generally discarded in landfills, which are more likely to be located in environmental justice communities.[43] Therefore, even if certain environmental justice communities are not exposed to PFAS through ingestion, they are more likely to be exposed through their drinking water due to leaching of high concentrations of PFAS in these landfills.[44]

Finally, PFAS exposure likely disproportionately affects indigenous populations. PFAS bioaccumulates in fish.[45] While reputationally the consumption of fish is sometimes associated with higher-income white communities, in reality the high consumption of fish is often associated with indigenous communities, particularly in the Pacific Northwest.[46] In many Indigenous tribes, fishing is a vital component of diet, culture, and religion.[47]

For example, for the Nez Perce, fish is the second-most important element of the tribe's religion due to the fact that fish come from water, and as such fish is served at every Nez Perce ceremonial feast.[48] One representative from the tribe has stated that "to fish is to *be* Nez Perce."[49] As such, members of Indigenous tribes consume much greater quantities of fish on average than the population at large.[50] This elevated consumption places tribal communities at a much larger risk of ingesting PFAS than the general population.

II. The Problem of Underregulation in Environmental Law

A. *General Framework for Underregulation in Environmental Law*

Fundamentally, the problem of underregulation, like all government behavior, is driven by the actor's desire to "build empire" by maximizing power, profit, and prestige.[51] Agency regulators achieve this empire-building by minimizing risk and avoiding public controversy in their regulations. Scholars have posited various theories to explain how the ultimate interests of government actors yield underregulation.

Six theories in particular emerge as best informing the phenomenon of underregulation in environmental law. First, Prof. John Mendeloff claims that the overregulation of environmental problems results in ultimate underregulation.[52] Second, Professor Buzbee suggests in his "regulatory commons" theory of underregulation that regulation is itself a resource that is subject to the tragedy of the commons.[53] Third, Profs. Jonathan Masur and Eric Posner suggest that relying exclusively on cost-benefit analysis as a regulatory model consistently produces underregulation.[54]

Fourth, Prof. Dave Owen argues that the scientific uncertainty inherent in many environmental problems creates underregulation through a lack of transparency in regulatory processes.[55] Fifth, Prof. Wendy Wagner claims that even when scientific evidence is clear, regulators' overreliance on science and failure to distinguish between science and policy, whether accidental or intentional, produces delay and improper regulation.[56] Finally, Prof. Daniel Farber suggests that even when agencies successfully promul-

38. *Id*.
39. *See*, *e.g.*, Richard V. Reeves & Sarah Nzau, *Black Americans Are Much More Likely to Serve the Nation, in Military and Civilian Roles*, Brookings (Aug. 27, 2020), https://www.brookings.edu/blog/up-front/2020/08/27/black-americans-are-much-more-likely-to-serve-the-nation-in-military-and-civilian-roles/; Sujata Gupta, *Military Towns Are the Most Racially Integrated Places in the U.S. Here's Why*, Sci. News (Feb. 8, 2022), https://www.sciencenews.org/article/military-towns-integration-segregation-united-states.
40. Andrea Carlson & Elizabeth Frazão, U.S. Department of Agriculture, Are Healthy Foods Really More Expensive? It Depends on How You Measure the Price (2012), https://www.ers.usda.gov/webdocs/publications/44678/19980_eib96.pdf.
41. Larissa Baraldi et al., *Consumption of Ultra-Processed Foods and Associated Sociodemocratic Factors in the USA Between 2007 and 2012: Evidence From a Nationally Representative Cross-Sectional Study*, 8 BMJ Open e020574 (2018).
42. Leticia M. Diaz & Margaret R. Stewart, *"Forever Chemicals": Forever Altering the Legal Landscape*, 7 Belmont L. Rev. 308 (2020).
43. *Id*.
44. *Id*.
45. *See*, *e.g.*, Nicolas Macorps et al., *Bioaccumulation of Per- and Polyfluoroalkyl Substance in Fish From an Urban River: Occurrence, Patterns, and Investigation of Potential Ecological Drivers*, 303 Env't Pollution 119165 (2022); Junda Ren et al., *Bioaccumulation of Polyfluoroalkyl Substances in the Lake Huron Aquatic Food Web*, 819 Sci. Total Env't 152974 (2022).
46. *See*, *e.g.*, Kelly Nokes, *An Opportunity to Protect—Analyzing Fish Consumption, Environmental Justice, and Water Quality Standards Rulemaking in Washington*, 16 Vt. J. Env't L. 323 (2014); *contra* Diaz & Stewart, *supra* note 42 ("PFAS exposure through fish consumption is greater among higher-income white individuals").
47. Nokes, *supra* note 46.
48. *Id*.
49. *Id*.
50. *Id*. (citing a Columbia River Inter-Tribal Fish Commission survey of four Columbia River Basin tribes and finding that these populations on average consumed upwards of 389 grams/day of fish, compared to the National Toxics Rule standard of 6.5 grams/day, based on national average consumption).
51. Daryl A. Levinson, *Empire-Building Government in Constitutional Law*, 118 Harv. L. Rev. 915 (2005).
52. John M. Mendeloff, The Dilemma of Toxic Substance Regulation: How Overregulation Causes Underregulation (1988).
53. Buzbee, *supra* note 4.
54. Jonathan S. Masur & Eric S. Posner, *Against Feasibility Analysis*, 77 U. Chi. L. Rev. 657 (2010).
55. Dave Owen, *Probabilities, Planning Failures, and Environmental Law*, 84 Tul. L. Rev. 264 (2009).
56. Wendy Wagner, *The Science Charade in Toxic Risk Regulation*, 95 Colum. L. Rev. 1613 (1995).

gate regulations, slippage results in underinclusive or even nonexistent regulation in practice.[57]

These theories in combination suggest that underregulation occurs as a cyclic, three-phase process. First, underregulation can occur due to hesitancy or inability to begin regulating in the first place. Once one or more agencies decide to begin the regulation process, temporary underregulation can occur as a result of delay in promulgating final regulations. Finally, underregulation may occur even after the publication of final regulations if they contain gaps either when promulgated or when implemented. Underregulation of CECs likely arises during all of these phases, and at each phase underregulation is particularly significant.

1. Hesitancy or Inability to Begin Regulation

Regulators' fundamental risk minimization goal is most apparent in the first phase of underregulation, as regulators often find excuses not to regulate at all. Professor Mendeloff's overregulation theory suggests in part that collective fears regarding the practical and economic hardship from past instances of too much regulation pose too great a risk and reduce regulators' willingness to continue promulgating regulations, even for unrelated issues.[58] In some instances, this risk may be so significant that agency regulators refuse to regulate even in response to congressional mandates, resulting in negative slippage in environmental statutes.[59] While scholars have pointed out that, at least within EPA, overregulation is largely a myth and instances of true overregulation in environmental law are rare, the specter of overregulation continues to promote hesitation in regulation.[60]

Professor Buzbee suggests additional reasons for hesitancy to regulate. He argues that in environmental issues that involve multiple regulators, and in particular in those that lack a regulator with primary authority, regulators lack incentives to regulate.[61] Specifically, he points out that individual regulators lack motivation to avoid blame for governmental inattention when the public cannot easily identify the particular regulator with the highest level of obligation.[62] Further, they also lack motivation to gain credit and goodwill from solving a public problem, as complete regulation likely involves competing credit claims between the multiple regulators.[63] In such instances, regulators are likely to act as free riders, waiting to act assuming other regulators will take the lead and bear the brunt of investment.[64] If all regulators act this way, regulation may never occur.

2. Delay in Promulgating Final Regulations

Even after recognizing the need for regulation, regulators may regulate inefficiently, resulting in serious delay. To some extent, this phenomenon is not limited to environmental law; most regulations face delay as a result of public or political pushback.[65] Scholars suggest that the nature of environmental law makes delay in this area of law particularly common and extensive, however, because of the extent to which science is relevant to standard-setting. As Professor Owen points out, unlike many other areas of law, environmental regulation often involves significant scientific uncertainty.[66] This lack of complete data leaves regulators without clear regulation models, as the scope of uncertainty differs from issue to issue. This lack of regulatory models in turn leads to inefficiency, as regulators must repeatedly derive regulations from first principles.[67]

Even when the science behind environmental issues is well-developed, Professor Wagner suggests that delay may still occur as a result of overreliance on this evidence.[68] She recognizes that nearly all environmental regulations require at least some policymaking; for example, when deciding a standard under Toxic Substances Control Act (TSCA) §6(a),[69] regulators must make the political choice as to how much exposure constitutes an "unreasonable risk of injury to health."[70] Regulators often mistakenly assume that policy decisions are decisions that can be resolved by science, and waste time debating the merits of different scientific theories for resolving the issue, or they acknowledge the existence of policy decisions and waste time disguising their policy choices as science to avoid public pushback.[71]

3. Regulatory Gaps

Once sufficient regulations are promulgated, regulators often deem environmental issues "regulated" and move on. Significant gaps in regulation often remain, however, resulting in persisting harm. Scholars condemning overregulation and those condemning reliance on cost-benefit analysis both suggest that focusing on one particular method or level of regulation may improperly limit regulation. In discussing the problems of overregulation, Professor Mendeloff suggests that when agencies focus on developing overly stringent regulation with respect to certain aspects of environmental problems, they lack the capacity and resources to regulate other aspects.[72] Similarly, Professors Masur and Posner suggest that strict adherence to cost-benefit analysis as a regulatory framework limits regulators' consideration to only those areas of an environ-

57. Daniel A. Farber, *Taking Slippage Seriously: Noncompliance and Creative Compliance in Environmental Law*, 23 Harv. Env't L. Rev. 297 (1999).
58. Mendeloff, *supra* note 52.
59. Farber, *supra* note 57.
60. *See* Pugsley, *supra* note 2; Buzbee, *supra* note 4.
61. Buzbee, *supra* note 4.
62. *Id.* at 33.
63. *Id.* at 32.
64. *Id.*
65. Stuart Shapiro, *Speed Bumps and Roadblocks: Procedural Controls and Regulatory Change*, 12 J. Pub. Admin. Rsch. & Theory 29 (2002) (finding that partisan control of political branches slowed the pace of regulation).
66. Owen, *supra* note 55.
67. *Id.*
68. Wagner, *supra* note 56.
69. 15 U.S.C. §2605, ELR Stat. TSCA §6(a).
70. *Id.*; Wagner, *supra* note 56.
71. Wagner, *supra* note 56.
72. Mendeloff, *supra* note 52.

mental issue that present the most significant economic threats, and results in regulators ignoring real but difficult-to-monetize regulatory benefits and leaving gaps.[73]

Regulatory commons issues may also produce regulatory gaps. There is often a jurisdictional mismatch between the scope of an environmental problem and the regulator or regulators tasked to manage the problem.[74] For example, Professor Buzbee points to environmental problems involving oceans, where various national authorities cannot apply actions to non-jurisdictional waters, and problems resulting from international competition, where any one country cannot control the actions of others.[75] In such instances, even when all regulators act, regulatory gaps remain.

Even if promulgated regulations are appropriate, often the standards as written are not the standards as enforced. According to Professor Farber, slippage is common in environmental law.[76] This slippage generally results in less stringent standards that leave regulatory gaps, for example when federal or state officials refuse to enforce standards as written and allow regulated parties wiggle room.[77]

B. Application to CECs

The nature of CECs makes the regulation problem particularly challenging, and therefore makes underregulation particularly prominent. CECs are defined and categorized by their associated lack of information, and at each stage of the process, this lack of information makes regulation of CECs less advantageous for government officials.

Most significantly, the lack of information about how a given CEC functions in the environment and affects human health increases the risk of undertaking regulation. Without concrete information that a CEC actually poses a significant threat, there is little incentive for agencies to contribute their resources, risk their credibility, and anger industries by beginning costly regulatory processes. Further, even were agency officials willing to assume the risk of regulation, lack of information magnifies the problem of jurisdictional mismatch articulated by Professor Buzbee, for without complete understanding of the scope of a CEC's impacts, it is unclear which regulatory agencies should be responsible for regulation.[78]

At the regulatory development stage, the problem that the lack of information that CECs provide is obvious: CEC regulation inherently involves more scientific uncertainty than other environmental regulation because CECs are defined specifically as chemicals with scientific uncertainty. As such, the delays and concerns expressed by Professors Owen and Wagner are all the more prominent in CEC regulation. With respect to Professor Wagner's concerns about recognizing the line between science and policy, having more scientific uncertainty could prompt more debate on scientific theories that could ultimately be fruitless, or it could prompt regulators to improperly insert policy judgments where science could in fact provide objective answers.

Finally, in implementing promulgated regulations, the uncertain ground that CEC regulations stand on may make slippage more likely or more significant. The lack of information on CECs applies not only to government regulators, but also to the public; with the public more unaware of the harm that CECs could cause, there is more room for regulated industries to push back on regulations, and more room for enforcement officials to underenforce regulations without sparking controversy.

III. Proof of Concept: Historical and Current Underregulation of CECs

Considering examples of historic and current CECs confirms the theoretical assumption that underregulation is particularly virulent with respect to CECs. Once again, asbestos, chlorpyrifos, and PFAS together serve as a representative sample of the class of CECs at large. The government's approach to asbestos represents its early efforts to federally regulate CECs at the advent of its current comprehensive environmental statutory scheme. The government's approach to chlorpyrifos illustrates how it has handled pesticide CECs in the recent past. And finally, the government's approach to PFAS illustrates how the government is addressing CECs found in consumer and industrial products in the present day. In all three instances, the federal government did and continues to significantly underregulate these materials.

The manner in which this underregulation occurs affirms the general framework for environmental underregulation and its particular significance with respect to CECs. Further, the similarities in underregulation between all three materials, despite their differences, suggests that regulators have failed to recognize the existence of a pattern of underregulating CECs.

A. Asbestos

1. Hesitancy to Regulate

Asbestos has been used since ancient times; historians have documented asbestos use in fire-resistant fabrics and construction dating back to the Egyptian and Roman empires.[79] Historical knowledge of the potential dangers of asbestos runs just as deep: ancient cultures documented high incidences of breathing difficulties of early asbestos workers.[80] In modern times, asbestos use became common in the United States during the Industrial Revolution.[81] By

73. Masur & Posner, *supra* note 54.
74. Buzbee, *supra* note 4.
75. *Id.* at 25.
76. Farber, *supra* note 57.
77. *Id.*
78. Buzbee, *supra* note 4.
79. John T. Suttles Jr., *Transmigration of Hazardous Industry: The Global Race to the Bottom, Environmental Justice, and the Asbestos Industry*, 16 Tul. Env't L. Rev. 1 (2002).
80. *Id.*
81. *Id.* at 18.

1927, asbestosis had been coined in medical literature, and by 1932, plaintiffs had brought the first successful compensation case involving asbestosis.[82] Despite this medical knowledge, asbestos use increased during and after World War II.

Though this rise to prominence occurred prior to passage of most of the federal environmental and health and safety laws that are currently used to regulate CECs, regulators still failed to take action within the existing legal landscape. For example, in the 1930s, the New Jersey Legislature refused to include asbestosis as a compensable occupational disease under the state's workers' compensation laws, after being persuaded by the asbestos lobby that the exposure limit of five million particles per cubic foot set by the American Conference of Governmental Industrial Hygienists in 1946 was widely regarded as far too lenient.[83] By the time EPA and the Occupational Safety and Health Administration (OSHA) were established in 1970 and 1971, respectively, and began federally regulating asbestos, asbestos had already been the subject of underregulation.

This failure to regulate asbestos can likely be explained by lack of incentive in several ways. First, from the Industrial Revolution to the establishment of EPA, asbestos was a vital material in facilitating the United States' huge growth in population and business. Asbestos allowed for this expansion at cheap cost, and as such it was undesirable for the government to stop this process. This inherent desire not to regulate was likely aided by the powerful lobby behind the mining and use of asbestos, who suppressed evidence of asbestos' physical and environmental harm.[84]

With less public knowledge of the dangers of asbestos came fewer calls for regulation, and thus less governmental fear of public pushback in not regulating. This lack of incentive aligns with Professor Buzbee's analysis: while in the case of asbestos, lack of incentive to regulate derived from lack of public knowledge as opposed to conflicting jurisdictions, the outcome is the same, confirming Professor Buzbee's argument that lack of incentive leads to hesitancy in regulation.[85] Finally, even had the government desired to extensively regulate asbestos before the 1970s, it lacked a powerful regulatory framework for doing so. Without an easy path to regulation, the federal government not only lacked incentive, but also tools. It is therefore not surprising that initial regulations of asbestos took as long as they did to manifest.

2. Delay in Promulgating Final Regulations

OSHA began regulating asbestos almost immediately after passage of the Occupational Safety and Health Act in 1970, establishing an emergency standard in 1971 in response to a petition from the American Federation of Labor-Congress of Industrial Organizations (AFL-CIO).[86] Shortly thereafter, OSHA formalized occupational exposure limits under the Act in 1974.[87] EPA and the Consumer Product Safety Commission (CPSC) too began regulating asbestos quickly; EPA established certain forms and uses of asbestos as hazardous air pollutants (HAPs) under the CAA, and established a corresponding national emissions standard in 1973, just three years after the statute was enacted in its modern form.[88]

CPSC banned consumer patching compounds and artificial emberizing materials containing respirable asbestos under the 1972 Consumer Product Safety Act within five years of its passage.[89] By 1986, EPA had listed asbestos as a toxic pollutant pursuant to the CWA and as a hazardous substance under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)[90]; in 1989, EPA issued a complete phaseout of asbestos and ban on new uses under TSCA; and in 1991, EPA promulgated a maximum contaminant level (MCL) of seven million fibers per liter under the Safe Drinking Water Act (SDWA).[91]

Though the various responsible federal agencies got off to a strong start regulating asbestos, progress stalled in the wake of judicial setback. In 1991, two years after the promulgation of a ban, the U.S. Court of Appeals for the Fifth Circuit invalidated EPA's complete ban on asbestos in *Corrosion Proof Fittings v. Environmental Protection Agency*.[92] The court reasoned that the complete ban was not the least burdensome alternative for limiting the unreasonable risk of exposure to asbestos, and as such violated TSCA's cost-benefit balancing requirements.[93] *Corrosion Proof Fittings* retained the 1989 rule's ban on asbestos in corrugated paper, rollboard, commercial paper, specialty paper, flooring felt, and new commercial uses beginning after 1989, but allowed many additional uses of asbestos to continue.[94]

And since the decision, regulatory action has been slow and limited in scope. OSHA tightened its workplace exposure standards soon after *Corrosion Proof Fittings*, but otherwise, significant action with respect to asbestos did not

82. *Id*.
83. Suttles, *supra* note 79.
84. From the 1920s to the 1950s, Metropolitan Life Insurance Company and Johns Manville, companies that insured many large asbestos manufacturers, commissioned studies at the Saranac Lake Laboratory for Research and at McGill University that found links between asbestos exposure and asbestosis, and then subsequently repeatedly suppressed the results of these studies. *Id*.
85. Buzbee, *supra* note 4.
86. 36 Fed. Reg. 23207 (Dec. 7, 1971).
87. 39 Fed. Reg. 23502 (June 27, 1974).
88. 38 Fed. Reg. 8820 (Apr. 6, 1973).
89. 42 Fed. Reg. 63362 (Dec. 15, 1997); 42 Fed. Reg. 63364 (Dec. 15, 1977).
90. 42 U.S.C. §§9601-9675, ELR Stat. CERCLA §§101-405.
91. 44 Fed. Reg. 44501, 44503 (July 30, 1979) (listing asbestos as a toxic pollutant under the CWA); 50 Fed. Reg. 13456, 13475 (Apr. 4, 1985) (listing asbestos as a hazardous substance under CERCLA); Asbestos: Manufacture, Importation, Processing, and Distribution in Commerce Prohibitions; Final Rule, 56 Fed. Reg. 29460 (July 12, 1989) (banning and phasing out all uses of asbestos under TSCA); 56 Fed. Reg. 3526, 3528 (Jan. 30, 1992) (establishing an enforceable MCL for asbestos under the SDWA); 42 U.S.C. §§300f to 300j-26, ELR Stat. SDWA §§1401-1465.
92. 947 F.2d 1201, 22 ELR 20037 (5th Cir. 1991).
93. *Id*.
94. *Id*. at 1230.

occur until 2019, 20 years after its attempted asbestos ban, when EPA issued a significant new use rule under TSCA.[95] The rule ensured that already discontinued uses of asbestos could not reenter the marketplace without EPA review, but did not promulgate additional restricted uses.[96] The political branches of government have also been reticent to extend protections against asbestos. Since 2002, three bills attempting to amend TSCA to fully ban asbestos have been introduced, but all three have stalled in the U.S. Congress.[97] As such, the current regulatory landscape of asbestos remains largely as it was in 1989.

EPA's delay and ultimate failure to effectively respond to *Corrosion Proof Fittings* with further regulatory actions is a prime illustration of Professor Mendeloff's "overregulation produces underregulation" theory. The Fifth Circuit essentially explicitly labeled the 1989 asbestos ban as overregulation when it determined that the ban was not the "least burdensome alternative" as required by TSCA.[98] As Professor Mendeloff suggests, seeing that this overregulation was not an effective strategy likely made EPA hesitant to enact further strong regulations, for fear that these regulations would meet the same fate as the 1989 ban and make EPA look ineffective as a regulator by extension.[99]

3. Regulatory Gaps

Despite the fact that asbestos is well-regulated under most major environmental statutes, regulatory gaps remain. Since the *Corrosion Proof Fittings* decision, asbestos may still be used for historical purposes other than those that the case specifically banned. This includes car parts, including brakes and other friction products, diaphragms for the production of sodium hydroxide, and sheet gaskets for use in chemical manufacturing.[100] As such, researchers estimate that more than 30 million pounds of asbestos are imported into the United States annually.[101] And these numbers are growing; a report from the U.S. International Trade Commission showed that in the first four months of 2022, the United States imported more asbestos than in all of 2021.[102] Asbestos is also not listed as a hazardous substance under the Resource Conservation and Recovery Act (RCRA),[103] so EPA cannot regulate the disposal of independent asbestos as waste.[104]

Further, asbestos remains in many existing structures, and therefore continues to have widespread latent exposure potential if such structures are disturbed and the asbestos becomes aerosolized.[105] While this concern is mitigated to some extent by the fact that HAP regulations mandate that building owners notify state agencies before undertaking any demolition or renovation that could release asbestos in amounts above a set threshold, no federal agency has promulgated regulations ordering asbestos removal or otherwise permanently neutralizing the concern.[106] As such, even asbestos, widely regarded as a "fully regulated" former CEC, remains a threat to human health.

Applying Professor Buzbee's regulatory commons theory may help explain why agencies have not taken further action toward mitigating risk posed by asbestos remaining in older homes and buildings. If the federal government were to take action to safely remove asbestos from these structures or mandate maintenance and safe repairs of asbestos-containing structures, it is unclear who would have primary authority. EPA as the regulator of significant asbestos uses?[107] The Department of Housing and Urban Development or OSHA in their authority over housing and workplaces, respectively?[108] According to Professor Buzbee, this jurisdictional uncertainty results in a lack of incentive for any of these agencies to regulate. This, combined with the fact that in the mind of the public asbestos is already substantially regulated, suggests that gaps in asbestos regulation exist because of lack of clear incentives otherwise.

B. Chlorpyrifos

1. Hesitancy to Regulate

Compared to other CECs, federal agencies expressed relatively little hesitancy in regulating chlorpyrifos. This is to some extent explained by chlorpyrifos' status as an insecticide. Chlorpyrifos was patented by Dow Chemical Company in 1966, and at the same time was registered under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).[109] The registration process requires applicants to provide toxicity information, and as such EPA likely was immediately aware of the human health threat that chlorpyrifos posed from the moment of its registration.[110] This knowledge and lack of hesitancy is reflected in EPA's

95. 84 Fed. Reg. 17345 (Apr. 25, 2019).
96. *Id.*
97. Ban Asbestos in America Act, S. 742, 110th Cong. (2007); Bruce Vento Ban Asbestos and Prevent Mesothelioma Act, H.R. 3339, 110th Cong. (2007); Alan Reinstein Ban Asbestos Now Act, H.R. 1603, 116th Cong. (2019).
98. *Corrosion Proof Fittings*, 947 F.2d 1201.
99. Mendeloff, *supra* note 52.
100. 40 C.F.R. §721.11095 (detailing exceptions to reporting requirements for significant new uses of asbestos).
101. *Asbestos: Think Again*, Env't Working Grp. (Mar. 4, 2004), http://www.ewg.org/research/asbestos-think-again/asbestos-bailout-fails-april-2004.
102. E.A. (Ev) Crunden, *U.S. Asbestos Imports Surge Despite Crackdown*, E&E News PM (May 12, 2022), https://subscriber.politicopro.com/article/eenews/2022/05/12/u-s-asbestos-imports-surge-despite-crackdown-00032078.
103. 42 U.S.C. §§6901-6992k, ELR Stat. RCRA §§1001-11011.
104. 40 C.F.R. §§261.30-.35.
105. *See* OSHA, FactSheet: Asbestos (2014), https://www.osha.gov/sites/default/files/publications/OSHA3507.pdf (presuming that any building constructed before 1981 contains asbestos); U.S. Census Bureau, *American Community Survey (ACS)*, https://www.census.gov/programs-surveys/acs (last reviewed Sept. 29, 2022) (finding that approximately one-half of homes in the United States were built before 1980).
106. Paulose, *supra* note 28.
107. 40 C.F.R. pt. 763.
108. 42 U.S.C. §3535(d); 29 C.F.R. §1975.2.
109. U.S. Patent No. 3,244,586 (filed Apr. 5, 1966); Christine Hyun-Gee Chai & Andrew Mui, *Lasting Protection: Equipping Federal Toxics Regulations for the Long Haul*, 22 Vt. J. Env't L. 40 (2021) (stating original FIFRA registration date); 7 U.S.C. §§136-136y, ELR Stat. FIFRA §§2-35.
110. 7 U.S.C. §136a (requiring the submission of studies as part of the pesticide registration procedure).

early chlorpyrifos regulation actions: EPA included chlorpyrifos in its original list of hazardous substances under CWA §311 in 1978 and in its original list of hazardous substances under CERCLA in 1986.[111]

The lack of regulatory hesitancy evidences the validity of underregulation theories by way of contradiction. Unlike some other subcategories of CECs, insecticides like chlorpyrifos are firmly the jurisdiction of EPA. Indeed there exists a statute, FIFRA, dedicated specifically to their regulation. As such, regulators face no regulatory commons issue when responding to chlorpyrifos.[112] Further, because FIFRA covers the regulation of insecticides quite comprehensively, chlorpyrifos regulators face less uncertainty as to what regulatory framework to follow, unlike other chemicals where regulators must decide which statute or statutes will best achieve their task.[113] Chlorpyrifos thus stands as an example that at least in the initial stages, regulatory success can be achieved by eliminating structural barriers.

2. Delay in Promulgating Final Regulations

Conversely, EPA's most recent and most significant regulatory decision with respect to chlorpyrifos was the subject of much delay. On August 30, 2021, EPA issued a final rule revoking all tolerances to chlorpyrifos under the Federal Food, Drug, and Cosmetic Act (FFDCA) §408(d), essentially banning the use of chlorpyrifos on crops.[114] This final rule marked the culmination of a nearly 15-year battle fought by environmentalists that began in 2007, when the Natural Resources Defense Council (NRDC) and the Pesticide Action Network North America (PANNA) petitioned EPA to revoke all tolerances and food-use registrations.[115]

After years of inaction and in response to a judicial order, in 2015, the Barack Obama EPA issued a proposed rule that would have granted the requests of the 2007 petition.[116] Before Administrator Gina McCarthy could issue a final rule, however, President Donald Trump assumed office, and in 2017 the Trump EPA issued a final rule denying the 2007 petition, which it reaffirmed in 2019.[117] In April 2021, the U.S. Court of Appeals for the Ninth Circuit ruled in *League of United Latin American Citizens v. Regan* that by leaving the tolerances in effect EPA had violated its obligation to ensure safety under the FFDCA, and consequently mandated that EPA modify or revoke tolerances and food-use registrations.[118] In response, EPA issued its final rule.[119]

Earlier milestones in chlorpyrifos regulation also potentially reflect delay, though the extent is less clear. In 1997 and 2000, EPA issued two voluntary agreements with Dow to eliminate certain uses of chlorpyrifos.[120] If Dow had not willingly agreed to this action, it is unclear how long it would have taken EPA to eliminate the uses of chlorpyrifos that it did unilaterally.

It is not entirely clear why EPA's ultimate tolerance revocations were subject to so much delay. Indeed, this aspect of chlorpyrifos regulation stands out as an instance in which established theories do not well explain practical failures. The last five years of EPA action on the revocations can be explained by changes in politics: the Obama EPA, known for being progressive, was ultimately willing to revoke chlorpyrifos tolerances.[121] The Trump EPA, known by contrast for supporting industry interests, was not.[122] When President Joe Biden took office, his EPA, which thus far has aligned much more with the Obama EPA than the Trump EPA in terms of priorities, followed through on the Obama EPA's actions and issued the ban.

This much is straightforward. What is harder to explain is why it took essentially the entire Obama Administration term for EPA to announce that it would grant NRDC and PANNA's 2007 petition. As described above, the proposed ban did not pose a regulatory commons problem or a problem of uncertain regulatory strategy: EPA had sole responsibility for regulating chlorpyrifos and had a clear path for revoking tolerances under the FFDCA.[123] Nor did the ban pose an obvious overregulation threat within the pesticide context. EPA has revoked all tolerances or otherwise banned pesticides on numerous previous occasions.[124] For example,

111. 43 Fed. Reg. 10474 (Mar. 13, 1978) (establishing chlorpyrifos as hazardous under the CWA); 51 Fed. Reg. 34534, 34547 (Sept. 29, 1986) (establishing chlorpyrifos as hazardous under CERCLA).
112. Buzbee, *supra* note 4.
113. Owen, *supra* note 55.
114. 40 C.F.R. §180.342; 86 Fed. Reg. 48315 (Aug. 30, 2021).
115. Petition, NRDC & PANNA, Petition to Revoke All Tolerances and Cancel All Registrations for the Pesticide Chlorpyrifos, 72 Fed. Reg. 58845 (Oct. 17, 2007).
116. In re Pesticide Action Network N. Am., 798 F.3d 809, 45 ELR 20148 (9th Cir. 2015); 80 Fed. Reg. 69080 (Nov. 6, 2015).
117. 82 Fed. Reg. 16581 (Apr. 5, 2017); 84 Fed. Reg. 35555 (July 24, 2019).
118. 996 F.3d 673, 701, 51 ELR 20075 (9th Cir. 2021).
119. 40 C.F.R. §180.342; 86 Fed. Reg. 48315 (Aug. 30, 2021).
120. Press Release, U.S. EPA, Agreement Reached Between EPA and Chlorpyrifos Pesticide Registrants (June 6, 1997), https://archive.epa.gov/epapages/newsroom_archive/newsreleases/e907eeff3f785ccd852564ae0050269c.html; 65 Fed. Reg. 76233 (Dec. 6, 2000).
121. *See, e.g.*, Tim Dickinson, *The Eco-Warrior: Lisa Jackson's EPA*, Rolling Stone (Jan. 20, 2010), https://www.rollingstone.com/politics/politics-news/the-eco-warrior-lisa-jacksons-epa-199050/ (describing Lisa Jackson, the EPA Administrator during President Obama's first term, as "the most progressive EPA chief in history"); Keith J. Benes, *Obama's Legacy: Bold Leadership on Climate*, Interpreter (Jan. 20, 2017), https://www.lowyinstitute.org/the-interpreter/obama-s-legacy-bold-leadership-climate (describing climate change as a "signature issue of President Barack Obama's tenure").
122. *See, e.g.*, Samantha Gross, *What Is the Trump Administration's Track Record on the Environment?*, Brookings: Voter Vitals (Aug. 4, 2020), https://www.brookings.edu/policy2020/votervital/what-is-the-trump-administrations-track-record-on-the-environment/ (identifying many major Trump EPA actions as deregulatory actions that support the fossil fuel industry).
123. *See supra* Section III.B.1.
124. *See, e.g.*, Carbofuran; Final Tolerance Revocations, 74 Fed. Reg. 23046 (May 15, 2009) (revoking all tolerances for carbofuran under the FFDCA); Agency for Toxic Substances and Disease Registry, Heptachlor and Heptachlor Epoxide—Production, Import/Export, Use, and Disposal, https://www.atsdr.cdc.gov/toxprofiles/tp12-c5.pdf (describing the 1987 voluntary decision to cancel heptachlor and EPA's 1988 decision to prohibit the sale, distribution, and shipment of all heptachlor products); U.S. EPA, Lindane Voluntary Cancellation and RED Addendum Fact Sheet (2006), https://www3.epa.gov/pesticides/chem_search/reg_actions/reregistration/fs_PC-009001_1-Jul-06.pdf (describing the series of voluntary cancellations that resulted in the complete cancellation of registrations of lindane).

in 2008, just one year after NRDC and PANNA submitted their petition to ban chlorpyrifos, EPA announced its intention to ban carbofuran, another nerve-disrupting insecticide.[125] All food tolerances were banned the following year.[126] It is unclear why EPA's courses and timelines for these two similar pesticides differed so significantly.

3. Regulatory Gaps

While environmentalists have unanimously lauded EPA's tolerance revocations as a significant victory, chlorpyrifos and its associated threats are not completely gone. Chlorpyrifos is also currently registered for non-food uses, including use in golf course turf, nonresidential sites like industrial plants, nonstructural wood treatments like fence posts, and public health uses like controlling mosquitos and fire ants.[127] And indeed, in EPA's most recent reregistration, it did not revoke registration for any of these uses.[128] While banning chlorpyrifos from crops significantly reduces annual national exposure to the CEC, the remaining non-food use exposure to chlorpyrifos is nontrivial. As such, EPA's continued allowance of some uses of chlorpyrifos under FIFRA continues to threaten human health.

The reason for these regulatory gaps likely closely parallels that for asbestos[129]: the public generally views the regulatory process for chlorpyrifos as complete and the threat neutralized, thereby leaving EPA with little incentive to continue regulating.[130] Without the fear of negative perceptions, EPA has little practical reason (aside from protecting human health, of course) to expend resources and open itself up to further challenge and criticism from industry supporters by considering further regulations.

C. *PFAS*

1. Hesitancy to Regulate

The fluorination process for synthesizing various PFAS was likely developed in the 1930s by chemistry professor John Simons.[131] By the 1950s, major manufacturers including DuPont and 3M were using PFAS for consumer products and industrial processes, including 3M's Scotchgard.[132]

Scientific studies conducted by major PFAS manufacturers reveal that as early as 1950 these manufacturers were aware of PFAS' potential and actual toxicity. Early internal studies revealed that PFAS built up in mice blood, enlarged rat and rabbit livers and spleens, and was toxic to rats and fish.[133] Later internal studies from the 1970s onward documented that 3M and DuPont were aware of PFAS' toxicity in humans specifically.[134] Despite their extensive knowledge of PFAS' harmful effects, these manufacturers did not reveal the extent of PFAS' toxicity to the public.

Even despite major manufacturers' attempts to withhold information about PFAS' toxicity, studies and reports reveal that the broader scientific community and the government had at least some toxicity knowledge well before official PFAS regulation began. In 1956, Stanford University researchers published a study that PFOA binds to protein in human blood.[135] In 1966, the Food and Drug Administration (FDA) refused a DuPont petition to accept a PFAS compound as a food additive because of its aware-

125. 73 Fed. Reg. 44863 (July 31, 2008).
126. Carbofuran; Final Tolerance Revocations, 74 Fed. Reg. 23046 (May 15, 2009).
127. Memorandum from Debra Edwards, Director, Special Review and Reregistration Division, Office of Pesticide Programs, U.S. EPA, to Jim Jones, Director, Office of Pesticide Programs, U.S. EPA (July 31, 2006), https://www3.epa.gov/pesticides/chem_search/reg_actions/reregistration/ired_PC-059101_28-Sep-01.pdf.
128. Cancellation Order for Certain Chlorpyrifos Registrations, 87 Fed. Reg. 53471 (Aug. 31, 2022).
129. *See supra* Section II.A.3.
130. *See*, *e.g.*, Nicole Greenfield, *The Chlorpyrifos Ban Is a Win for Science—And Children*, NRDC (Sept. 17, 2021), https://www.nrdc.org/stories/chlorpyrifos-ban-win-science-and-children; Gina Solomon, *The EPA Is Banning Chlorpyrifos, a Pesticide Widely Used on Food Crops, After 14 Years of Pressure From Environmental and Labor Groups*, Conversation (Aug. 24, 2021), https://theconversation.com/the-epa-is-banning-chlorpyrifos-a-pesticide-widely-used-on-food-crops-after-14-years-of-pressure-from-environmental-and-labor-groups-166485.
131. ITRC, History and Use of Per- and Polyfluoroalkyl Substances (PFAS) Found in the Environment (2020), https://pfas-1.itrcweb.org/wp-content/uploads/2020/10/history_and_use_508_2020Aug_Final.pdf; Joseph H. Simons, *Production of Fluorocarbons: I. The Generalized Procedure and Its Use With Nitrogen Compounds*, 95 J. Electrochem. Soc'y 47 (1949).
132. *See*, *e.g.*, ITRC, *supra* note 131; 3M, *PFAS History*, https://www.3m.com/3M/en_US/pfas-stewardship-us/pfas-history/ (last visited Oct. 19, 2022); Vaughn Barry et al., *Perfluorooctanoic Acid (PFOA) Exposures and Incident Cancers Among Adults Living Near a Chemical Plant*, 121 Env't Health Persps. 1313 (2013) (documenting that DuPont began using PFOA in its manufacturing processes at its Washington Works plant in West Virginia in 1951).
133. 3M, Oral, Intraperitoneal, and Intravenous Test (1950) (unpublished study), https://static.ewg.org/reports/2019/pfa-timeline/1950_Mice.pdf (finding that heptafluorobutyric acid builds up in the blood of mice); Gerald J. Arenson, Toxicity of Teflon Dispersing Agents (Nov. 9, 1961) (unpublished study), https://static.ewg.org/reports/2019/pfa-timeline/1961_Rat-Liver-Damage.pdf (reporting that several PFAS used by DuPont in Teflon enlarged rat and rabbit livers); E.I. duPont de Nemours and Company, Ninety-Day Feeding Study in the Rat (Nov. 30, 1965) (unpublished study), https://static.ewg.org/reports/2019/pfa-timeline/1965_Rat-Study.pdf (finding in a study from DuPont that PFAS increased the liver, kidney, and spleen in rats); Letter from S.I. Kalkstein, President, 3M, to Editor, Fire Journal (June 15, 1970), https://static.ewg.org/reports/2019/pfa-timeline/1970_Fire-Journal.pdf (stating that PFAS were toxic to fish).
134. *See*, *e.g.*, Letter from W.E. Hilton, Fluorocarbons Division, Washington Works, DuPont, to J. Mitchell Jr., Plastics Department, Experimental Station, DuPont (Feb. 18, 1970), https://static.ewg.org/reports/2019/pfa-timeline/1970_Teflon-Tox-Request.pdf (stating that the PFAS C-8 APCF was "highly toxic when inhaled and moderately toxic when injected"); Telephone Conversation with Dr. William Guy, College of Medicine, University of Florida (Aug. 14, 1975), https://static.ewg.org/reports/2019/pfa-timeline/1975_Dr-Guy.pdf (reporting to 3M that studies revealed that fluorocarbon carboxylic acids built up in human blood samples); Memorandum from Y.L. Power, M.D., Medical Superintendent, DuPont Plastic Products & Resins Department, Status Report on Washington Works Liver Function and Coronary Heart Disease Mortality Study (Aug. 28, 1979), https://static.ewg.org/reports/2019/pfa-timeline/1979_Liver-Function-Survey-Update.pdf (reporting that studies of workers exposed to PFOA had higher incidence of myocardial infarction and lower liver function than the general population); Letter from Jack S. Mandel, Associate Professor, University of Minnesota, to Larry R. Zobel, Staff Physician, 3M Center (Apr. 6, 1989), https://static.ewg.org/reports/2019/pfa-timeline/1989_Cancer-Rates.pdf (finding elevated cancer rates among PFAS workers).
135. Gordon L. Nordby & J. Murray Luck, *Perfluorooctanoic Acid Interactions With Human Serum Albumin*, 219 J. Biological Chemistry 399 (1956).

ness of the PFAS' harmful liver effects.[136] And by 1998, 3M had provided EPA with evidence that PFAS accumulates in blood.[137] Despite this public and private knowledge and calls for PFAS regulation, the first PFAS regulation did not come until 2002, two years after 3M announced that it would voluntarily phase out production of PFOS and PFOA because of their environmental and public health threats, when EPA published two TSCA significant new use rules limiting the manufacturing and importation of PFOS and other PFAS chemicals.[138]

As was the case with asbestos, failure to promptly begin regulating PFAS can likely be explained, at least in part, by a lack of public information as a result of industry secrecy and misinformation.[139] Further, PFAS likely also faces regulatory commons issues. Compared to other CECs, PFAS is particularly ubiquitous, and its uses are particularly diverse, and as such multiple agencies likely have some regulatory claim to PFAS, including EPA, FDA, CPSC, and OSHA. Such circumstances are prime scenarios in which conflicting regulatory claims inhibit regulation.[140]

2. Delay in Promulgating Final Regulations

Since EPA's initial actions, further regulations have been sporadic and limited. Much of EPA's regulatory action to date has been through TSCA: since the 2002 rules, EPA has published additional significant new use rules in 2007, 2013, and 2020, which restricted the further use of phased-out PFAS, required reporting on use of PFOA in carpets, and required notification before phased-out long-chain PFAS could reenter the marketplace.[141]

Outside of TSCA, EPA has taken very little action. In 2016, EPA also established a health advisory level of 70 parts per trillion for PFOS and PFOA in drinking water under SDWA §1412(b)(1)(F).[142] In 2020, EPA added 172 PFAS to the Toxics Release Inventory (TRI), making them subject to reporting under the Emergency Planning and Community Right-to-Know Act (EPCRA).[143] But because under SDWA health advisories are nonregulatory and nonenforceable, and EPCRA does not impose substantive limitations on chemicals listed in the TRI, these actions arguably have little significance on reducing PFAS exposure.[144] FDA has also taken regulatory action with respect to PFAS. In 2016, the agency banned three PFAS compounds from use in food packaging.[145]

This is not to suggest that federal agencies have not been paying much attention to PFAS, however. Much of EPA's PFAS work has been research-focused. Since it began regulating PFAS, EPA has developed a laboratory method for measuring PFAS in drinking water, conducted human health toxicity assessments, and ordered research on the impacts of potential regulations on agriculture and other industries and economies.[146] Further, EPA action on PFAS has accelerated since President Biden took office. Beginning in February 2021, EPA has increased PFAS data collection and requirements and made a regulatory determination to set enforceable drinking water standards for PFOS and PFOA.[147] Most significantly, in October 2021, the Biden EPA announced a PFAS road map that stated intentions to regulate at least PFOS and PFOA under CERCLA, RCRA, the CWA, and potentially the CAA.[148]

Many of the delays in promulgating enforcement standards and formal recognition of PFAS as hazardous can be attributed to uncertainty. While all CECs inherently involve uncertain science to some extent as part of being classified as "emerging," uncertainty with respect to PFAS chemicals is particularly extensive and particularly challenging because of the class's sheer size. To regulate each PFAS individually, regulators would need significant information on thousands of chemicals. As Professor Owen suggests, such large amounts of uncertainty likely significantly delay regulation.[149]

This scientific uncertainty delay was likely exacerbated by politics. Comparing the Biden EPA's PFAS Strategic Roadmap with the Trump EPA's 2019 Action Plan demonstrates the two Administrations' different priorities with respect to the contaminants.[150] The 2019 "Action" Plan made no concrete promises for establishing MCLs under the SDWA or listing PFAS as hazardous under CERCLA, instead focusing much more on monitoring, research, and

136. E.I. du Pont de Nemours & Co., Food Additive Petition No. 5B1747: "Zonyl" RP Paper Fluoridizer (Mar. 23, 1966), https://static.ewg.org/reports/2019/pfa-timeline/1966_PFAS-Food-Packaging.pdf.
137. 3M, Science Publication Strategy (Dec. 10, 1998) (unpublished study), https://static.ewg.org/reports/2019/pfa-timeline/1998_Publication-Strategy.pdf.
138. News Release, U.S. EPA, EPA and 3M Announce Phase Out of PFOS (May 16, 2000), https://archive.epa.gov/epapages/newsroom_archive/newsreleases/33aa946e6cb11f35852568e1005246b4.html; 67 Fed. Reg. 11008 (Mar. 11, 2002) (requiring notification before future manufacture of 13 PFAS chemicals); 67 Fed. Reg. 72854 (Dec. 9, 2002) (requiring notification before future manufacture of 75 PFAS chemicals).
139. *See supra* Section III.A.1.
140. Buzbee, *supra* note 4.
141. 72 Fed. Reg. 57222 (Oct. 9, 2007); 78 Fed. Reg. 62443 (Oct. 22, 2013); 85 Fed. Reg. 45109 (July 27, 2020).
142. 81 Fed. Reg. 33250 (May 25, 2016).
143. 85 Fed. Reg. 37354 (June 22, 2020); 42 U.S.C. §§11001-11050, ELR Stat. EPCRA §§301-330.
144. 42 U.S.C. §300g-1(b)(1)(F).
145. 81 Fed. Reg. 5 (Jan. 4, 2016) (banning (1) diethanolamine salts of mono- and bis C8-C18 perfluoroalkyl phosphates; (2) pentanoic acid derivatives; and (3) perfluoroalkyl substituted phosphate ester acids).
146. *See, e.g.*, Jody A. Shoemaker et al., Determination of Selected Perfluorinated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS) (Sept. 2009) (EPA/600/R-08/092) (on file with author) (establishing a scientific method for measuring concentrations of PFAS in drinking water); 83 Fed. Reg. 58768 (Nov. 21, 2018) (publishing a toxicity assessment for perfluorobutane sulfonic acid (PFBS)); Memorandum from Andrew R. Wheeler, Acting Administrator, U.S. EPA, to Jennifer Orme-Zavaleta, Principal Deputy Assistant for Science, U.S. EPA, Directive to Prioritize Federal Research on Impacts to Agriculture and Rural Economies in EPA's Per- and Polyfluoroalkyl Substances (PFAS) Action Plan (Feb. 27, 2019) (on file with author).
147. News Release, U.S. EPA, EPA Takes Action to Address PFAS in Drinking Water (Feb. 22, 2021), https://www.epa.gov/newsreleases/epa-takes-action-address-pfas-drinking-water.
148. U.S. EPA, PFAS Strategic Roadmap: EPA's Commitments to Action 2021-2024 (2021) (EPA-100-K-21-002).
149. Owen, *supra* note 55.
150. *Compare* U.S. EPA, *supra* note 148, *and* U.S. EPA, EPA's Per- and Polyfluoroalkyl Substances (PFAS) Action Plan (2019) (EPA823R18004).

risk communication.[151] In an Administration that restricted EPA's use of certain science and expressly aligned itself with powerful industry, it is not surprising that progress regulating contaminants where science is inherently uncertain temporarily stalled.[152]

3. Regulatory Gaps

As the law currently stands, PFAS are not listed as hazardous waste under CERCLA or RCRA, subject to federal water quality standards under the CWA, limited to an MCL under the SDWA, or subject to air emissions standards under the CAA.[153] Though the Biden EPA's Strategic Roadmap is certainly a step in the direction of comprehensive regulation, the Strategic Roadmap's proposals, even if executed in accordance with Administrator Michael Regan's timeline, will not be finalized into formal regulations until at least 2023.[154] Further, these proposed regulations would regulate only certain PFAS as opposed to PFAS as a class, thereby leaving loopholes for manufacturers to continue exposing populations to PFAS' harmful health effects via substitute chemicals.[155]

Assuming that the Biden Administration eventually does execute its Strategic Roadmap, the largest gap in PFAS regulation will be the government's failure to regulate PFAS as a class. The best explanation for EPA's resistance to class-based regulation is likely fear of overregulation. Deciding to regulate PFAS as a class would mean that each regulatory decision EPA made would be very significant in magnitude, for each would impact thousands of chemicals. It is reasonable to assume that such drastic decisions would give EPA pause.

D. Takeaways

First, the real-life underregulation of asbestos, chlorpyrifos, and PFAS confirm the threefold mechanism by which underregulation occurs. With the exception of the initial decision to regulate chlorpyrifos, the federal government failed to regulate all three materials at all three stages of the framework. While certainly this persistent underregulation is not heartening, this does shed some light on how and why this problem is occurring.

Second, and more concerning, the fact that many trends and rationales for underregulation repeat across contaminants indicates that the federal government is unaware of the underregulation problem. For example, there are many similarities between asbestos and PFAS with respect to the government's hesitancy to begin regulation. In both instances, a strong industry lobby motivated by huge profits hid evidence of the contaminant's human health harms first from the government and then from the general public, thereby giving agencies little incentive to proactively regulate the contaminant.[156] With respect to delay in promulgating final regulations, there are similarities between chlorpyrifos and PFAS: EPA stalled in regulating both contaminants because of ideological waffling across political administrations.[157]

And finally, all three contaminants share similarities with respect to regulatory gaps. For both asbestos and chlorpyrifos regulation, the federal government conveyed a significant rulemaking as a universal fix to the public, allowing regulatory gaps to exist without public pushback.[158] It appears that this trend may be repeating with PFAS as well via the Biden Administration's "comprehensive" PFAS Strategic Roadmap.[159]

It is likely that these trends are repeating, and that the federal government is failing to recognize patterns in underregulation due to the fact that CECs are defined by their lack of information, as opposed to their uses or exposure mechanisms. The broad nature of the class masks the underlying underregulation problem, because neither regulators nor the public traditionally assume that in regulating biomaterials that threaten human health via inhalation, neurodisruptive pesticides, and carcinogenic chemicals used in consumer products, regulators face the same underlying challenges. This recognition failure makes CEC underregulation even more problematic and difficult to resolve, as without acknowledgment that they are perpetuating a problem regulators cannot hope to stop it.

IV. Recommendations

The significant underregulation of CECs necessitates a response, especially in light of the far-reaching and serious environmental justice threats that such underregulation of CECs poses. This section provides several suggestions that range from the least effective long-term but least intrusive, to the most effective but most intrusive.

151. News Release, U.S. EPA, EPA Acting Administrator Announces First-Ever Comprehensive Nationwide PFAS Action Plan (Feb. 14, 2019), https://www.epa.gov/newsreleases/epa-acting-administrator-announces-first-ever-comprehensive-nationwide-pfas-action.

152. *See, e.g.*, *A Four-Year Timeline of Trump's Impact on Science*, Nature (Oct. 5, 2020), https://www.nature.com/articles/d41586-020-02814-3 (documenting the Trump Administration's restrictions on science, including budget proposals that reduce funding for scientific agencies and the 2018 EPA data ban); Jeff Tollefson, *Industry Trumps Peer-Reviewed Science at US Environment Agency*, Nature (Aug. 14, 2018), https://www.nature.com/articles/d41586-018-05946-9 (describing changes to EPA's chemical assessment guidance that place greater weight on industry-sponsored research); Public Citizen, *Trump's Corporate Cabinet*, https://www.citizen.org/article/corporatecabinet/ (last visited Oct. 19, 2022) (outlining the industry ties of each member of Trump's Cabinet).

153. ITRC, Regulation of Per- and Polyfluoroalkyl Substances (PFAS) (2020), https://pfas-1.itrcweb.org/wp-content/uploads/2020/10/regs__508_Aug-2020-Final.pdf.

154. U.S. EPA, *supra* note 148.

155. *See, e.g.*, Sharon Lerner, *People Exposed to PFAS Criticize EPA Action Plan as Too Little, Too Late*, Intercept (Oct. 19, 2021, 11:33 AM), https://theintercept.com/2021/10/19/pfas-epa-water-dupont-chemours/; E.A. (Ev) Crunden, *EPA's Long-Sought PFAS Plan Falls Short With Critics*, Greenwire (Nov. 11, 2021, 1:40 PM), https://subscriber.politicopro.com/article/eenews/2021/11/11/health-groups-slam-epas-big-pfas-plan-slow-and-toothless-282868.

156. See discussion *supra* Section III.A.1, Section III.C.1.

157. See discussion *supra* Section III.B.2, Section III.C.2.

158. See discussion *supra* Section III.A.3, Section III.B.2.

159. U.S. EPA, *supra* note 148.

A. Treat Symptoms of CEC Harm by Better Responding to Environmental Justice Concerns When They Arise

For members of environmental justice communities experiencing the human health impacts of CECs firsthand, of utmost primary concern is addressing symptoms as opposed to causes. To best alleviate victims of CEC underregulation of their burdens in the short term, the government should reform its judicial and legislative practices to be more receptive to environmental justice claims and grant relief willingly. There has been much discussion in legal literature about how to reform both the judicial and the legislative arenas to appropriately recognize environmental harms as legitimate and to consider community interests in law making.

A full assessment of the strategies proposed is beyond the scope of this Article, as these strategies vary widely. For example, with respect to judicial approaches, scholars have suggested that environmental justice harms may violate federal civil rights statutes like Title VI of the Civil Rights Act of 1964 or provisions of the U.S. Constitution like the Equal Protection Clause of the Fourteenth Amendment or the Due Process Clauses of the Fifth and Fourteenth Amendments.[160] With respect to legislative strategies, scholars, states, and federal agencies alike have proposed models that make community-based public decisionmaking a requirement in statutes that impact environmental justice populations.[161]

These strategies are incredibly important for providing appropriate redress for those impacted by CEC contamination and those suffering environmental harm more generally. In terms of addressing the problem of CEC regulation, however, focusing solely on ultimate harm is incomplete in the long term. Improving the processes for seeking relief from environmental justice harms does nothing to stop CEC underregulation and the resulting harm in the first instance. As such, a society with environmental justice relief mechanisms but no mechanisms for addressing underregulation is like a society with ibuprofen but no soap: flu patients may be more comfortable with reprieve from their temperatures, but people are being exposed to the disease all the same. To completely address the problem proposed by the underregulation of CECs, the government must invent soap.

B. Retain the Current Regulatory Framework and Improve the Processes for Regulating CECs

To some extent, agencies could improve regulation by making simple modifications and mindset adjustments. First, advocates and the executive branch could attempt to shift the mental framework of agency regulators away from empire-building and risk avoidance and toward supporting communities. Shifting this mindset could compel agencies to undertake regulation of more CECs even when not compelled to do so, and when regulation may be socially necessary but not as politically advantageous. To encourage this mindset-shifting, the executive branch could, for example, pass executive orders that require agencies to interact with environmental justice communities on a regular basis or conduct annual research on the environmental justice impacts of their programs.

Second, increasing agency communication, whether informally or formally, could help increase the quantity of CECs regulated and the comprehensiveness of regulations by helping reduce the regulatory commons problem. Such communication could help reduce the free-rider problem present in interagency decisions, where each agency waits for other agencies to step up and bear the brunt of the regulatory costs and pushback before beginning to regulate themselves.

Finally, encouraging agency regulators to adopt the precautionary principle over regulatory models like pure cost-benefit analysis could help increase the ultimate protectiveness of regulations.[162] Unlike cost-benefit analysis, which typically yields regulations that are only the most minimally protective, the precautionary principle yields regulations with room for error. This wiggle room accounts for slippage during the enforcement process, and will more likely result in regulations that as enforced still protect at-risk communities.

These strategies are certainly steps in the right direction, as they would increase the amount, efficiency, and protectiveness of CEC regulation. These strategies are inherently limited by their discretionary nature, however. Retaining the current regulatory framework continues to vest ultimate discretion in agency officials, and so, regardless of the extent to which these officials are encouraged to regulate, they ultimately may decide against doing so. It thus appears that revising current regulatory methods is not a long-term solution to the problem of CEC underregulation, but would be most effective as a temporary fix while legislators work to make more fundamental changes.

160. *See*, *e.g.*, Dana & Turerkheimer, *supra* note 5; Madison Lauren, *Substantive Due Process as Recourse for Flint Water Crisis Plaintiffs*, 64 Wayne L. Rev. 531 (2019).

161. *See*, *e.g.*, Anika Singh Lemar, *Overparticipation: Designing Effective Land Use Public Processes*, 90 Fordham L. Rev. 1083 (2021) (proposing a participation model that balances public input with expertise for land use planning); Wyatt G. Sassman, *Community Empowerment in Decarbonization: NEPA's Role*, 96 Wash. L. Rev. 1151 (2021) (suggesting that the National Environmental Policy Act (NEPA) should be modified to require meaningful community engagement); S. 9, 2021-2022 Leg., 192d Gen. Ct. (Mass. 2021) (requiring increased public participation in the form of increasing access to notices and translation services, holding public meetings in accessible locations, and establishing local document repositories for proposed projects with environmental justice impacts); H.B. 7008, Gen. Assemb., Sept. Special Sess. (Conn. 2020) (requiring applicants proposing projects with environmental justice impacts to submit meaningful participation plans before their projects are approved).

162. The precautionary principle is generally understood as the concept that in the face of uncertainty, regulators should not fail to act, and in general "it is better to overregulate than to underregulate new technologies." Daniel A. Farber, *Uncertainty*, 99 Geo. L.J. 901 (2011).

C. *Establish New Frameworks That Are Specifically Tailored to Rectify Barriers to CEC Regulation*

To best regulate CECs, the government must modify its traditional practices of entrusting agencies with significant regulatory discretion, allowing agencies to regulate independently, and assuming that regulations as promulgated are the same as regulations as enforced by fundamentally reconceptualizing its regulatory approach. A new regulatory strategy should include two key components.

1. Pass Legislation to Compel More Regulation of CECs

First, a new regulatory strategy would overcome the problem of risk avoidance by removing discretion over when to regulate from agency officials, and legislatively compelling more regulation. Congress should pass legislation embodying the precautionary principle that requires the appropriate agencies to begin regulating any CECs that meet a statutory definition. For example, Congress could amend TSCA, the existing environmental statute that most closely covers CECs. TSCA currently includes six subchapters: the first addresses the control of toxic substances generally, and the next five consist of rules for abating hazards of certain recognized toxins (asbestos, radon, lead, and formaldehyde) and standards for maintaining healthy schools. Congress could add a seventh subpart of TSCA that compels EPA and all other relevant agencies to regulate all materials that, for example, have the potential to threaten the environment and human health.[163]

Alternatively, Congress could pass a new statute dedicated entirely to addressing CECs. While the content of this new statute would likely be similar to the amendments to TSCA, passing a stand-alone law would have an added symbolic and rhetorical impact. Such a law would signal the importance of regulating CECs to the broader community, implying that it is a significant environmental issue that deserves special attention in and of itself and not simply a branch of the toxic substances regulation. Once again, there is precedent for such laws; look, for example, to the Marine Mammal Protection Act (MMPA)[164] and the Bald and Golden Eagle Protection Act,[165] which function to provide additional protections to particularly threatened and valued animals on top of the Endangered Species Act (ESA).[166]

In addition to compelling more regulation, this legislation should also authorize regulators to impose a wide variety of temporary safeguards without requiring significant scientific evidence. For example, the legislation might grant agencies the authority to establish temporary bans, restrictions, or capped uses, or designate substances as hazardous with less extensive public comment. This authorization would mitigate the scientific uncertainty efficiency delay problems identified by Professor Owen, by providing clear regulatory pathways even in the presence of scientific uncertainty, and allow for some regulation to occur while scientists work to gather toxicology information.[167]

While it is true that more intensive congressional mandates could lead to slippage resulting from agency refusal to honor the mandates, as Professor Farber suggests, this is still likely a better strategy than relying on the will of naturally risk-averse agencies, as congressional mandates can at the very least be judicially enforced.[168] Further, while such a precautionary approach is less common in modern environmental law, which largely operates on a cost-benefit analysis framework, it is not unheard of.

2. Establish an Interagency CEC Regulatory Task Force

Once congressional mandates trigger a regulatory obligation, agencies could most efficiently and accurately promulgate rules by working together. The executive branch should establish an interagency CEC Regulatory Task Force comprising scientists and policymakers from each agency that potentially promulgates regulations on toxic substances, including, for example, EPA, OSHA, FDA, and CPSC. Additionally, the task force should include representatives from each regulatory interest group and representatives from environmental justice communities particularly at risk of exposure to the CEC in question.[169] This task force should work collaboratively to decide which agencies should ultimately promulgate which standards and what these standards should be.

Such collaboration could mitigate multiple regulatory threats. First, while interagency collaboration does not completely eliminate the threat of regulatory commons problems, increasing communication in conjunction with requiring that regulations be promulgated would at least reduce the free-rider problem present in interagency decisions, where each agency waits for other agencies to step up and bear the brunt of the regulatory costs and pushback before beginning to regulate themselves.[170]

Further, as Professor Wagner suggests in her recommendations, depending on the practices of the task force, this model could help bypass incentives for regulators to misconvey policy decisions as scientific decisions. For example, she proposes that, while task force appointments should be subject to public comment and judicial review, task force decisions and final standards should not be.[171] Without the pressure of review, agencies would be less compelled to spend time unnecessarily debating science to couch policy decisions in order to justify decisions to the public.[172]

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163. Siddique et al., *supra* note 8.
164. 16 U.S.C. §§1361-1421h, ELR Stat. MMPA §§2-410.
165. 16 U.S.C. §§668-668d.
166. 16 U.S.C. §§1531-1544, ELR Stat. ESA §§2-18.
167. Owen, *supra* note 55.
168. Farber, *supra* note 57.
169. Wagner, *supra* note 56.
170. Jody Freeman & Jim Rossi, *Agency Coordination in Shared Regulatory Space*, 125 Harv. L. Rev. 1131 (2012).
171. Wagner, *supra* note 56.
172. *Id.*

Finally, this multidimensional task force could potentially reduce negative slippage to at least some extent. Professor Farber suggests that a common reason for slippage is noncompliance by regulated parties.[173] If the parties to be regulated are present during the rulemaking process as representatives in the task force, they will be more likely to be satisfied with the standards ultimately promulgated, and in turn will be more likely to follow them.

V. Conclusion

The government's consistent underregulation of CECs is easy to miss when the public views these CECs and their impacts like the government currently does: as distinct chemicals whose impact and concern are limited to their specific uses and manners of exposure. When viewed more broadly in terms of the threat that materials where scientific uncertainty exists bring, however, a clear and disturbing trend emerges: when faced with CECs, the government waits to regulate and when it finally does so regulates incompletely, leaving environmental justice communities to bear the burden. To fully address this trend requires the environmental law community to commit to restructuring the regulatory system as they know it, to compel regulation even in the face of uncertainty and to encourage interagency collaboration.

173. Farber, *supra* note 57.