

The Forever Fight Against Forever Chemicals: Analyzing Loopholes in California's PFAS Ban for Consumer Products

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Per- and polyfluoroalkyl substances (PFAS) are a class of synthetic chemicals used for their unique qualities in manufacturing across numerous industries. PFAS, also known as “forever chemicals,” persist in the environment for long periods of time and cause serious health risks to consumers. Given mounting research on PFAS and their adverse health effects, the California legislature passed four laws banning the chemicals in specific consumer products.

This Note argues that three new California laws requiring manufacturers to replace PFAS with “the least toxic alternative” are inadequate because they are ambiguous. This ambiguity will invite litigation and create business challenges by allowing manufacturers to substitute chemicals that technically comply with statutory requirements but still pose health risks to consumers. This issue both raises environmental justice concerns and obscures manufacturing compliance. Because current statutory language raises more questions than it answers, a more concrete standard specifying which alternatives are permissible would benefit consumers and corporations alike.

While it is impossible to know how this language will play out in practice, California's existing regulatory scheme needs clarification at a minimum. A one size fits all standard may not exist to judge PFAS alternatives across different sectors. However, further regulatory clarification and a technology-based approach would increase predictability and quell environmental justice concerns.

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INTRODUCTION

Per- and polyfluoroalkyl substances (PFAS) refer to a class of man-made chemicals that were first used in consumer products in the 1950s due to their nonstick, heat-resistant, water-repellant, and durable characteristics.¹ Over the past decade, PFAS regulations have gained prominence as a significant form of environmental and consumer protection² driven by mounting evidence of potential harms.³ Animal toxicology studies in the 1980s initially suggested that this class of chemicals posed some risk, but advancements in scientific techniques during the 1990s and early 2000s allowed researchers to better understand its human health implications.⁴

Embodying these concerns, California's regulatory system has some of the most stringent PFAS regulations in the country.⁵ California differs from other states by regulating the entire class of PFAS chemicals under a single umbrella,⁶ rather than targeting individual variations one by one.⁷ Despite California's unique regulatory framework, three consumer product laws contain vague language, each requiring manufacturers to replace PFAS with "the least toxic alternative."⁸ This ambiguous language implicates numerous interests, ranging from commercial manufacturers to environmental watchdogs.

Given ambiguous phrasing, this Note analyzes current statutory language in detail. Essentially, this Note investigates whether the subject language provides an adequate and administrable legal framework, or whether its ambiguity invites litigation stemming from cost implications, compliance difficulties, and environmental justice concerns. My findings suggest that the chosen language invites litigation and creates compliance challenges by allowing manufacturers to substitute nominally safer chemicals. Notwithstanding compliance difficulties, these laws lack tangible impact because they leave room for manufacturers to circumvent toxic substances regulation while selling products that California's regulatory scheme was designed to prohibit.

1. *Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS)*, NAT'L INST. ENV'T HEALTH SCIS. (May 6, 2025), <https://www.niehs.nih.gov/health/topics/agents/pfc>.

2. Theodore Weiss, *California's Approach to PFAS Regulation Creates Compliance Challenges*, BAKERHOSTETTLER: INSIGHTS (Feb. 21, 2024), [https://www.bakerlaw.com/insights/californias-approach-to-pfas-regulation-creates-compliance-challenges/#:~:text=pdf%20\(ca.gov\),.parts%20per%20million%20\(ppm\)](https://www.bakerlaw.com/insights/californias-approach-to-pfas-regulation-creates-compliance-challenges/#:~:text=pdf%20(ca.gov),.parts%20per%20million%20(ppm)).

3. Nadia Gaber, Lisa Bero & Tracey J. Woodruff, *The Devil They Knew: Chemical Documents Analysis of Industry Influence on PFAS Science*, ANNALS GLOB. HEALTH, June 1, 2023, at 1, 7.

4. *See id.* (detailing the history of public health knowledge on PFAS).

5. Weiss, *supra* note 2.

6. Simona Andreea Bălan, Vivek Chander Mathrani, Dennis Fengmao Guo & André Maurice Algazi, *Regulating PFAS as a Chemical Class Under the California Safer Consumer Products Program*, ENV'T HEALTH PERSPS., Feb. 2021, at 1, 2.

7. *Id.* at 4.

8. Assemb. 652, 2021–2022 Reg. Sess. (Cal. 2021); Assemb. 1200, 2021–2022 Reg. Sess. (Cal. 2021); Assemb. 1817, 2021–2022 Reg. Sess. (Cal. 2022).

Part I begins by summarizing vital background information on PFAS science and current California regulation.⁹ Part II analyzes the implications of applicable statutory language on manufacturing compliance and explains the challenges of regulating such a widely used substance. Part III outlines environmental justice concerns within the current regulatory framework, highlighting the disproportionate impacts of toxic substance pollution on marginalized communities. Finally, this Note concludes by summarizing findings and proposing viable technology-based standards to help manufacturers better assess alternatives and address environmental justice concerns.

I. UNDERSTANDING PFAS AND CALIFORNIA'S REGULATORY SCHEME

Regulating toxic chemicals is especially difficult when a substance is both useful in manufacturing and dangerous to consumers.¹⁰ PFAS is an umbrella term used to describe a class of around 9,000 individual man-made chemicals.¹¹ PFAS have desirable characteristics for manufacturers because they help make consumer and industrial products waterproof, fireproof, stain resistant, grease resistant, and durable, among other things.¹² Products that frequently contain PFAS include non-stick cookware, personal care products such as dental floss or cosmetics, stain and water resistant upholstery or clothing, food packaging, and more.¹³ These same characteristics, while helpful in manufacturing useful products, can amplify consumer health risks.¹⁴

A. THE BASIC SCIENCE

Although this Note primarily addresses legal issues surrounding government regulation,¹⁵ a rudimentary understanding of PFAS science helps contextualize why these chemical characteristics exist and frame subsequent analysis. At risk of oversimplification, PFAS get their properties from carbon and fluorine atoms held together by strong chemical bonds.¹⁶ Many scientists aptly refer to PFAS as “forever chemicals” because their powerful chemical

9. See discussion *infra* Part.I.

10. See Kathryn Crawford, *What Are PFAS, the 'Forever Chemicals' Showing Up in Drinking Water? An Environmental Health Scientist Explains*, CONVERSATION (July 11, 2023, at 10:57 ET), <https://theconversation.com/what-are-pfas-the-forever-chemicals-showing-up-in-drinking-water-an-environmental-health-scientist-explains-185015> (acknowledging that, while dangerous, PFAS have desirable characteristics causing them to be widely used).

11. *Id.*

12. See, e.g., *Our Current Understanding of the Human Health and Environmental Risks of PFAS*, EPA (Nov. 26, 2024), <https://www.epa.gov/pfas/our-current-understanding-human-health-and-environmental-risks-pfas>.

13. *Id.*

14. See Bella Isaacs-Thomas, *Why Getting PFAS Out of Our Products Is So Hard—and Why It Matters*, PBS NEWS (Mar. 14, 2023, at 14:25 ET), <https://www.pbs.org/newshour/science/pfas-are-everywhere-what-can-we-do-to-change-that>.

15. See discussion *infra* Parts.II, III (addressing substantive legal issues implicated by emerging California regulation).

16. *What Are PFAS?*, UNIV. OF N.C.: NC PURE, <https://ncpure.collaboratory.unc.edu/science/what-are-pfas/#:~:text=PFAS%20is%20an%20acronym%20for,the%20chemicals%20difficult%20to%20degrade> (last visited Sep. 30, 2025).

bonds remain intact for thousands of years.¹⁷ This chemical durability contributes to bioaccumulation in both the environment and human body.¹⁸ Carbon-fluorine bonds are among the strongest in organic chemistry, rendering man-made chemicals like PFAS “nearly indestructible.”¹⁹ Recent advancements in decontamination techniques address this problem by severing carbon-fluorine bonds and safely degrading PFAS.²⁰ However, currently available methods fail to adequately address or reverse large-scale contamination since they are best suited for specific waste sites.

B. THE RISKS

Because of these durable carbon-fluorine bonds and other chemical characteristics, PFAS are appealing to manufacturers across various industries.²¹ For example, a nonprofit called the Environmental Working Group²² used Environmental Protection Agency (EPA) data to compile a map of over 40,000 industrial and municipal sites across the country that use, produce, or are suspected of using or producing PFAS.²³ Current estimates may even underestimate PFAS usage due to data collection issues.²⁴ For instance, some advocates allege that reporting loopholes compromise figures from EPA databases relying on self-reporting.²⁵

Given their widespread usage across various industries, PFAS leach into the environment, where they can adversely impact “nearly every living

17. *Id.*; Morgan Coulson, *The Omnipresence of PFAS—and What We Can Do About Them*, JOHNS HOPKINS BLOOMBERG SCH. PUB. HEALTH (Mar. 28, 2024), <https://publichealth.jhu.edu/2024/what-to-know-about-pfas#:~:text=Because%20of%20their%20longevity%20and,can%20last%20thousands%20of%20years.>

18. UNIV. OF N.C.: NC PURE, *supra* note 16; *see* Coulson, *supra* note 17.

19. *Breaking the Strongest Bond to Carbon*, UNIV. OF MINN.: DEP’T OF CHEMISTRY, <https://cse.umn.edu/chem/news/breaking-strongest-bond-carbon> (last visited Oct. 3, 2025).

20. Dep’t of Toxic Substances Control, *Factsheet on PFASs in Consumer Products: Key Points for Decision Makers*, CAL. EPA 5 (Aug. 2023), <https://dtsc.ca.gov/wp-content/uploads/sites/31/2023/09/PFAS-Factsheet.pdf>.

21. *See id.* at 1 (“[C]arbon-fluorine bonds give PFASs their useful properties, including their resistance to heat, harsh chemicals, and microbial decay. This kind of resistance to breakdown is a useful feature of a chemical in a consumer product, but it is problematic once the chemical reaches the environment.”); *Suspected Industrial Discharges of PFAS*, ENV’T WORKING GRP., https://www.ewg.org/interactive-maps/2021_suspected_industrial_discharges_of_pfas/map (last visited Oct. 4, 2025) (containing an interactive map displaying locations of “industrial and municipal sites that are known to produce or use, are suspected of using, or are a suspected source of the toxic fluorinated chemicals known as PFAS”).

22. *Who We Are*, ENV’T WORKING GRP., <https://www.ewg.org/who-we-are> (last visited Oct. 4, 2025) (stating that the nonprofit specializes in expanding access to public health information).

23. ENV’T WORKING GRP., *supra* note 21.

24. *See* Press Release, Earthjustice, EPA Sued Over PFAS “Secrecy” Reporting Loopholes, EARTHJUSTICE (Jan. 20, 2022), <https://earthjustice.org/press/2022/epa-sued-over-pfas-secrecy-reporting-loopholes#:~:text=EPA%2Dcreated%20loopholes%20allow%20chemical,air%20or%20water%20takes%20place> (citing an Earthjustice review finding that manufacturers are underreporting or failing to disclose PFAS usage in violation of applicable regulations).

25. *Id.*

organism,”²⁶ including wildlife.²⁷ Some of the most common exposure pathways for PFAS to enter and persist in the human body include consumption, physical contact, inhalation, and exposure in utero.²⁸ Risk of exposure is so pervasive in our environment that 97% of human blood samples contained PFAS in a 2012 Centers for Disease Control and Prevention (CDC) National Health and Nutrition Examination Survey.²⁹ Short-term and long-term exposure resulting from widespread PFAS usage is linked to a range of health risks, including endocrine and metabolism disruption, adverse kidney health, reduced bone mass, low birth weight, certain cancers, immunotoxicity, hypertension, and more.³⁰ While the science is complex, the consensus is clear: PFAS adversely affect health outcomes.³¹

C. REGULATORY HISTORY AND FRAMEWORK

Growing concerns about exposure to PFAS and other toxic substances are reflected in federal action. Enacted in 1976, the Toxic Substances Control Act (TSCA) was a landmark piece of legislation addressing “the production, importation, use, and disposal of” dangerous chemicals such as asbestos and lead-based paint.³² The TSCA was amended in 2016 to include more modern

26. Dep’t of Toxic Substances Control, *supra* note 20, at 3.

27. See David Q. Andrews, Tasha Stoiber, Alexis M. Temkin & Olga V. Naidenko, *Discussion. Has the Human Population Become a Sentinel for the Adverse Effects of PFAS Contamination on Wildlife Health and Endangered Species?*, SCI. TOTAL ENV’T, Sep. 26, 2023, at 1, 2 (“As the global wildlife and biodiversity conservation crisis deepens, there is an urgent need to better protect wildlife from the threats of chemical pollution.”).

28. Dep’t of Toxic Substances Control, *supra* note 20, at 3; Michelle G. Scanlon, *Will ‘Forever Chemicals’ Be Around Forever? An Analysis and a Proposal Concerning PFAS Contamination and Public Health*, 34 HEALTH L. 52, 60 (2022) (“PFAS can be ‘highly mobile’ in air and water, which allows them to travel long distances.” (quoting Carol F. Kwiatkowski et al., *Scientific Basis for Managing PFAS as a Chemical Class*, ENV’T SCI. & TECH. LETTERS 532, 533 (2020)). “Importantly, ‘[a]ccumulation of certain PFAS has been shown through blood tests to occur in humans and animals.’” *Id.* (quoting *Per- and Polyfluoroalkyl Substances (PFAS)*, U.S. FDA. (Jan. 3, 2025), <https://www.fda.gov/food/environmental-contaminants-food/and-polyfluoroalkyl-substances-pfas>).

29. Ryan C. Lewis, Lauren E. Johns & John D. Meeker, *Serum Biomarkers of Exposure to Perfluoroalkyl Substances in Relation to Serum Testosterone and Measures of Thyroid Function Among Adults and Adolescents from NHANES 2011–2012*, 12 INT’L J. ENV’T. RSCH. & PUB. HEALTH 6098, 6103 (2015) (interpreting publicly available data from a survey administered by the Centers for Disease Control and Prevention.)

30. Gaurav Jha, Vanaja Kankarla, Everaldo McLennon, Suman Pal, Debjani Sihi, Biswanath Dari, Dawson Diaz & Mallika Nocco, *Per- and Polyfluoroalkyl Substances (PFAS) in Integrated Crop–Livestock Systems: Environmental Exposure and Human Health Risks*, INT’L J. ENV’T. RSCH. & PUB. HEALTH, Nov. 28, 2021, at 1, 5–6 (“[S]everal studies have shown an association with various adverse health issues in humans with exposure to PFAS.”).

31. Paul Massari, *Before ‘Forever,’* HARV. JOHN A. PAULSON SCH. OF ENG’G & APPLIED SCIS. (Feb. 28, 2024), <https://seas.harvard.edu/news/2024/02/forever>.

32. *Summary of the Toxic Substances Control Act*, EPA (Aug. 25, 2025), <https://www.epa.gov/laws-regulations/summary-toxic-substances-control-act>. While not explicitly clear from my research, I surmise that the TSCA did not address PFAS when it was passed because it initially addressed the most well understood substances of the time.

enforcement mechanisms for manufacturers.³³ This amendment imposed reporting requirements on regulated chemicals and notice requirements for novel substances.³⁴ Aligning with these amendments, the EPA promulgated a rule in December 2024 that subjects PFAS and other toxic chemicals to the full review process and removes any otherwise applicable exemptions.³⁵

Several federal agencies besides the EPA also take on roles in responding to PFAS risks, such as the Food and Drug Administration (FDA), Department of Agriculture (USDA), Department of Defense (DOD), and Agency for Toxic Substances and Disease Registry (ATSDR).³⁶ While administrative agencies like the EPA enforce federal regulatory statutes such as the TSCA, state legislatures are taking more aggressive measures to address PFAS concerns and supplement federal efforts.³⁷ In 2024 alone, an analysis conducted by a nation-wide alliance of environmental health organizations suggests that “at least [thirty-six] states [considered] at least 450 bills” on toxic chemical and plastics related policies.³⁸

California is one such state—an emerging leader in PFAS regulation.³⁹ California toxic substances laws are often stricter than their federal counterparts.⁴⁰ For example, the California Department of Toxic Substances Control (DTSC) enforces environmental laws by regulating PFAS as a class of substances that exhibit similar toxic chemical profiles.⁴¹ Sometimes called the “P-sufficient” approach, this risk-assessment strategy targets all PFAS by using

33. See James B. Pollack, Isabel Q. Carey & Victor Y. Xu, *Regulation of Products with PFAS*, 54 ENV'T L. REP. 10148, 10149 (2024) (summarizing the history of the TSCA and its 2016 amendment).

34. *Id.*

35. *Actions Under TSCA Section 5*, EPA (Sep. 16, 2025), <https://www.epa.gov/reviewing-new-chemicals-under-toxic-substances-control-act-tsca/actions-under-tsca-section-5>.

36. ELENA H. HUMPHREYS, DAVID M. BEARDEN, LAURA GATZ, LANCE N. LARSON & JERRY H. YEN, CONG. RSCH. SERV., R45986, FEDERAL ROLE IN RESPONDING TO POTENTIAL RISKS OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) (2022) (“Several federal agencies, including EPA and the Agency for Toxic Substances and Disease Registry, have been evaluating potential health effects that may be associated with exposures to various PFAS.”).

37. Xiaolu Wang, *DEEP DIVE: The PFAS Regulatory Landscape at the State Level*, 3E (June 4, 2024), <https://www.3eco.com/article/deep-dive-the-pfas-regulatory-landscape-at-the-state-level/> (“[S]tate legislatures are not waiting for the federal government to take action and are making their own moves to regulate or ban PFAS.”); *id.* (“EPA said it was allocating \$1 billion in funding from the Bipartisan Infrastructure Law to help states and U.S. territories implement PFAS testing and treatment.”).

38. SAFER STATES, 2024 ANALYSIS OF STATE LEGISLATION ADDRESSING TOXIC CHEMICALS AND PLASTICS 3 (Feb. 8, 2024), <https://www.saferstates.org/wp-content/uploads/Safer-States-2024-Multistate-Analysis.pdf>.

39. Weiss, *supra* note 2.

40. *Compare, e.g.*, Assemb. 1200, 2021–2022 Reg. Sess. (Cal. 2021) (defining regulated PFAS as any intentionally added PFAS or the presence of PFAS in a product “at or above 100 parts per million, as measured in total organic fluorine”) with 40 C.F.R. § 705.3 (2025) (defining PFAS as any substance with one of the three following chemical structures: “(1) R-(CF₂)-CF(R')R”, where both the CF₂ and CF moieties are saturated carbons”; “R-CF₂O-CF₂-R”, where R and R' can either be F, O, or saturated carbons”; and “CF₃C(CF₃)R'R”, where R' and R” can either be F or saturated carbons”). California’s definition is stricter and, thus, more inclusive of substances that do not have the chemical structure enumerated in the federal regulation.

41. Bălan et al., *supra* note 6.

“high persistence” as a proxy for harmful effects.⁴² Put simply, this approach justifies regulating high persistence chemicals that may remain hazardous in the environment for long periods of time.⁴³ Rather than choosing a particular chemical structure as the lynchpin or enumerating banned substances on a single list, the “P-sufficient” approach facilitates a more dynamic regulatory strategy and complements other risk assessment methods.⁴⁴

The California legislature has passed four laws since 2021 that embrace the “P-sufficient” approach. Each law effectively bans PFAS in specific areas of consumer products.⁴⁵ Critics of the “P-sufficient” approach label it “over[ly]-cautious,” while proponents cite established evidence that chemical persistence is harmful in any capacity.⁴⁶ Ultimately, California adopts the “P-sufficient” strategy for targeted consumer products, treating all PFAS variations as dangerous despite slight chemical differences.⁴⁷ However, California’s laws are still inadequate. Their ambiguous language invites litigation and creates compliance challenges.

II. IMPLICATIONS OF CALIFORNIA’S REGULATORY APPROACH

Following a general discussion on PFAS, their chemical characteristics, and regulatory responses to toxic substances, this Note will now specifically analyze three California laws targeting distinct consumer products: Assembly Bill (AB) 1200 targeting food packaging, AB 652 targeting juvenile products, and AB 1817 targeting textile articles. A fourth law, AB 2771, bans PFAS in cosmetic products, but will not be analyzed with the other three because it does not contain the least toxic alternative language.⁴⁸ According to the author of AB 1817, “[t]hese laws were passed on the premise that prevention is the best cure, and eliminating PFAS in consumer products is the best way to reduce the adverse health impacts of these chemicals on California residents.”⁴⁹

42. See Ian T. Cousins, Carla A. Ng, Zhanyun Wang & Martin Scheringer, *Why Is High Persistence Alone a Major Cause of Concern?*, 21 ENV’T SCI.: PROCESSES & IMPACTS 781, 782 (2019) (“By ‘high persistence’ we mean that a chemical has at least one degradation half-life exceeding, for example, [six] months.”).

43. *Id.*

44. *Id.*

45. See Assemb. 652, 2021–2022 Reg. Sess. (Cal. 2021) (targeting juvenile products); Assemb. 1200, 2021–2022 Reg. Sess. (Cal. 2021) (targeting food packaging); Assemb. 1817, 2021–2022 Reg. Sess. (Cal. 2022) (targeting textile articles); Assemb. 2771, 2021–2022 Reg. Sess. (Cal. 2022) (targeting cosmetic products). The first three laws completely ban PFAS “that are either intentionally added or present at levels exceeding 100 parts per million total organic fluorine.” *Food Packaging Containing Perfluoroalkyl or Polyfluoroalkyl Substances*, DEP’T OF TOXIC SUBSTANCES CONTROL, <https://dtsc.ca.gov/scp/food-packaging-containing-pfass> (last visited on Oct. 10, 2025). However, AB 2771 is different because it only targets intentionally added PFAS rather than setting an upper limit on fluorine content. See Weiss, *supra* note 2.

46. See Cousins et al., *supra* note 42, at 789 (arguing that implementing precautionary measures through the “P-Sufficient” approach is “entirely rational and empirically well founded”).

47. See generally Bălan et al., *supra* note 6 (describing California’s use of the “P-sufficient” strategy).

48. See generally Assemb. 2771, 2021–2022 Reg. Sess. (Cal. 2022) (targeting cosmetic products).

49. CAL. ASSEMB. COMM. ON ENV’T SAFETY AND TOXIC MATERIALS, ANALYSIS OF ASSEMB. 1817, 2021–2022 Reg. Sess., at 4 (2022) (referring to a series of consumer and environmental protection laws passed in California to address PFAS).

Each law bans PFAS usage in consumer product manufacturing by reclassifying the class of chemicals from their former Priority Product status.⁵⁰ According to the DTSC, a Priority Product has the potential to harm humans or the environment but is not entirely banned.⁵¹ Manufacturers can still use Priority Products if DTSC officials are satisfied by the proper risk assessment review procedures.⁵² This review process requires manufacturers to submit an Alternatives Analysis, which weighs and investigates potential alternatives.⁵³

Until the passage of the California laws analyzed in this Note, PFAS were solely classified as Priority Products. However, each law now outright bans regulated PFAS in its respective area, thus rendering the prior designation moot.⁵⁴ Even manufacturers who follow risk assessment procedures for Priority Products, such as submitting an Alternatives Analysis, have no recourse to use PFAS in consumer products targeted by the laws.⁵⁵ In light of California's new framework, risk assessment procedures like those used for Priority Products will still be relevant for poorly researched PFAS alternatives.⁵⁶

Effective PFAS regulation in consumer products requires more than an outright ban; it demands additional guidance for evaluating replacement chemicals. The three California laws are a step in the right direction, yet suffer from ambiguity. Although Assembly Bills 1200, 652, and 1817 regulate different industries, they each contain identical definitions for PFAS and require manufacturers to substitute PFAS with the least toxic alternative.⁵⁷ Therefore,

50. See generally *Priority Products*, DEP'T OF TOXIC SUBSTANCES CONTROL, <https://dtsc.ca.gov/scp/priority-products> (last visited Oct. 10, 2025) (describing Priority Product status and listing adopted and proposed Priority Products).

51. *Id.*

52. See *id.* (outlining process for using Priority Products as described in Safer Consumer Products Regulations); *Priority Products Notification and Alternatives Analysis Frequently Asked Questions*, DEP'T OF TOXIC SUBSTANCES CONTROL, <https://dtsc.ca.gov/scp/alternatives-analysis-frequently-asked-questions-faqs> (last visited Oct. 10, 2025) (answering frequently asked questions about the process for using Priority Products in manufacturing).

53. *Alternatives Analysis*, DEP'T OF TOXIC SUBSTANCES CONTROL, <https://dtsc.ca.gov/scp/alternatives-analysis> (last visited Oct. 10, 2025) (requiring manufacturers that use Priority Products to submit an Alternatives Analysis).

54. See, e.g., DEP'T OF TOXIC SUBSTANCES CONTROL, *supra* note 45 ("This bill bans all plant fiber-based food packaging containing PFASs that are either intentionally added or present at levels exceeding 100 parts per million total organic fluorine, beginning January 1, 2023. Therefore, there is no longer a need for this product-chemical combination to be listed as a Priority Product."); see DEP'T OF TOXIC SUBSTANCES CONTROL, *supra* note 53 (summarizing the process for one risk assessment procedure that can, under the right circumstances, allow manufacturers to use Priority Products).

55. See DEP'T OF TOXIC SUBSTANCES CONTROL, *supra* note 45.

56. Martin Krayer von Krauss & Poul Harremoës, *MTBE in Petrol as a Substitute for Lead*, in *LATE LESSONS FROM EARLY WARNINGS: THE PRECAUTIONARY PRINCIPLE 1896–2000* 110, 120 (Poul Harremoës, David Gee, Malcolm MacGarvin, Andy Stirling, Jane Keys, Brian Wynne & Sofia Guedes Vaz eds., 2002) (analyzing how a seemingly less toxic lead replacement in gasoline called MTBE was eventually found to be unsafe due to high levels of persistence); *id.* ("There are now a considerable number of examples of persistent chemicals (including chlorofluorocarbons, polychlorinated biphenyls and tributyltin) that caused unwelcome 'surprises' with serious consequences.").

57. See Assemb. 652, 2021–2022 Reg. Sess. (Cal. 2021) (targeting juvenile products); Assemb. 1200, 2021–2022 Reg. Sess. (Cal. 2021) (targeting food packaging); Assemb. 1817, 2021–2022 Reg. Sess. (Cal. 2022) (targeting textile articles).

the three laws can be analyzed together because they suffer from the same fundamental loophole.⁵⁸

A. STATUTORY INTERPRETATION

California's three statutes—AB 1200, AB 652, and AB 1817—fail to elaborate on what constitutes a least toxic alternative or provide a standard to guide PFAS replacement efforts.⁵⁹ The terms “PFAS,” “Cookware,” “Intentionally added chemical,” and “Manufacturer” are defined clearly in the laws to help the reader understand how these words and phrases fit within the larger statute.⁶⁰ By contrast, the statutes do not identify a metric influencing toxicity or choose a standard that regulators can adopt.⁶¹ The ordinary meaning of words typically sheds some light in the absence of a statutory definition.⁶² But, because the word “toxicity” differs significantly depending on the context, an ordinary dictionary definition is not dispositive.

One method to determine legislative intent without explicit textual guidance or clarity from ordinary meaning is to examine bill analyses.⁶³ Bill analyses are written by legislative staff to explain a law's likely impact and summarize relevant considerations for lawmakers.⁶⁴ Even though these reports are not written by lawmakers themselves, they provide a crucial window into the legislative process.⁶⁵

For example, a California Senate Committee on Environmental Quality report comments on this language in AB 1200 by acknowledging that the best alternatives for PFAS remain unclear.⁶⁶ This shows how difficult it would be to enshrine a least toxic standard. Regarding AB 652, another report claims that the least toxic alternative language was added to “prevent regrettable substitutions” of PFAS with other toxic substances.⁶⁷ This language suggests an underlying legislative goal. While no document in AB 1817's Bill Analysis directly addresses this language, one Assembly Committee report refers to PFAS usage

58. See Lawrence Reichman, *PFAS and Food Packaging: The State of Regulation*, PERKINS COIE: UPDATES (Jan. 25, 2023), <https://perkinscoie.com/insights/update/pfas-and-food-packaging-state-regulation> (“One difficult issue in toxicology is ‘regrettable substitutions.’ This occurs when a chemical is banned but is replaced with a chemical that is potentially less well-studied and equally (or more) harmful.”).

59. See, e.g., Assemb. 1200, 2021–2022 Reg. Sess. (Cal. 2021).

60. *Id.*; see Chris Micheli, *California Legislation and Defined Terms*, CAPITOL WEEKLY (Mar. 24, 2024), <https://capitolweekly.net/california-legislation-and-defined-terms>.

61. See, e.g., Assemb. 1200, 2021–2022 Reg. Sess. (Cal. 2021).

62. Micheli, *supra* note 60 (“Definitions of words and phrases play an important part in statutes, particularly where these words or phrases are not used in their common, ordinary manner, such as a definition found in a dictionary.”).

63. *California Legislative History and Advocacy: Bill Analyses*, UCLA SCH. OF L. HUGH & HAZEL DARLING L. LIBR., <https://libguides.law.ucla.edu/callegislativehistory/analyses> (last visited Oct. 10, 2025).

64. *California Legislative History: Bill Analyses*, LOY. L. SCH., <https://guides.library.lls.edu/c.php?g=497693&p=3407411> (last visited Oct. 10, 2025).

65. *Id.*

66. CAL. S. COMM. ON ENV'T QUALITY, ANALYSIS OF ASSEMB. 1200, 2021–2022 Reg. Sess., at 11 (2021).

67. CAL. ASSEMB. COMM. ON ENV'T SAFETY & TOXIC MATERIALS, ANALYSIS OF ASSEMB. 652, 2021–2022 Reg. Sess., at 10 (2021); Reichman, *supra* note 58.

in textiles as “non-essential”—a designation that supports stricter regulation.⁶⁸ In fact, the same Committee report cites experts who argue that PFAS should only be allowed for “essential” purposes critical to the functioning of society and where no feasible alternatives exist.⁶⁹

Taken together, these reports shed some light on the legislature’s intent regarding applicable statutory language. First, at minimum, the legislature intended to prevent manufacturers from using risky PFAS alternatives that may have unforeseen and potentially equally damaging consequences.⁷⁰ Put differently, they want to prevent regrettable substitutions: “when a chemical with an unknown or unforeseen hazard is used to replace a chemical identified as problematic.”⁷¹ Yet, the Assembly Committee on Environmental Safety and Toxic Material admits that identical least toxic alternative language failed to prevent regrettable substitutions when it appeared in a separate law banning bisphenol—another toxic chemical.⁷² This admission implies that the legislature failed to implement an explicit least toxic alternative standard despite recognizing loopholes in the same language elsewhere.

Second, the reports highlight that the California legislature still recognizes a need for potentially risky chemicals in some industries.⁷³ The reports differentiate certain essential uses of PFAS, like occupational protective clothing or medical devices, from non-essential uses in consumer textiles, like footwear and outdoor apparel.⁷⁴ This distinction suggests that the legislature wanted stricter regulation of PFAS alternatives in products with high potential for absorption through prolonged skin or food contact.⁷⁵ Thus, the legislature

68. CAL. ASSEMB. COMM. ON ENV’T SAFETY & TOXIC MATERIALS, ANALYSIS OF ASSEMB. 1817, 2021–2022 Reg. Sess., at 7 (2022) (emphasis omitted) (“An ‘essential’ use is necessary for health or safety or is critical for the functioning of society, and has no available technically and economically feasible alternatives.”).

69. *Id.* (citing Ian T. Cousins, Gretta Goldenman, Dorte Herzke, Rainer Lohmann, Mark Miller, Carla A. Ng, Sharyle Patton, Martin Scheringer, Xenia Trier, Lena Vierke, Zhanyun Wang & Jamie C. DeWitt, *The Concept of Essential Use for Determining When Uses of PFASs Can Be Phased Out*, 21 ENV’T SCI.: PROCESSES & IMPACTS 1803, 1804 (2019)).

70. CAL. ASSEMB. COMM. ON ENV’T SAFETY & TOXIC MATERIALS, ANALYSIS OF ASSEMB. 652, 2021–2022 Reg. Sess., at 10 (2021).

71. See Alexandra Maertens, Emily Golden & Thomas Hartung, *Avoiding Regrettable Substitutions: Green Toxicology for Sustainable Chemistry*, 9 ACS SUSTAINABLE CHEMISTRY & ENG’G 7749, 7749 (2021).

72. CAL. ASSEMB. COMM. ON ENV’T SAFETY & TOXIC MATERIALS, ANALYSIS OF ASSEMB. 652, 2021–2022 Reg. Sess., at 10 (2021) (citation omitted) (“This language is well-intentioned, but failed to prevent regrettable substitutions when it [was] used in AB 1319 which banned bisphenol A in beverage containers used by young children.”).

73. CAL. ASSEMB. COMM. ON ENV’T SAFETY & TOXIC MATERIALS, ANALYSIS OF ASSEMB. 1817, 2021–2022 Reg. Sess., at 7 (2022).

74. *Id.* at 7–8.

75. The three pieces of legislation target industries such as food packaging, juvenile products, and textile articles, where consumers frequently touch or eat products exposed to PFAS. See, e.g., *id.* at 8 (“According to the Washington State Department of Ecology, there are a number of ways to meet the function of stain, oil, and water resistance in textiles and furnishings, including by using PFAS chemistries, non-PFAS ‘drop in’ alternatives, or fibers that are inherently stain resistant.”).

may have envisioned stricter standards for new PFAS replacements in consumer products compared to industries dependent on technical applications.⁷⁶

Third and most important, the reports suggest that the legislature did not define what constitutes a least toxic alternative because ideal substitutions differ based on industry needs.⁷⁷ For example, the Bill Analysis for AB 1200 cites a Washington State Department of Ecology study that identifies potential alternatives to PFAS in food packaging.⁷⁸ In this study, experts identified less hazardous alternatives that were available at a similar cost and suitable for food packaging.⁷⁹ AB 1200's Bill Analysis used this study to display how some industries have viable PFAS alternatives, while other industries do not.⁸⁰ Although viable substitutions can vary across industries, the three California laws ban PFAS in their entirety and require manufacturers to avoid dangerous or poorly researched alternatives at a minimum.

Regardless of the regulated industry, legislators wanted to exclude replacements exhibiting similar chemical structure, impact, and hazard profile to PFAS.⁸¹ The absence of a one-size-fits-all standard for judging PFAS alternatives makes some level of ambiguity unavoidable. However, the three California laws contain a boilerplate directive which is not tailored to a specific industry and has already failed to prevent regrettable substitutions in laws regulating other toxic chemicals.⁸² Regrettable substitutions with bisphenol are but one of many such examples.⁸³ While it is impossible to know how this

76. *See id.* at 7–8 (distinguishing essential PFAS uses, such as occupational protective clothing, from non-essential uses, such as consumer products whose manufacturers have fully phased out, or have committed to phasing out, PFAS in their products).

77. Shalene Thomas, *Phasing Out “Forever Chemicals”: Finding Alternatives for PFAS*, INSIDE BATELLE (July 17, 2024), <https://inside.battelle.org/blog-details/phasing-out-forever-chemicals-finding-alternatives-for-pfas> (claiming government agencies are still reviewing PFAS alternatives and noting that some industries have made more progress than others).

78. CAL. S. COMM. ON ENV'T QUALITY, ANALYSIS OF ASSEMB. 1200, 2021–2022 Reg. Sess., at 11 (2021) (citing WASH. STATE DEP'T OF ECOLOGY, SAFER ALTERNATIVES TO PFAS IN FOOD PACKAGING: REPORT TO THE LEGISLATURE PURSUANT TO RCW 70A.222.070 2 (2021)).

79. WASH. STATE DEP'T ECOLOGY, SAFER ALTERNATIVES TO PFAS IN FOOD PACKAGING: REPORT TO THE LEGISLATURE PURSUANT TO RCW 70A.222.070 2 (2021).

80. *See* CAL. S. COMM. ON ENV'T QUALITY, ANALYSIS OF ASSEMB. 1200, 2021–2022 Reg. Sess., at 11 (2021) (explaining that alternatives for PFAS in food packaging, unlike some other industries, have been well researched).

81. *Id.* (referencing PFAS alternatives in food packaging that are well-researched, chemically low-risk, natural, and sustainable, such as wax coated, clay coated, or uncoated options); CAL. ASSEMB. COMM. ON ENV'T SAFETY & TOXIC MATERIALS, ANALYSIS OF ASSEMB. 652, 2021–2022 Reg. Sess., at 9 (2021) (referencing non-fluorinated PFAS alternatives).

82. *See* CAL. ASSEMB. COMM. ON ENV'T SAFETY & TOXIC MATERIALS, ANALYSIS OF ASSEMB. 652, 2021–2022 Reg. Sess., at 9 (2021); Wei Bao, Buyun Liu, Shuang Rong, Susie Y. Dai, Leonardo Trasande & Hans-Joachim Lehmler, *Association Between Bisphenol A Exposure and Risk of All-Cause and Cause-Specific Mortality in U.S. Adults*, JAMA NETWORK OPEN, Aug. 17, 2020, at 1, 6 (“Substitution of BPA with other bisphenol analogues, such as bisphenol F and bisphenol S, is becoming popular; however, the health effects of those emerging BPA substitutes remain largely unknown. Evidence from animal and epidemiologic studies, although still limited, suggest that some BPA substitutes may have toxic effects.”).

83. Bao et al., *supra* note 82.

language will play out in practice, legislative history displays the need for statutory clarification.⁸⁴

B. MANUFACTURING COMPLIANCE CHALLENGES

Committee reports suggest that legislative intent for AB 1200, AB 652, and AB 1817 is to prevent regrettable PFAS substitutions and permit non-regrettable ones.⁸⁵ Nonetheless, ambiguous language, without further elaboration in the statute to guide agency interpretation, obscures compliance requirements for manufacturers. Because the phrase “least toxic alternative” is not defined, the DTSC “presumably envisions a process similar to the ‘Alternatives Analysis’ required for manufacturers of products subject to [California’s] Safer Consumer Products (SCP) program.”⁸⁶ But both the DTSC and California’s laws have failed to publish any rules or procedures that give manufacturers predictability when replacing PFAS.⁸⁷ As a result, manufacturers are left to speculate which substances might be permissible within the current regulatory framework—an outcome that poses significant risk to consumers and companies alike.⁸⁸

Amidst otherwise obscure compliance requirements, two California laws authorizing a regulatory enforcement program for PFAS provide some, albeit imperfect, clarity to manufacturers.⁸⁹ Assembly Bills 347 and 2515 direct the DTSC to standardize methods used to test for PFAS and requires manufacturers of juvenile products, textile articles, food packaging, and menstrual products to register, pay a fee, and certify their compliance by 2029.⁹⁰ These laws seem to increase predictability for manufacturing compliance because they provide a timeline for the DTSC to establish official testing rules.⁹¹ However, these laws

84. See CAL. ASSEMB. COMM. ON ENV’T SAFETY & TOXIC MATERIALS, ANALYSIS OF ASSEMB. 652, 2021–2022 Reg. Sess., at 10 (2021).

85. See, e.g., *id.* (explaining that AB 652, as written, provided some protection against regrettable PFAS substitutions but that protections could be strengthened).

86. Joseph J. Green, *California Bans PFAS “Forever Chemicals” in Clothing, Textiles, and Cosmetics*, KELLEY DRYE (Oct. 13, 2022), <https://www.kelleydrye.com/viewpoints/blogs/ad-law-access/california-bans-pfas-forever-chemicals-in-clothing-textiles-and-cosmetics>.

87. The closest guidance I could find was a non-exhaustive list of PFAS alternatives in treatments for converted textiles or leathers compiled from the DTSC’s own 2022 research. However, this list only seems applicable to textiles and does not provide guidance on which factors influence toxicity. See generally DEP’T OF TOXIC SUBSTANCES CONTROL, POTENTIAL ALTERNATIVES TO PFAS IN TREATMENTS FOR CONVERTED TEXTILES OR LEATHERS 1 (2022) (listing potential PFAS alternatives).

88. See Emma Schwartz, Article, *Too Little Too Late: Underregulation of Contaminants of Emerging Concern*, 52 ENV’T L. REP. 10964, 10976 (2022) (noting the tendency of manufacturers to use substitute chemicals that narrowly avoid regulation).

89. See Sarahann Rackl, Sarah Parker, Madeleine Bee, Sara Hearon & Chau Reidy, *California to Create PFAS Regulatory Enforcement Program*, EXPONENT (Oct. 1, 2024), <https://www.exponent.com/article/california-create-pfas-regulatory-enforcement-program> (summarizing Assemb. 347, 2023–2024 Reg. Sess. (Cal. 2024) and Assemb. 2515, 2023–2024 Reg. Sess. (Cal. 2024)).

90. *Id.* (“AB 347 and AB 2515 address Governor Newsom’s concerns about enforcement, providing DTSC with a clear pathway to monitor and regulate PFAS in consumer products under their existing Priority Product Work Plan.”).

91. *Id.*

only address PFAS testing used to assess compliance;⁹² they do not clarify which replacement chemicals constitute the least toxic alternatives. Assembly Bills 347 and 2515 provide some guidance on future testing procedures, but significant challenges remain for manufacturers impacted.⁹³

Without clarity from the legislature or the DTSC itself, manufacturers must address challenges stemming from the current regulatory regime to mitigate PFAS liability.⁹⁴ Challenges include, but are not limited to, supply chain considerations,⁹⁵ cost implications,⁹⁶ and the need to comply with differing regulations between states.⁹⁷

Compliance with the three California laws proves difficult because PFAS can contaminate consumer goods at different points in the supply chain, even when they are not intentionally added.⁹⁸ Packaging, transportation, and manufacturing processes, such as machine lubrication, can each introduce “hidden” sources of PFAS into products.⁹⁹ Consequently, manufacturers must scrutinize contracts with vendors and suppliers to ensure their chosen PFAS alternatives are not already contaminated by another party.¹⁰⁰ Recall that California’s definition of PFAS encompasses both intentionally added PFAS and products containing PFAS over the permissible limit.¹⁰¹ This definition, coupled with the least toxic alternative requirement, may complicate compliance where the safest possible alternative lacks intentionally added PFAS but can only be sourced from a supplier that uses PFAS-contaminated supply chains. An explicit standard is necessary to fill gaps in supply chain contracts and ensure that manufacturers substitute reputable sourced alternatives from compliant suppliers.

92. *Id.*

93. *Id.*

94. *Id.* (“Because it can be difficult to assess compliance in the absence of approved testing methods, manufacturers of products alleged to contain PFAS could potentially face litigation or challenges to their brand image based on the results of a non-standardized test method that may or may not indicate noncompliance with the new bills.”).

95. Jessica F. Bartolacci, Matthew H. Clark, Priya Desai & Amy Rubenstein, *Retailers Face Compliance Issues as PFAS Regulations Grow*, DENTONS (Aug. 31, 2023), <https://www.dentons.com/en/insights/alerts/2023/august/31/retailers-face-compliance-issues-as-pfas-regulations-grow>.

96. See Alissa Cordner, Gretta Goldenman, Linda S. Birnbaum, Phil Brown, Mark F. Miller, Rosie Mueller, Sharyle Patton, Derrick H. Salvatore & Leonardo Trasande, *The True Cost of PFAS and the Benefits of Acting Now*, 55 ENV’T SCI. & TECH. 9630, 9630 (2021) (“The PFAS industry claims that the chemicals’ use in consumer goods and industrial applications brings wide benefits, valuing the U.S. fluoropolymer segment at \$2 billion a year.”).

97. See *id.* at 9631–32 (explaining that states differ in how they choose to regulate PFAS).

98. Bartolacci et al., *supra* note 95.

99. *Id.* (“PFAS can be found in the lubricant on a sewing machine or conveyor, packaging, or water used in production.”).

100. *Id.*

101. See, e.g., Assemb. 1200, 2021–2022 Reg. Sess. (Cal. 2021) (defining regulated PFAS as any intentionally added PFAS or the presence of PFAS in a product “at or above 100 parts per million, as measured in total organic fluorine.”).

Regulated entities will also continue to experience cost implications from having to adjust to a rapidly evolving regulatory ecosystem. The U.S. PFAS industry is valued at an estimated \$2.4 billion dollars and encompasses a wide array of sectors ranging from technology to cooking equipment.¹⁰² California is the world's sixth largest economy, and companies located in-state will have to frequently adjust compliance strategies to account for tighter PFAS restrictions.¹⁰³ In particular, companies have to adjust quickly and expend resources when regulators adjust key rules or procedures—PFAS testing is one of many areas.¹⁰⁴ For example, a manufacturer can spend years developing what they believe is a viable alternative, only to discover that it violates standards published years after development began.

Additionally, potential litigation costs related to emerging PFAS alternatives present another serious risk to companies under the current regulatory regime. For context, collective U.S. PFAS settlement awards are approaching twenty billion dollars.¹⁰⁵ The Attorneys General of thirty states have filed lawsuits against PFAS manufacturers for contaminating water supplies and hurting other natural resources.¹⁰⁶ Given the widely researched harm PFAS present to the environment, it is no surprise companies face costly litigation from regulators and private citizens.

Pervasive cost implications are magnified for companies that operate in interstate commerce.¹⁰⁷ Thus, companies have a strong incentive to influence PFAS regulations across different states through strategic and covert means.¹⁰⁸ One review of PFAS in drinking water notes that companies have collaborated

102. ELLEN CUNNINGHAM, ALEX MATULINA, JULIUS KREISSIG & DAVID TYRER, WOOD ENV'T & INFRASTRUCTURE SOLS. UK LTD., SOCIO-ECONOMIC ASSESSMENT OF THE US FLUOROPOLYMER INDUSTRY 3–4 (2020), <https://fluoropolymerpartnership.com/wp-content/uploads/2020/03/Socio-Economic-Assessment-of-the-US-Fluoropolymer-Industry-Executive-Summary.pdf> (listing and describing sectors dependent on fluoropolymers).

103. John Gardella, *California PFAS Ban in Products: 6th Largest Global Economy Enters the Fray*, CMBG3 L. (Mar. 25, 2024), <https://www.cmbg3.com/california-pfas-ban> (describing compliance implications of a California law banning intentionally added PFAS with an exception for “unavoidable uses”).

104. *Id.* (referring to reporting requirements). Although the author analyzes separate PFAS reporting requirements, ambiguous “least toxic alternative” language causes equal, if not greater, uncertainty, because it could require manufacturers to change their entire production process rather than simply compelling data reporting.

105. Venetia Despotaki, Eric Hang & Eleanor Bragg, *PFAS Litigation Could Generate Billions in Ground-Up Losses. Here's How.*, VERISK (Apr. 5, 2024), <https://core.verisk.com/Insights/Emerging-Issues/Articles/2024/April/Week-1/PFAS-Litigation-Could-Generate-Billions-in-Ground-Up-Losses>.

106. *Policies for Addressing PFAS: State Attorneys General PFAS Lawsuits*, SAFER STATES, <https://www.saferstates.org/priorities/pfas/?section=state-ags-pfas-action> (last visited Oct. 10, 2025).

107. See Alissa Corder, Vanessa Y. De La Rosa, Laurel A. Schaidler, Ruthann A. Rudel, Lauren Richter & Phil Brown, *Guideline Levels for PFOA and PFOS in Drinking Water: The Role of Scientific Uncertainty, Risk Assessment Decisions, and Social Factors*, 29 J. EXPOSURE SCI. & ENV'T EPIDEMIOLOGY 157, 164 (2019) (“[V]ariation [in PFAS drinking water guideline levels] reflects responses to scientific uncertainty in risk assessment, technical decisions and capacity, and social, political, and economic influences from involved stakeholders.”).

108. *Id.* at 165–66.

with regulators to craft guidelines,¹⁰⁹ hired paid consultants to conduct and selectively publish industry friendly research,¹¹⁰ and avoided regulatory requirements by concealing relevant information using legal arguments rooted in confidentiality or privilege.¹¹¹ Complex social, political, and economic factors driven by corporate behavior can also exacerbate regulatory discrepancies between states, making compliance difficult for companies that operate in commerce.¹¹² Despite these challenges, a clearer least toxic alternative requirement in California will improve predictability and benefit companies and consumers alike—particularly in interstate commerce where multi-jurisdictional compliance is key.

C. ENVIRONMENTAL JUSTICE CONCERNS

A regulatory regime ripe with ambiguous compliance standards and regrettable substitution loopholes raises environmental justice concerns about how the use of toxic chemicals disproportionately impacts certain communities. Environmental justice is a movement that combats environmental harms by employing a nuanced understanding of how and why historically marginalized communities face disproportionate burdens.¹¹³ California's three new laws implicate environmental justice concerns because discrimination, health disparities, and economic inequality concentrate environmental burdens onto the most vulnerable populations.¹¹⁴ Case studies on PFAS and other toxic chemicals suggest that, while inadequate environmental regulation frequently results in tangible harm to everyone, disadvantaged communities experience the greatest

109. *Id.* at 165 (“[I]n 2001 EPA and West Virginia Department of Environmental Protection (WVDEP) learned that DuPont scientists had found high levels of PFOA in regional drinking water. The following year, DuPont collaborated with WVDEP and a state-appointed C8 Assessment Toxicity Team to develop a screening level of 150,000ng/L, despite numerous conflicts of interest and DuPont’s own internal guideline of 1000ng/L.”).

110. *Id.* at 166 (“Studies or assessments funded by a company or industry that benefits financially from the product under investigation are less likely to identify risks and more likely to demonstrate efficacy (or ambiguity), while the opposite is true of studies funded by government agencies or independent parties.”).

111. *Id.* (“Today, PFAS manufacturers commonly assert that information on production quantities, use in consumer goods, and chemical identity is confidential business information, creating barriers for scientists and regulators seeking to prevent harmful exposures.”).

112. *Id.* (comparing drinking water PFAS guidelines in Vermont and North Carolina).

113. See LUKE W. COLE & SHEILA R. FOSTER, *A History of the Environmental Justice Movement*, in FROM THE GROUND UP: ENVIRONMENTAL RACISM AND THE RISE OF THE ENVIRONMENTAL JUSTICE MOVEMENT 19, 21 (2000).

114. *Id.* at 21 (“Civil rights activists brought . . . to the Environmental Justice Movement . . . a perspective that recognized that the disproportionate impact of environmental hazards was not random or the result of ‘neutral’ decisions but a product of the same social and economic structure which had produced de jure and de facto segregation and other racial oppression; and the experience of empowerment through political action.”).

impact.¹¹⁵ The EPA itself acknowledged as much in a 2021 analysis of climate change impacts.¹¹⁶

Environmental justice movements first gained prominence fighting against toxic substances pollution in the 1970s when then-President Jimmy Carter declared Love Canal, New York a disaster area because it was improperly constructed on a toxic waste site.¹¹⁷ For decades, the Hooker Chemical Company discarded chemical waste into a ditch left behind from a failed canal construction project.¹¹⁸ The ditch was filled and sold to the city for one dollar, where a working-class neighborhood was constructed.¹¹⁹ Residents suffered birth defects, cancer, and other horrific health issues.¹²⁰ To this day, environmental justice advocates combat the same underlying issues that plagued residents in Love Canal when they unknowingly settled on a former industrial chemical dumpsite.¹²¹

PFAS contamination fits a troubling pattern observed in many environmental justice disasters: companies prioritizing profit by knowingly selling products that contain dangerous substances.¹²² Two companies have manufactured a majority of the PFAS in the United States.¹²³ The first is 3M, which produces a stain-repellant fabric coating called Scotchgard.¹²⁴ The other is DuPont, which produced a popular nonstick pan coating called Teflon.¹²⁵ Both 3M and DuPont have paid billions of dollars in settlements for contaminating drinking water with PFAS linked to cancer and other diseases.¹²⁶

But massive settlements will never fully remedy environmental justice concerns. Research proves that certain groups are more likely to reside in areas

115. For an example of environmental justice concerns uncovered through research of toxic substances, see *id.* at 25 (“Beyond lobbying the federal government, the academics researched and wrote (and continue to produce) studies that demonstrate the disproportionate impact of environmental hazards on people of color and on low-income people.”).

116. Press Release, EPA, EPA Report Shows Disproportionate Impacts on Climate Change on Socially Vulnerable Populations in the United States (Sep. 2, 2021), <https://www.epa.gov/newsreleases/epa-report-shows-disproportionate-impacts-climate-change-socially-vulnerable>.

117. COLE & FOSTER, *supra* note 113, at 22.

118. See Eckardt C. Beck, *The Love Canal Tragedy*, 5 EPA J. 16, 17 (1979) (recounting “one of the most appalling environmental tragedies in American history”).

119. *Id.*

120. *Id.*

121. *Id.* at 18.

122. For an example showing that PFAS manufacturers understood adverse impacts of their product decades before facing any consequences, see Gaber et al., *supra* note 3, at 2 (“Legal discovery in *Tennant* showed that DuPont and 3M had evidence of clear health and environmental impacts as early as 1976.”).

123. *Id.*

124. *Id.*; *3M Withdraws Scotchguard Range After Environment Fears*, WARC (May 18, 2000), <https://www.warc.com/newsandopinion/news/3m-withdraws-scotchguard-range-after-environment-fears/en-gb/6154>.

125. See Gaber et al., *supra* note 3, at 2; *The History of Teflon™ Fluoropolymers*, TEFLON, <https://www.teflon.com/en/news-events/history> (last visited Oct. 10, 2025).

126. Clark Mindock, *3M, DuPont Defeat Massive Class Action over Forever Chemicals*, REUTERS (Nov. 28, 2023, at 09:20 PT), <https://www.reuters.com/markets/commodities/3m-dupont-defeat-massive-class-action-over-forever-chemicals-2023-11-27>.

of increased PFAS exposure, leading to continued harm.¹²⁷ In fact, PFAS manufacturing facilities are disproportionately constructed near low-income communities and communities of color.¹²⁸ This is no accident. Manufacturers know that underfunded public resources, redlining, and disenfranchisement provide a “path of least resistance” for them to operate freely and avoid consequences.¹²⁹ Internal documents reveal that 3M and DuPont were fully aware of the health ramifications of PFAS, yet continued to sell them for decades.¹³⁰ Discovery documents from lawsuits in 1998 and 2002 show that DuPont suppressed unfavorable internal research and withheld information from employees who might have been exposed to PFAS.¹³¹ Like the PFAS industry,¹³² the cigarette industry concealed research unfavorable to business with devastating effects on consumers lulled into the falsity.¹³³ In light of previous corporate deception regarding now unambiguously dangerous products like cigarettes, environmental justice advocates have good reason to view ambiguous California regulations through a critical lens.

In addition to concealing information, 3M and DuPont have put consumers at risk by exploiting regulatory loopholes.¹³⁴ A recent review of the EPA’s Toxics Release Inventory (TRI) reporting database suggests that this

127. Jillianne Lyon, *Forever Chemicals: A Legacy of Environmental Racism*, INV. ADVOC. FOR SOC. JUST. (Jan. 19, 2024), <https://iasj.org/forever-chemicals-a-legacy-of-environmental-racism> (citing *Communities of Color Disproportionately Exposed to PFAS Pollution in Drinking Water*, HARV. T.H. CHAN SCH. OF PUB. HEALTH (May 15, 2023), <https://hsph.harvard.edu/news/communities-of-color-disproportionately-exposed-to-pfas-pollution-in-drinking-water>).

128. *Id.*

129. ROBERT D. BULLARD, PAUL MOHAI, ROBIN SAHA & BEVERLY WRIGHT, TOXIC WASTES AND RACE AT TWENTY 1987—2007: A REPORT PREPARED FOR THE UNITED CHURCH OF CHRIST JUSTICE & WITNESS MINISTRIES, at xii (2007) (“For many industries it is a ‘race to the bottom,’ where land, labor and lives are cheap. It’s about profits and the ‘bottom line.’ Environmental ‘sacrifice zones’ are seen as the price of doing business. Vulnerable communities, populations and individuals often fall between the regulatory cracks. They are in many ways ‘invisible’ communities. The environmental justice movement served to make these disenfranchised communities visible and vocal.”).

130. See generally Jared Hayes, *For Decades, Polluters Knew PFAS Chemicals Were Dangerous but Hid Risks From Public*, ENV’T WORKING GRP. (Aug. 29, 2019), <https://www.ewg.org/research/decades-polluters-knew-pfas-chemicals-were-dangerous-hid-risks-public> (containing a collection of internal memos, studies, and other company documents detailing how 3M and DuPont knew about health risks of PFAS yet kept them secret for decades).

131. Jeffrey Kluger, *Companies Knew the Dangers of PFAS ‘Forever Chemicals’—and Kept Them Secret*, TIME (June 1, 2023, at 16:22 ET), <https://time.com/6284266/pfas-forever-chemicals-manufacturers-kept-secret>.

132. See Cordner et al., *supra* note 107, at 165 (“Internal industry documents reveal a broad ‘science-based defense strategy’ to ‘command the science’ on PFAS, ranging from suspected influence on state environmental protection agencies in the case of West Virginia, to the selective peer review publication of internal research, to paying academic scientists to influence the peer-review process.”).

133. *The Gavel That Unraveled the Tobacco Industry*, AM. LUNG ASS’N: STATE OF TOBACCO CONTROL (Jan. 27, 2025), <https://www.lung.org/research/sotc/by-the-numbers/10-appalling-tobacco-facts>.

134. See Jared Hayes, *Dow, 3M and Others Likely Exploit Loophole to Avoid Reporting ‘Forever Chemicals’ Releases*, ENV’T WORKING GRP. (Sep. 22, 2022), <https://www.ewg.org/news-insights/news/2022/09/dow-3m-and-others-likely-exploit-loophole-avoid-reporting-forever> (reviewing manufacturing sites that report using PFAS but do not report any discharges).

phenomenon is likely to continue.¹³⁵ According to the EPA, some companies, including 3M, exploit a reporting exemption for chemicals used in negligible concentrations.¹³⁶ In 2021, the EPA contacted companies to inquire about lower-than-expected PFAS reporting; every single respondent cited the loophole to justify their data and explained that they technically complied with regulations.¹³⁷ This raises questions about whether the exemption was invoked legitimately or whether it was simply a workaround to withhold data. Reporting loopholes raise environmental justice concerns because they show how companies deliberately take the least compliant measures permissible within a statute or regulation.

PFAS manufacturers are not the first businesses to exploit regulatory loopholes. As mentioned earlier, hard plastic manufacturers took the least compliant measures permissible when they substituted one harmful chemical called Bisphenol A (BPA) for a similar chemical called Bisphenol S (BPS).¹³⁸ BPS was once considered a viable substitute in infant products like baby bottles as the least toxic member of the bisphenol family.¹³⁹ Emerging evidence says otherwise: BPS has similar, if not more severe, health risks than its banned cousin BPA.¹⁴⁰ This case study showcases that regrettable substitutions can have the adverse effect of magnifying environmental burdens on vulnerable populations. Studies show that lower income levels and food security are correlated with higher bisphenol concentrations.¹⁴¹ Therefore, in the related context of PFAS, environmental justice advocates have well-founded skepticism surrounding the three ambiguous California laws because critical loopholes remain open.

CONCLUSION AND RECOMMENDATION

California's regulatory framework for PFAS will remain inadequate so long as its ambiguous least toxic alternative language complicates

135. *Id.*

136. Press Release, EPA, EPA Proposes Rule to Enhance Reporting of PFAS Data to the Toxics Release Inventory (Dec. 5, 2022), <https://www.epa.gov/newsreleases/epa-proposes-rule-enhance-reporting-pfas-data-toxics-release-inventory>; see Hayes, *supra* note 134.

137. See Hayes, *supra* note 134 (“All the facilities cited the loophole ‘as their reason for not submitting TRI reports for the PFAS.’”).

138. Maertens et al., *supra* note 71 (“[B]y focusing on one of the most commonly given examples of a regrettable substitution—Bisphenol S (BPS) for Bisphenol A (BPA)—we illustrate what kinds of tools and approaches need to be developed and what mistakes should not be repeated.”).

139. Ga Won Jeon, *Bisphenol A Leaching from Polycarbonate Baby Bottles into Baby Food Causes Potential Health Issues*, 65 CLIN. & EXP. PEDIATR. 450, 450 (2022); *Understanding Bisphenol S (BPS) & Its Danger to Your Health*, SGS (Jan. 15, 2024), <https://www.sgs.com/en-hk/news/2024/01/understanding-bisphenol-s-bps-and-its-danger-to-your-health>.

140. SGS, *supra* note 139.

141. See Jessica W. Nelson, Madeleine Kangsen Scammell, Elizabeth E. Hatch & Thomas F. Webster, *Social Disparities in Exposures to Bisphenol A and Polyfluoroalkyl Chemicals: A Cross-Sectional Study Within NHANES 2003-2006*, ENV'T HEALTH, Mar. 6, 2012, at 1, 13 (“BPA concentrations were higher in people who reported very low food security and received emergency food assistance than in those who did not.”).

manufacturing compliance¹⁴² and sparks environmental justice concerns.¹⁴³ In the face of this ambiguity, it is unlikely that a one-size-fits-all standard will materialize to judge PFAS alternatives across different sectors. Nonetheless, current regulation falls short of the legislature's intent to, at a minimum, prevent regrettable substitutions.¹⁴⁴ The three statutes each contain the same problematic language—a notable change from California's typical position as a bastion of environmental progress.¹⁴⁵

In addressing how lawmakers can improve a currently inadequate framework, this Note proposes that a technology-based standard could close existing loopholes by allowing least toxic alternative requirements to grow and change with emerging innovation.¹⁴⁶ Technology-based approaches can change over time and are mainly used to control pollution by benchmarking regulatory standards against the best available industry capabilities.¹⁴⁷ This flexible approach would allow for uniform statutory language to fit the needs of different “classes and categories of industry.”¹⁴⁸

Technology-based standards have been extremely successful in comparable pollution control regimes such as the National Pollutant Discharge Elimination System (NPDES).¹⁴⁹ Codified in the Clean Water Act, the NPDES issues five-year permits in which regulated entities may discharge pollutants under strict restrictions.¹⁵⁰ A similar system exists on the state level administered by the California State Water Resources Control Board.¹⁵¹ This, or a comparable permitting regime, applied to PFAS alternatives could simplify compliance and increase predictability for manufacturers, while addressing reasonable environmental justice concerns about existing loopholes. A system that allows companies to obtain a permit for a defined period if it uses safe PFAS alternatives could prevent regrettable substitutions and increase transparency. Regulators could even publish and update lists of approved least toxic PFAS alternatives to guide manufacturers.¹⁵² So long as they use approved alternatives,

142. See *supra* Part.II.B and accompanying notes.

143. See *supra* Part.II.C and accompanying notes.

144. CAL. ASSEMB. COMM. ON ENV'T SAFETY & TOXIC, ANALYSIS OF ASSEMB. 652, 2021–2022 Reg. Sess., at 10 (2021).

145. See Assemb. 652, 2021–2022 Reg. Sess. (Cal. 2021); Assemb. 1200, 2021–2022 Reg. Sess. (Cal. 2021); Assemb. 1817, 2021–2022 Reg. Sess. (Cal. 2022).

146. See Wendy E. Wagner, *The Triumph of Technology-Based Standards*, 2000 U. ILL. L. REV. 83, 88 (noting that technology-based regimes allow regulatory bodies such as the EPA to adjust standards for “classes and categories of industry” to best effectuate congressional goals).

147. *Id.*

148. *Id.* at 88, 94.

149. *National Pollutant Discharge Elimination System (NPDES) 101*, RIVER NETWORK, <https://www.rivernetnetwork.org/resource/national-pollutant-discharge-elimination-system-npdes-101> (last visited Oct. 10, 2025).

150. See *NPDES Permit Basics*, EPA (June 3, 2025), <https://www.epa.gov/npdes/npdes-permit-basics>.

151. See *National Pollutant Discharge Elimination System (NPDES)—Wastewater*, STATE WATER RES. CONTROL BD. (Aug. 21, 2025), https://www.waterboards.ca.gov/water_issues/programs/npdes/.

152. See, e.g., *TSCA Chemical Substance Inventory*, EPA (Aug. 14, 2025), <https://www.epa.gov/tscainventory> (containing links to chemical substances that do not qualify for a TSCA exemption or exclusion); see

manufacturers could rely on the evidence-based judgement of expert regulators to avoid penalties.

Additionally, legislators could adopt a more aggressive approach to technology-based standards: require manufacturers to substitute PFAS with non-toxic alternatives or avoid a substitution altogether. The three California laws analyzed in this Note each regulate consumer products that come into regular contact with people's skin or food.¹⁵³ Juvenile products, food packaging, and textile articles are not areas where even the least toxic alternative should suffice. These products should only consist of well-researched, well-regulated, non-toxic, and patently safe materials.

This Note scrutinizes California's approach to regulating PFAS and argues that, given implications for manufacturers and environmental justice movements, legislators can and should do better. New PFAS laws are unquestionably beneficial to consumers because they ban a toxic substance and align with the protective P-sufficient approach.¹⁵⁴ However, banning such a widely used substance creates an obligation to consider likely industry reactions. As a wise man once said: "with great power . . . come[s] great responsibility."¹⁵⁵ Banning PFAS in California is a good first step. But to realize the legislature's intent and protect the health of consumers, California must lead the way and advance a nationwide standard to evaluate PFAS alternatives.

generally DEP'T OF TOXIC SUBSTANCES CONTROL, *supra* note 87 (listing potential alternatives to PFASs in "treatments for converted textiles or leathers").

153. *See* Assemb. 652, 2021–2022 Reg. Sess. (Cal. 2021) (juvenile products); Assemb. 1200, 2021–2022 Reg. Sess. (Cal. 2021) (food packaging); Assemb. 1817, 2021–2022 Reg. Sess. (Cal. 2022) (textile articles).

154. *See* Cousins et al., *supra* note 42, at 789 (arguing that implementing precautionary measures through the "P-Sufficient" approach is "entirely rational and empirically well founded").

155. This quote appears as a narration in a popular Marvel comic featuring Spider-Man. STAN LEE & STEVE DITKO, *AMAZING FANTASY* #15 11 (1962), https://archive.org/details/Amazing_Fantasy_vol1_15_201607/mode/2up.
