

Draft Market Analysis for Safer Products for Washington Cycle 2, Phase 3

Hazardous Waste and Toxics Reduction Program

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Related Information

Safer Products for Washington Cycle 2

- Cycle 2, Phase 3: Draft Regulatory Determinations Report to the Legislature[1]
- Cycle 2, Phase 3: Draft Technical Supporting Documentation for Regulatory Determinations Report to Legislature[2]
- Cycle 2, Phase 2: Report to the Legislature on Priority Products[3]
- Cycle 2, Phase 2: Technical Supporting Documentation for Priority Consumer Products[4]
- Cycle 2, Phase 1: Report to the Legislature on Priority Chemicals[5]
- Cycle 2, Phase 1: Technical Supporting Documentation for Priority Chemicals[6]

Safer Products for Washington Cycle 1.5

- Cycle 1.5, Phase 3: Regulatory Determinations Report to the Legislature[7]
- Cycle 1.5, Phase 3: Technical Supporting Documentation for Regulatory Determinations[8]

Safer Products for Washington Cycle 1

- Cycle 1, Phase 3: Regulatory Determinations Report to the Legislature[9]

[1] https://apps.ecology.wa.gov/publications/SummaryPages/2604042.html
[2] https://apps.ecology.wa.gov/publications/SummaryPages/2604043.html
[3] https://apps.ecology.wa.gov/publications/SummaryPages/2504030.html
[4] https://apps.ecology.wa.gov/publications/SummaryPages/2504031.html
[5] https://apps.ecology.wa.gov/publications/SummaryPages/2404025.html
[6] https://apps.ecology.wa.gov/publications/SummaryPages/2404026.html
[7] https://apps.ecology.wa.gov/publications/SummaryPages/2404023.html
[8] https://apps.ecology.wa.gov/publications/summarypages/2404024.html
[9] https://apps.ecology.wa.gov/publications/SummaryPages/2204018.html

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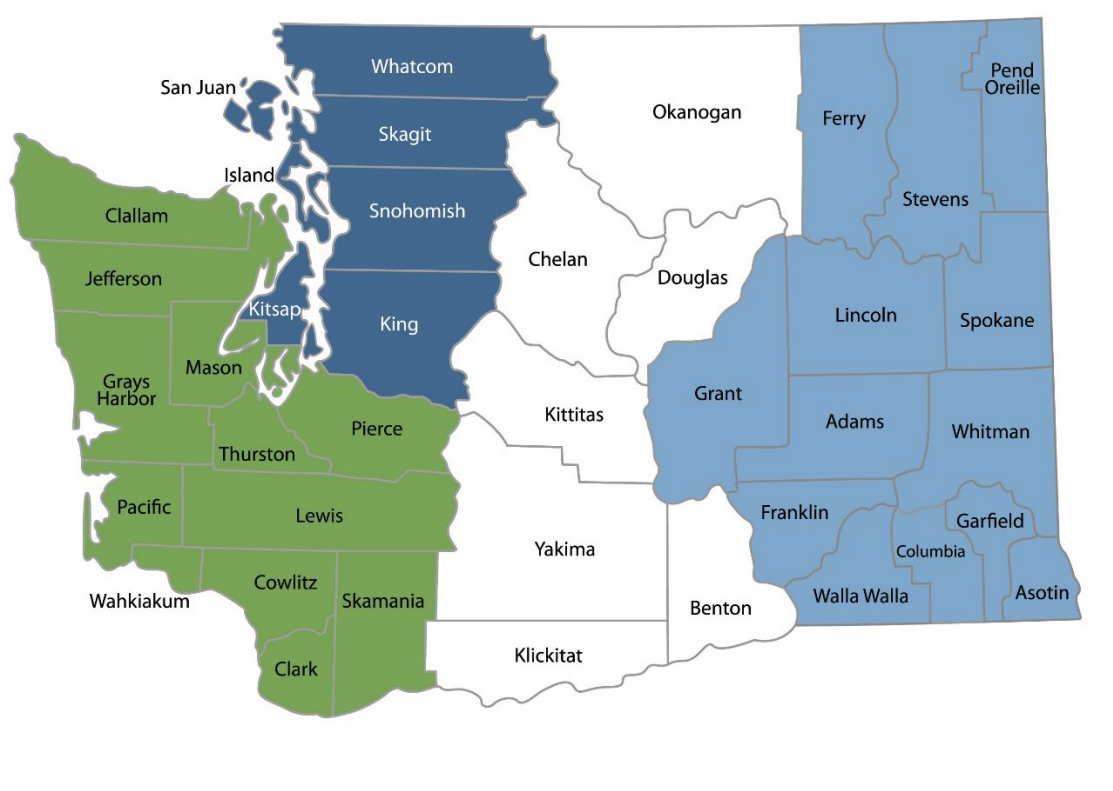
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Draft Market Analysis: Safer Products for Washington, Cycle 2, Phase 3

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Chapter 1: Introduction

1. Introduction

The market analysis is designed to support the current cycle (Cycle 2) of Safer Products for Washington, specifically Phase 3 of Cycle 2 focusing on determining regulatory actions. We focused our attention on a subset of priority products and chemicals covered in this cycle. We prioritize the products and chemicals covered here because our work indicated that safer alternatives to priority chemicals were likely feasible and available for the category and a restriction was a possible regulatory determination.

For chemicals and products where a restriction is possible, Ecology is particularly interested in gathering additional information prior to rulemaking, which would be completed as part of Cycle 2 Phase 4. When proposing any rule amendment to Chapter 173-337 WAC, Safer Products Restrictions and Reporting, the Administrative Procedure Act requires Ecology, Chapter 34.05 RCW, to perform various analyses, including a benefit-cost analysis. The market analysis presented here contains information that may be used in the economic analyses that are developed for the rulemaking. Rule amendments could include a restriction or a reporting requirement for a chemical-product combination that is not included here. In that event, a similar analysis, including explicit benefit and cost estimates, would be completed prior to the proposal of any rule amendment and would be published alongside the proposed rule amendment.

The following sections of the market analysis are each centered on a different product category. Within those sections, we first estimate the size of the market for each of the product categories. We then present research that summarizes relevant estimates of the prevalence of the chemical of interest within each product category, largely drawing on literature presented in Safer Products for Washington Cycle 2 Phase 2 report. The next subsection presents any information on differences in the market price between products that contain the restricted chemical and those that do not. Then we present any information that may affect consumer demand for products that contain alternatives to the identified chemical. Finally, we present a general approach to estimate costs associated with a potential restriction for each chemical and product.

Table 1: Cycle 2 Phase 3 chemical-product combinations, and the associated market analysis sections (where applicable)

Product	Chemical Class	Market Analysis Section Number
Architectural paints	Alkylphenol ethoxylates (APEs)	2
Architectural paints	PFAS	2
Artificial turf	N-(1,3-dimethylbutyl)-N' -phenyl-p-phenylenediamine (6PPD)	3
Artificial turf	Per- and polyfluoroalkyl substances (PFAS)	3
Cookware and kitchen supplies	PFAS	4
Cosmetics	Cyclic volatile methyl siloxanes (cVMS)	5
Firefighting personal protective equipment (PPE)	PFAS	6
Floor waxes and polishes	PFAS	7
Hard surface sealers	PFAS	8
Insulation	Organohalogen flame retardants	Not covered
Jewelry and accessories	Cadmium and cadmium compounds	9
Jewelry and accessories	Lead and lead compounds	9
Motor vehicle tires	6PPD	Not covered
Nail products	Benzene, ethyl benzene, toluene, and xylenes (BTEX) substances	10
Plastic packaging	PVC and PVDC (organochlorine substances)	Not covered
Printing inks	PCBs	Not covered
Sealants, caulks, and adhesives	Ortho-phthalates	11
Solid deodorizers	1,4-dichlorobenzene (organochlorine substance)	12

1.1 Regulatory costs

Before addressing each product category in turn, it may be helpful to provide a general note on costs associated with potential restrictions. In general, costs deriving from a regulation may include any of the following:

- A one-time cost in investment in equipment, research and development, or change in production process.

- Ongoing per-unit costs due to change in inputs or changes in a production process that requires additional costs for each item produced.
- Change in product attributes that cause a change in the product's desirability for consumers, such as change in the product's longevity or aesthetics.
- Change in product price or attributes may, in turn, cause a change in the amount consumers purchase, leading to changes in revenue and changes in levels and distribution of consumer spending.
- While generally not quantified by Ecology analyses, the interconnected nature of the economy may cause spillovers to other sectors. If a product becomes more expensive, consumers may have less disposable income to spend elsewhere or may shift consumption to substitute products, changing demand for other products, or even other sectors. Changes in intermediate demand—the demand for certain supplies by manufacturers— may cause changes in prices for those supplies which may be used by manufacturers in other sectors.

Most of the approaches to estimating the costs of a potential restriction are presented in this analysis in a generalized way. Any cost may be borne at any part of the product supply chain. Often manufacturers bear the initial regulatory cost, but some of these costs would then be passed through in the form of increased product costs for retailers and consumers.[11] Retailers and consumers may pay these higher costs directly or forego stocking or purchasing an item that they now deem too expensive. Who eventually bears the economic burden of a regulation is referred to as the "cost incidence." This incidence may be predictable for certain well-studied sectors of the economy, but there is rarely sufficient information for consumer product categories to model the cost incidence with any degree of precision. In this market analysis, we address the incidence of regulatory costs through qualitative discussions rather than quantitative estimates.

[11] See Ganapti, et al. (2020) for an example of how energy regulatory costs can pass through to manufacturers and consumers.

Chapter 2: PFAS and APEs in Architectural Paints

2.1 Architectural Paints Market Size

Retail sales of interior and exterior paint are estimated by the Census Bureau under the NAPCS 5001850003 and 5001850006, respectively. As of the 2017 economic census, the retail sales value of paints in Washington was estimated to be $248 million for interior paints and $147 million for exterior paints, resulting in a total estimated value of $395 million.[12] Overall, Washington consumer spending on goods increased by 52% between 2017 and 2024.[13] While "goods" is an imprecise consumer spending category, paints are not precisely captured by any of the spending categories in consumer spending data. Growth in spending on paints may not match growth in spending on all goods, but it is the best information we have on the paints market. If we apply the increase in Washington spending to retail paint sales and assume a growth rate of 4.4% after 2024 (equal to the annualized growth for that spending category over the previous 20 years), it suggests that paint accounts for approximately $655 million of retail sales in Washington in 2026.[14]

An alternative measure of total Washington retail paint sales can be constructed through revenue data from Washington's paint stewardship program. Established by the legislature in 2019 to help manage paint waste, the program is overseen by PaintCare, which produces annual reports on the program's activities, including the revenue it collects.[15] Between 2023–2025, there was an average of 7.6 million paint containers sold each year. Roughly 53% of these were medium containers, holding between one and two gallons.[16] 24% were large containers with more than two gallons of paint and up to five gallons. 22% were small containers with at least a half-gallon of paint but less than one gallon. While we do not have data on an average price per gallon of paint in Washington, a variety of online buying guides[17,18,19] and listed prices at online retailers such as Home Depot and Lowe's suggest an average price of roughly $30 to $60 per gallon. Using the range of prices and container sizes, we simulated the potential

[12] https://data.census.gov/table?g=040XX00US53&codeset=napcs~5001850003:5001850006
[13] https://www.bea.gov/data/consumer-spending/state
[14] Alternatively, if a large proportion of paints are used in the home, growth in spending on household supplies may be more closely match the growth in spending on paints. Between 2017 and 2024, spending in this category grew by 45%. Applying this growth rate to the category up until 2024, and then a growth rate of 3.6% thereafter (equal to the average annualized growth rate over the last 20 years) suggests an alternate total retail value of paint sales of Washington of $613 million, about 6% lower than our other estimate.
[15] https://ecology.wa.gov/waste-toxics/reducing-recycling-waste/our-recycling-programs/paint-stewardship
[16] Based on the reported revenue totals in PaintCare (2025) and the fees of $0.45 for small containers, $0.95 for medium containers, and $1.95 per large container.
[17] https://paintloving.com/how-much-does-paint-cost-a-gallon
[18] https://woodworkingadvisor.com/how-much-is-a-gallon-of-paint-at-sherwin-williams
[19] https://carolinarenew.com/resources/paint-price-index

spending on retail paint in Washington as between $436 million and $833 million, which is in line with the spending projection based on economic census data.

In addition to paints, the Ecology product category for architectural paints includes varnishes and lacquers. Retail sales of stains, varnishes, shellacs, and other coatings are measured in the economic census under NAPCS 5001850009. The 2017 economic census records $47 million in retail sales in Washington. Applying the same adjustment as we did for paints above suggests estimated retail sales of $81 million in 2026.

2.2 Prevalence of PFAS and APEs in Architectural Paints

2.2.1 PFAS

When short-chain PFAS is used as a fluorosurfactant in low concentrations in paints, it can help paints to adhere better and to form a smoother surface without cracking or beading. It can also help prevent the paint from feeling sticky or tacky.[20]

Two studies we are aware of have focused on paints available in the Pacific Northwest, and may be representative of paints available in Washington. A study of 27 paints purchased in Oregon between 2021 and 2022 found 14 of the paints had detectable levels of particular classes of PFAS.[21] Six out of 10 bridge paints tested collected from two regional transportation facilities in the Pacific Northwest tested positive for total fluorine.[22]

The broadest testing was published in a non-peer reviewed report in 2023 by the non-governmental group Healthy Building Network (now called Habitable). They report that roughly 50% of the 94 paints they tested had detectable fluorine, with ranges between 42–688 ppm.[23] In Chapter 173-337 WAC, Ecology similarly relies on total fluorine concentration as an indicator of intentionally added PFAS, presuming that a threshold above 50 ppm indicates the intentional addition of PFAS for some product categories. While this report was not peer-reviewed, it represents the largest sample of testing we currently have on the presence of PFAS in the U.S. paint market.

An alternative estimate provided in an OECD publication reports that 92% of the paint market across the European Union, Asia, and North and South America uses non-PFAS materials as of 2011.[24] The report, published in 2022, also notes that regulations since 2011, particularly in the European Union, has restricted certain solvents in paints and has caused the prevalence of PFAS in paints to increase.

[20] OECD (2022)
[21] Cahuas, et al. (2022)
[22] Kim-Fu, et al. (2024)
[23] Healthy Building Network (2023)
[24] OECD (2022)

We considered whether it is possible to determine if a paint contains PFAS based on positioning claims. This is possible for some products, such as cookware, where specific claims, such as "PTFE-free" or "ceramic-based non-stick" are used to advertise a product that does not contain PFAS. However, specific claims around PFAS are not yet sufficiently common in the paint sector to assess the overall market. PFAS helps to impart paints with certain properties, such as oil- and water-resistance. These paints may be more likely to be marketed with these claims, but there are alternative chemicals that impart the same properties, and there may be uses of PFAS that do not have an associated marketing claim.

2.2.2 APEs

Safety data sheets and the EPA ChemExpo database can be used to identify paint products that contain APEs.[25] Getting a sample searching through safety data sheets that accurately represents the market can be challenging, but it may be possible in the event of a restriction in order to estimate the number of paint formulations that would be impacted. Information suggests that the number of paint formulations that include APEs is declining,[26] but there is not market information currently to suggest the precise share of the market that contain APEs.

2.3 Market Pricing of Safer Alternatives

2.3.1 PFAS

Because paints that contain PFAS are not necessarily identifiable without chemical analysis, it would be difficult to estimate any difference in price between paints that contain PFAS and those that do not. As of right now, we are unaware of any existing analysis that has estimated price differences or any chemical or market database that would allow Ecology to do so. While some paints are specifically advertised as PFAS-free or PTFE-free (such as those with a Green Seal certification[27]), most of the market is not sufficiently transparent about whether a product contains PFAS in order to make positioning claims that would be amenable to large-scale analysis or drive differences in consumer pricing. We are not aware of any data or analysis that suggests paints that contain PFAS are priced significantly different than products that do not contain PFAS.

2.3.2 APEs

A variety of paints are advertised as free of nonylphenol ethoxylate (NPE), a specific type of APE. Large paint brands, such as Benjamin Moore and Sherwin Williams, have product lines that are formulated without NPE. An Ecology report from 2021 suggested that paints formulated without NPEs are comparably priced to product lines that include NPE.[28]

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[25] Ecology (2025b)
[26] https://www.syensqo.com/en/solutions-market/building/coatings/architectural-industrial/sustainable-formulations/ape-free-eguide
[27] https://greenseal.org/wp-content/uploads/GS-11-Standard-Ed-4.1-03.2025.pdf
[28] Ecology (2021)

Paints formulated without APEs can also be distinguished by specific certifications, such as the Green Seal GS-11 certification which prohibits the use of APEs as well as PFAS.[29] However, certifications such as these contain additional requirements beyond being APE-free, which could impact the price. The large home improvement retailer, Home Depot, has recently announced that their entire selection of interior and exterior latex water-based wall paints for U.S. stores is APE-free.[30] It is reasonable to assume that, as a major paint retailer, their selection contains paints that fall along the full spectrum of prices, and that the latex water-based paint market segment does not contain a substantial premium for formulations that do not contain APEs.

2.4 Demand for Safer Alternatives

2.4.1 PFAS

Though not as widespread as APE positioning claims which we cover in 2.4.2, guidance for purchasing PFAS-free paints are becoming more frequent.[31] While not specific to paints, a recent study of consumer demand for PFAS-free alternatives among three different classes of products found that consumers were willing to pay significantly more to avoid PFAS exposure.[32]

Despite strong demand for alternatives without PFAS, consumers are often prevented from expressing that preference in the market. A key hurdle is that the presence of PFAS is often difficult to determine without a chemical analysis. Apart from certifications, such as the Green Seal GS-11 certification which prohibits PFAS as of 2025,[33] it can be impossible for consumers to determine which products contain PFAS and which do not.

2.4.2 APEs

There has been a rise of positioning claims among manufacturers and retailers of APE-free paints. This suggests an established demand for alternative products without APEs that these claims are meant to capture. The addition of new information related to APEs could make the issue more salient for consumers who were previously unaware of APEs in paints as a potential health concern.

As noted in 2.3.2, Home Depot announced in 2023 that APEs are excluded from all interior and exterior latex water-based wall paints in their Canada and U.S. stores.[34] Several different online sources and buying guides maintain lists of paints and paint brands that are free of

[29] https://greenseal.org/wp-content/uploads/GS-11-Standard-Ed-4.1-03.2025.pdf
[30] https://ecoactions.homedepot.com/wp-content/uploads/2026/04/Chemical-Strategy-PFAS-update-Aug-2023-FINAL.pdf
[31] e.g., https://learn.pfasfreelife.com/research/pfas-in-interior-wall-paint
[32] Ek and Wårell (2026)
[33] https://greenseal.org/wp-content/uploads/GS-11-Standard-Ed-4.1-03.2025.pdf
[34] https://ecoactions.homedepot.com/wp-content/uploads/2026/04/Chemical-Strategy-PFAS-update-Aug-2023-FINAL.pdf

APEs.[35,36,37,38] We could not corroborate the information presented in these sources, but their presence suggests some awareness of, and consumer demand for, paints made without APEs.

2.5 Potential Costs of a PFAS and APE Restriction in Architectural Paints

We expect that any restriction of either or both PFAS or APEs would result in paints being reformulated in order to meet the restriction. Even in the absence of a restriction in Washington, the paint industry appears to be moving away from the use of APEs, both voluntarily and through regulatory restrictions. While PFAS is not yet restricted in paints, PFAS is regulated in many consumer products in several states.

If paints were to be reformulated in response to a restriction, there are several strategies we may use to estimate the potential costs.

When Ecology has data on the number of formulations on the market and some information on the potential reformulation costs, then we can multiply the estimates of reformulation costs by the number of potential reformulations to get a total estimated compliance cost. While we do not currently have specific information on the number of paint formulations in the Washington market, that might be information we can seek out in the event of a chemical restriction. The closest information we have on the reformulation cost comes from EPA estimates of the cost of reformulating food and cosmetics. We have previously applied these estimates to other chemical formulations, such as automotive washes and cleaning products,[39] but this approach can only be applied when the reformulation process for the product category is a sufficiently close match to the product categories for which the cost estimates were originally derived.

An alternative strategy is to use price information on the market to estimate costs. In this case, price differences between products that contain the restricted chemical and the rest of the market is combined with assumptions about consumer and producer elasticities to infer differences in underlying production costs. This approach has previously been applied to estimate the cost of restricting PFAS in apparel.[40]

Finally, in the absence of any data other than an estimate of market size and prevalence of the restricted chemical, we may assume that costs amount to a loss of market share for impacted product lines across different potential adaptation timelines. This approach was generally applied in the regulatory analyses for the initial adoption of Chapter 173-337 WAC.[41]

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[35] https://www.mychemicalfreehouse.net/2023/07/paint-brands-free-of-alkylphenol-ethoxylates-apes.html
[36] https://ceh.org/yourhealth/safe-house-paint-tips
[37] https://paintersinc.net/blog/best-paint-brands-benjamin-moore-vs-sherwin-williams
[38] https://informed.habitablefuture.org/product-guidance/3-paint
[39] Chapter 3 in Ecology (2025c)
[40] Chapter 3 in Ecology (2025c)
[41] Ecology (2023b)

Chapter 3: 6PPD and PFAS in Artificial Turf

3.1 Artificial Turf Market Size

We are not aware of any state or federal government data that identifies the market value of installed artificial turf. However, the Synthetic Turf Council, an artificial turf trade group, estimated that the total value of installed synthetic turf in the United States was $2.43 billion as of 2020. Scaling that figure to Washington's share of the U.S. population in 2020,[42] and adjusting for population growth and changes in prices[43] between 2020 and 2026 suggests an installed synthetic turf value in Washington of approximately $75.8 million.

Artificial turf fields last between 8 and 15 years according to one estimate[44] and between 10 and 12 years according to another.[45] Taking the wider range, this suggests the annual value of keeping a constant number of artificial turf fields is roughly $5.1 million to $9.5 million, assuming replacement every 8 to 15 years. The population in Washington is expected to increase by 0.6% per year on average over the next twenty years.[46] To maintain a constant number of artificial turf fields per person would require an additional $455 thousand per year in new artificial turf field construction. Taking both the field replacement and the purchase of new artificial turf fields into account suggests that spending on artificial turf would be roughly $5.5 million to $9.9 million per year.

This estimate assumes a constant demand for turf playing fields as well as a constant relative demand for synthetic turf compared to natural turf. It is possible that either of these assumptions could be incorrect. Of particular note, concerns about water use could increase the demand for synthetic turf compared to natural turf, while concerns about environmental and health impacts could decrease the demand for synthetic turf.

3.2 Prevalence of 6PPD and PFAS in Artificial Turf

3.2.1 6PPD

The latest generation of artificial turf fields use some form of synthetic fiber and fill in the space between each fiber with infill material. Often, this material consists of pieces of rubber, including rubber from recycled tires. Tires contain the chemical 6PPD, an antioxidant and antiozonant added to tires during the manufacturing process to prevent the tire from degrading and becoming brittle when exposed to typical operating environments. Currently, all tires are made with 6PPD.[47]

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[42] https://www.census.gov/data/tables/time-series/demo/popest/2020s-state-total.html
[43] https://fred.stlouisfed.org/series/CPIAUCSL
[44] https://keystonesportsconstruction.com/how-long-do-turf-fields-last
[45] https://themotzgroup.com/sport_blog/how-long-will-my-synthetic-turf-field-last-how-can-i-extend-its-life
[46] https://ofm.wa.gov/wp-content/uploads/2026/03/stfc_2025.pdf
[47] https://www.ustires.org/6ppd-tire-manufacturing

The Safer Products Cycle 2 Phase 2 report summarized studies that measured 6PPD in rubber samples.[48] 6PPD was found in each sample in each of the four studies of artificial turf fields or playgrounds. Though, the report also includes an additional Japanese study of rubber directly from a manufacturer that did not find 6PPD in 20% of the samples tested.[49]

6PPD is likely present in any artificial turf system that contains crumb rubber, particularly crumb rubber derived from recycled tires. We are not aware of any reliable estimates of the proportion of artificial turf installations that use crumb rubber infill in Washington. However, what information exists suggests that crumb rubber is the most common type of infill.[50,51]

3.2.2 PFAS

The Safer Products Cycle 2 Phase 2 report found that fluoropolymers can be used as a polymer processing aid in the manufacture of turf grass blades.[52] Fluoropolymers are PFAS and can themselves be manufactured using PFAS, and PFAS may still be present in the finished artificial turf product.

Some studies have detected the presence of PFAS in artificial turf, including a 2023 study that detected fluorotelomer alcohols (FTOH), a precursor that can degrade to PFAS, in both crumb rubber and the turf fibers of a new sample of artificial turf.[53] However, there is no known database that contains estimates of PFAS levels in artificial turf, either new or installed, that could be representative of the entire market. This is perhaps due to the specialized nature of the product, the lack of reporting requirements for chemicals in artificial turf, and the cost of obtaining samples that would necessarily be from geographically dispersed sites.

The largest sample study we are aware of is a doctoral thesis published in 2023, which measured specific PFAS in 27 samples of artificial turf from across the United States. The study found at least one PFAS above the limit of detection in 23 of the artificial turf samples.[54] If we assume the sampling for this study is representative of the market as a whole, a bootstrapped simulation suggests that between 74% and 96% of the existing artificial turf in the U.S. market contains measurable levels of at least one PFAS included in the study. However, this estimate is from existing artificial turf, rather than new installations that would be impacted by a PFAS restriction. The Synthetic Turf Council reported in 2024 that they are working with members and raw material suppliers to ensure that there are no PFAS-based ingredients or processing aids in their products, which suggests that intentionally added PFAS in new artificial turf installations be considerably lower than the historical average.[55]

[48] Ecology (2025b)
[49] Kawakami, et al. (2022)
[50] https://dreamfieldsusa.com/artificial-turf-infill-types-comparison
[51] https://themotzgroup.com/infill_blog/what-are-my-artificial-turf-infill-options
[52] Ecology (2025b)
[53] Zuccaro, et al. (2023)
[54] Whitehead (2023)
[55] https://www.syntheticturfcouncil.org/page/faq-turf

The only known estimate of PFAS in artificial turf fields within Washington comes from the King County Department of Natural Resources and Parks. In 2024, they tested five newly manufactured batches of a single artificial turf infill used in King County for extractable organic fluorine (EOF). None of the samples were above the limits of detection of between 230 and 250 ppb. However, it is worth noting that WAC 173-337-110 presumes the intentional addition of PFAS based on total fluorine rather than EOF for those product categories where PFAS is restricted.

While these two results are most germane to the case of a potential restriction of PFAS in artificial turf in Washington, the Safer Products Cycle 2 Phase 2 report contains information on additional studies.

3.3 Market Pricing of Safer Alternatives

3.3.1 6PPD

Artificial turf fields that use crumb rubber infill are the most likely to contain 6PPD. Alternatives to crumb rubber infill exist, including coconut coir fiber, walnut shells, olive pits, and proprietary alternatives, such as BrockFILL. These various alternatives each have advantages and disadvantages. Crumb rubber tends to be among the lowest cost options, with silica sand infill being the only comparably priced alternative.[56,57] One estimate from 2018 suggests that alternative infill systems can be expected to cost roughly 10–15% more than crumb rubber.[58]

3.3.2 PFAS

Unlike 6PPD, which tends to appear in fields with a certain infill, the presence of PFAS in a particular artificial turf is uncertain without testing. PFAS may be present in turf fields due to its use as a processing aid in manufacturing, but alternative processing aids are available.

A study of artificial turf in Sweden published in 2022 measured total fluorine in the filling, backing, and blades of 17 different fields across five different types of infill.[59] Ecology uses the concentration of total fluorine as an indicator of intentionally added PFAS for existing product restrictions in WAC 173-337-110. While total fluorine concentration was lowest for organic fields, fluorine was present in all samples from each field. However, extractable organic fluorine and target PFAS were not found in every field.

Given that the presence of PFAS in artificial turf is not highly predictable without specific testing of the elements of each artificial turf field, it is not currently possible to estimate the relative price of artificial turf fields that do not contain intentionally added PFAS.

[56] https://dreamfieldsusa.com/artificial-turf-infill-types-comparison
[57] https://turf.best/blog/artificial-turf-infill-comparison-2026
[58] https://themotzgroup.com/sport_blog/cost-difference-between-crumb-rubber-progressive-infill-turf-fields
[59] Lauria, et al. (2022)

3.4 Demand for Safer Alternatives

3.4.1 6PPD

There is a clear market for alternatives to crumb rubber infill due to environmental and health concerns over 6PPD. Comparisons of different infill types regularly include health and safety concerns of different alternative artificial turf systems, and concern for product safety is one of the defining features of crumb rubber infill.[60,61] Concerns about the drawbacks of crumb rubber infill, including chemical exposure and heat retention, have resulted in demand for alternatives. However, it is unclear to what extent these concerns may override the advantages of crumb rubber infill, such as cost-effectiveness and durability, at least for some uses.

3.4.2 PFAS

As we mentioned above, in response to public concerns about PFAS, the Synthetic Turf Council reported in 2024 that they are working with members and raw material suppliers to ensure that there are no PFAS-based ingredients or processing aids in their products.[62] California's Department of Toxic Substances reports that it is monitoring the ongoing removal of PFAS from artificial turf sold in California.[63]

Several states prohibit artificial turf with intentionally added PFAS, including Colorado[64] and Vermont,[65] both of which have restrictions as of 2026. Maine[66] and Rhode Island[67] have scheduled similar restrictions to go into effect in 2029. There are also local laws in other states that restrict the use of artificial turf.[68]

We expect that the publicity given to the potential for PFAS in artificial turf by news reports and regulatory bodies, public commitments to removing PFAS by manufacturers, and restrictions of PFAS in artificial turf in some states, cumulatively serve to raise awareness of the issue among the public and increase demand for alternatives.

3.5 Potential Costs of a 6PPD and PFAS Restriction in Artificial Turf

3.5.1 6PPD

Higher prices for alternatives to crumb rubber infill generally suggests a higher unit production cost that would contribute to higher prices in the event of a restriction. However, this higher

[60] https://dreamfieldsusa.com/artificial-turf-infill-types-comparison
[61] https://turf.best/blog/artificial-turf-infill-comparison-2026
[62] https://www.syntheticturfcouncil.org/page/faq-turf
[63] https://dtsc.ca.gov/scp/artificial-turf-containing-pfass
[64] https://leg.colorado.gov/bills/sb24-081
[65] https://legislature.vermont.gov/Documents/2024/Docs/ACTS/ACT131/ACT131%20As%20Enacted.pdf
[66] https://legislature.maine.gov/legis/statutes/38/title38sec1614.html
[67] https://webserver.rilegislature.gov/Statutes/TITLE23/23-18.18/23-18.18-4.htm
[68]https://www.healthandenvironment.org/assets/images/Municipal%20%26%20regional%20initiatives.pdf

price could potentially be offset by offering more desirable consumer attributes. Alternatives would be expected to have fewer human and environmental health risks, and some offer better performance in heat or improved longevity. These commensurate benefits could make up for some of the changes in costs for consumers.

3.5.2 PFAS

Given that manufacturers need to invest in alternative manufacturing processes and coordinate with their suppliers to remove PFAS, it is likely that a PFAS restriction would incur some costs. However, the magnitude of this cost depends on how the market would evolve in the absence of potential restrictions. Given that an industry group reports that their members are working with their suppliers to remove PFAS, it is possible that the share of the market that contains intentionally added PFAS would decline markedly even without a restriction. That manufacturers are undertaking this voluntarily also suggests that any costs of removing PFAS are an expected net economic benefit for many businesses. Any costs of removing PFAS must be set against the potential reputational costs they would incur by continuing to manufacture artificial turf using PFAS.

Chapter 4: PFAS in Cookware and Kitchen Supplies

4.1 Cookware and Kitchen Supplies Market Size

4.1.1 Cookware and Bakeware

Federal economic categories are not well-suited to capturing the cookware and bakeware market in Washington. Within the economic census NAPCS 5000750000 measures retail sales of tableware, kitchenware, cookware, and glassware, which amounted to roughly $2 billion in Washington in 2017. However, this category includes many products outside of the scope of Ecology's product category. The only NAICS code to capture cookware is NAICS 332215, which similarly includes the manufacturing of cookware, utensils, cutlery, and flatware.

Instead, for cookware, we rely on estimates from other market reports, specifically, a report on the U.S. cookware market produced by Grand View Research.[69] This report suggests the U.S. cookware market was $4.02 billion in 2023. Assuming the proportion of spending on cookware in Washington compared to the United States is roughly the same as the ratio of total consumer spending on durable goods, this would imply that the total cookware market in Washington is roughly 2.6% of the total U.S. market in 2023. While cookware represents only a small part of the spending on durable goods in Washington and may not capture Washington spending precisely, it represents the best information we have on the relative spending on cookware in the state. Other methods of scaling national estimates down to Washington, such as relative GDP or relative population, result in similar numbers. Applying an annual growth rate of 4.2% after 2023, which is the average annualized growth for durable goods spending in Washington over the previous 20 years, suggests a total Washington market of $118 million for cookware in 2026.

4.1.2 Small Kitchen Appliances

Ecology's cookware and kitchen supplies product category also includes small kitchen appliances. Retail sales of small kitchen appliances are measured by the U.S. Census NAPCS 5000725000. However, this category also includes other small household appliances, such as tap water purifiers and filters and personal care appliances, such as hair dryers, curling irons, and shavers. The 2017 economic census reports that there were $326 million in annual sales of small appliances in Washington, though this includes many products beyond Ecology's product category.

We look to other analyses to provide additional information. One market analysis of small kitchen appliances estimated the total U.S. market was $5.32 billion in 2024.[70] As for cookware, we assume that the Washington retail market for small kitchen appliances is roughly 2.6% of the entire U.S. market and apply a 4.2% growth rate after 2024. This suggests a total

[69] https://www.grandviewresearch.com/industry-analysis/us-cookware-market-report
[70] https://www.grandviewresearch.com/horizon/outlook/small-kitchen-appliances-market/united-states

Washington market of $152 million for small kitchen appliances in 2026, which appears to be plausible given the 2017 economic census estimate for sales in the broader small appliance category.

4.2 Prevalence of PFAS in Cookware and Kitchen Supplies

PFAS is often used in cookware and food contact services of small kitchen appliances for non-stick coatings. The primary coating used for this purpose is based on polytetrafluoroethylene (PTFE), which is a type of polymeric PFAS. Up until around 2015, PTFE was manufactured in the U.S. using perfluorooctanoic acid (PFOA) but a voluntary phase-out program among large manufacturers has since largely replaced the PFOA in PTFE with other fluorosurfactants. While PFOA is no longer generally used, thus allowing products to be marketed as "PFOA-free," the alternative fluorosurfactants used to manufacture PTFE, such as hexafluoropropylene oxide dimer acid (HFPO-DA),[71] are still PFAS chemicals and residual fluorosurfactants from manufacturing are still PFAS as well.

We estimate the proportion of the cookware and kitchen supplies market that contains PFAS for Washington by gathering online retail data. We focused on products available through Walmart and Target stores, as well as Amazon e-retailer, as representing some of the largest retail suppliers in Washington. We gather representative products by selecting one store each for Target and Walmart located in King County and gathered information on products listed as available in that store through their online portal.[72] While one store is not a sufficient sample to be representative of all of Washington, King County is the highest population concentration in the state and we chose the store that had the highest volume of online customer reviews.

For Amazon, we gather information on the first 30 products within each product category after sorting the available products for best-sellers. We describe the product categories within each subsection below. We gathered the online price and product information for all retailers between June 26, 2026, and July 7, 2026.

We scale the cookware market share of each retailer according to relative U.S. revenue and by proportion of physical stores in Washington.[73,74,75] Based on this scaling, we assume Walmart,

[71] https://www.epa.gov/sites/default/files/2018-11/documents/factsheet_pfbs-genx-toxicity_values_11.14.2018.pdf
[72] While Seattle stores are not necessarily representative of the entire state, it does represent the location with the highest concentration of consumers. Spot-checks of other locations in the state suggest that the product mix is largely similar across different locations.
[73] https://www.statista.com/statistics/196002/worldwide-retail-sales-by-the-top-50-retailers
[74] https://www.statista.com/statistics/196006/united-states-share-of-worldwide-retail-sales-by-top-retailers
[75] https://www.mmcginvest.com/post/walmart-vs-target-an-analytical-comparison-of-two-american-retail-giants

Amazon, and Target are representative of 61%, 24%, and 15% of the Washington market, respectively, for which we recorded price information.

4.2.1 Cookware and Bakeware

To our knowledge, there is no estimate of the market share of Washington cookware that contains PFAS. One market report estimates that 63% of the U.S. cookware market is non-stick[76] and a global estimate suggests that 40% of the non-stick cookware market uses a coating that contains PTFE.[77] If we assume these numbers are representative of Washington, it would suggest that roughly 25% of the Washington cookware market contains PFAS, or about $30 million.

We use the online retail data we gathered to estimate the overall prevalence of PFAS in the cookware market in Washington. We focus on four product categories: frying pans or skillets, saucepans, stockpots, and baking sheets. We use information within each retailer's product page, centralized information from Defend Our Health on PFAS disclosures,[78] as well as manufacturer product information to determine whether a product is likely to contain intentionally added PFAS.[79] All four product categories had options that were uncoated—often made with stainless steel or cast iron. All four product categories also had coated options that were PFAS-free. Notably, every baking sheet in our sample appeared to be PFAS-free.

We assess the prevalence of PFAS in the market using the price information of the products in our sample. In the absence of any additional information, we assume each of these four product categories that we measure represents roughly equal shares of the market. Market reports for the U.S. cookware and bakeware sector suggests that the U.S. residential bakeware market is valued at around one-third of the total residential market for pots and pans, which suggests that equally weighting these four cookware categories is potentially reasonable.[80,81]

Under the assumption that each product that we recorded data for has roughly equal sales within its product category and retailer, and weighting the product category and retailer according to the market shares we previously defined, we found the weighted average of the total cookware market that contained PFAS. We quantify the uncertainty in this weighted average using an approach called "bootstrapping;" this involves randomly drawing items from

[76] https://www.grandviewresearch.com/industry-analysis/us-cookware-market-report
[77] https://www.grandviewresearch.com/horizon/statistics/nonstick-cookware-market/coating/teflon-coated/global
[78] https://defendourhealth.org/toxic-free-products/find-top-cookware-brands-materials-disclosures/
[79] For many of the products that contain PFAS, the Target item description will state that it cannot be shipped to Colorado, Maine, or Minnesota, states with a restriction on PFAS in cookware. Walmart will likewise often report that the item cannot be shipped to an address in Colorado, Maine, or Minnesota. In general, we assume a product with claims to be PTFE-free does not contain PFAS, while products with claims to be PFOA-free may contain PFAS.
[80] https://www.grandviewresearch.com/industry-analysis/us-bakeware-market-report
[81] https://www.grandviewresearch.com/industry-analysis/us-cookware-market-report

our original sample with replacement and calculating the statistics of interest for each draw and repeating that a sufficient number of times to get a distribution of the statistic.[82] Across the four product categories and three retailers, we estimate that between 17% and 25% of the Washington cookware market contains PFAS. This is slightly lower than the estimate we produced earlier using the nation-wide estimate of the proportion of non-stick items and the global estimate of coatings that contain PTFE.

4.2.2 Small Kitchen Appliances

Given that PFAS is predominately used in the manufacture of non-stick surfaces, we used online retail information to determine which products most often use non-stick surfaces. Small kitchen appliances where non-stick surfaces are often advertised include: waffle irons, grills and griddles, rice and pressure cookers, and fryers. Globally, these four product categories are estimated to represent 9%, 5%, 5%, and 4% of the total small kitchen appliance market, respectively, according to one market report. In total, these four product categories represent about 22% of the market,[83,84] but may represent the majority of small kitchen appliances that contain intentionally added PFAS.[85]

4.3 Market Pricing of Safer Alternatives

4.3.1 Cookware and Bakeware

We start by limiting the sample of products to only those that are advertised as non-stick in order to compare similar products as much as possible.

After limiting our sample to only non-stick products, we compare the relative price information we gathered as described in section 4.2 for non-stick cookware products that have PFAS compared to those that do not. Simply comparing the average price of each product, PFAS-free products cost about 56% more on average than products that are not PFAS-free. However, the price data includes a small handful of items over $100, representing just 6% of the sample. All of these items are PFAS-free and there are no similar equivalent highly-priced products that

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[82] We quantify the uncertainty in this weighted average using an approach called "bootstrapping;" this involves randomly drawing items from our original sample with replacement and calculating the statistics of interest for each draw. We repeated this procedure 5,000 times to ensure the distribution of the statistic was stable. We took bootstrap draws separately for each retailer and product category; the retailer/category-specific draws are then combined to calculate the weighted average. The range we report represents the 10th and 90th percentile of the bootstrapped distribution.

[83] This market share of the four product categories are rounded, so the sum is not necessarily the same as the sum of the rounded percentages listed previously

[84] https://www.grandviewresearch.com/horizon/outlook/small-kitchen-appliances-market

[85] Other categories of small kitchen appliances include coffeemakers, toasters, blenders, and stand mixers. Some sources suggest that PFAS can be present in these products. For example, it is possible that PFAS may be present as a coating in coffeemaker carafes or water reservoirs or in internal tubing. However, we have not generally been able to identify whether products in these categories contain PFAS and "non-stick" positioning claims are not common for these products.

contain PFAS. These more expensive items are not truly alternatives to items that have PFAS since there are no similar premium products in our sample that contain PFAS. Including these items in the sample makes this simple average misleading. If items priced at more than $100 are removed from the sample, PFAS-free products are 27% more expensive.

We further adjust for the market share of each product category and retailer. As in section 4.2, we assume that frying pans and skillets, saucepans, and stockpots represent roughly equal proportions of the market.[86] Because we did not identify any bakeware sheet pans that contained PFAS, we exclude this product category. After adjusting for the market share of each product category and retailer, PFAS-free cookware products are between 11% and 30% more expensive, or roughly three to seven dollars.[87] We further adjusted for the metal and size of the cookware item, but the results are largely unchanged; the PFAS-free products are 12% to 29% more expensive than products that contain PFAS.[88]

However, this estimate may overstate the price premium for PFAS-free cookware. Even after filtering out products above $100, some more premium brands are still included in the dataset. These products are both more expensive and more likely to have a PFAS-free non-stick coating than more budget-friendly brands. The greater expense is likely due, at least in part, to qualities other than the non-stick coating. Statements by manufacturers corroborate this observation; that much of the price difference among products is due to attributes of the product unrelated to the non-stick coating.

For a more exact comparison within closely-matched products, we look at prices of similar items made with or without PFAS from the same manufacturer and sold through the same retailer. At the time our initial data was gathered in late June 2026, we found that the Target online store listed T-fal brand PFAS-free ceramic frying pans for 6.3% more than nearly identical pans with a PTFE coating. Target also listed ceramic nonstick saucepans made by T-fal at a 24% higher price than PTFE-coated saucepans. Carote brand frying pans were identically priced at Target's online store regardless of whether the coating was ceramic or PTFE. All-Clad's online store similarly priced their items the same regardless of the non-stick coating. T-fal's online store priced ceramic coated cookware between 17% less expensive and 23% more expensive than the closest PTFE-coated equivalent products.

[86] https://www.grandviewresearch.com/horizon/statistics/nonstick-cookware-market

[87] We do this by bootstrapping each retailer and item, keeping the overall number of items with and without PFAS the same. We calculate the average price for items with and without PFAS. We then multiply that average by the market share of the product category and retailer that we assumed in Section 9.2. The adjusted average is added together for a bootstrap draw within each product category and retailer to produce the final overall adjusted average price. This series of draws is repeated 5,000 times to produce a distribution, and we take the 10th and 90th percentile as our lower- and upper-bound estimates.

[88] Within the bootstrap procedure, we use a log-linear model of price with the covariates: size (by diameter or volume), metal type as a categorical factor, and an indicator for PFAS-free.

Table 2: Measures of PFAS-free cookware pricing

Market Price Measure	PFAS-free Price Premium
Simple average	56%; 27% (price outliers removed)
Market-weighted average	20%; 20% (adjusted for metal and size)
Product-matched (Target retailer)	0% (Carote); 6.3% (T-fal skillet); 24% (T-fal saucepan)
Product-matched (manufacturer)	0% (All-Clad); -17% to +23% (T-fal)

4.3.2 Small Kitchen Appliances

We attempted to compare prices for small kitchen appliances that are PFAS-free with those that contain PFAS using the exact match on retailer and manufacturer. However, the retail sites we searched did not have comparable products made with and without PFAS. And, among the major manufacturers that we checked, all products within the same category either contained PFAS or were PFAS-free. There generally were not items that were nearly identical other than the non-stick coating. For that reason, in the absence of any additional data, we assume the price difference for PFAS-free alternatives is roughly the same as other cookware.

4.4 Demand for Safer Alternatives

The market share for PFAS-free nonstick cookware has increased dramatically in the past several years. This trend is attributed to several sources, including:

- Consumer awareness of PFAS and its potential health and environmental costs.
- Technological innovations that have reduced prices for PFAS-free alternatives.
- Regulations or anticipated regulations of PFAS in cookware products.[89]

Other states have restricted PFAS in cookware or required the presence of PFAS to be disclosed to consumers. Minnesota restricted intentionally added PFAS in cookware as of January 1, 2025. In the definition of cookware, Minnesota includes "any product used to prepare, dispense, or store food, foodstuffs, or beverages."[90] Colorado and Maine implemented similar restrictions a year later. Statutory restrictions on intentionally added PFAS in cookware are set to begin in 2027 in Rhode Island and in 2028 in Vermont and Connecticut.[91,92] New Mexico has also banned PFAS in cookware but makes exceptions for polymer forms of PFAS. A legislative bill last year that would have enacted a similar restriction in California in 2030 was vetoed by

[89] Grand View Research (2026). Cookware: Market Analysis 2021-2033
[90] https://www.pca.state.mn.us/air-water-land-climate/2025-pfas-prohibitions#cookware
[91] https://legislature.vermont.gov/statutes/section/09/063/02494f
[92] https://cga.ct.gov/current/pub/chap_446z.htm#sec_22a-903c

the governor. But an earlier California law passed in 2021 has required any intentionally added PFAS to be disclosed to consumers on all cookware labels.[93]

Labeled disclosures give consumers additional information about the product they are purchasing and may help influence consumer behavior.[94] In addition to California's disclosure requirements, Connecticut statute requires any cookware manufactured or sold in the state to be labeled if it contains PFAS as of July 1, 2026. New Jersey adopted a similar law in 2026 to go into effect in 2028.[95]

PFAS restrictions in product categories other than cookware are being enacted in many places. Washington has restricted or has set dates for restriction of intentionally added PFAS in several consumer product categories, including carpets and rugs, cleaning products, and apparel and accessories.[96] France and Denmark have set PFAS restrictions on several consumer product categories as well, though cookware is not one of the product categories.[97] The European Union and Sweden are considering ways to broadly limit PFAS in consumer products, including a proposal that would ban on PFAS in some products in Sweden beginning in 2028.[98,99] A broader regulatory environment that is gradually restricting PFAS in different consumer product categories in different jurisdictions may both increase consumer awareness of PFAS and induce a change in supply as manufacturers anticipate potential restrictions.

In addition to regulatory disclosure requirements and restrictions, research suggests there is consumer demand for PFAS-free alternatives. A recent Swedish study reported estimates from a nationally-representative survey of more than 2000 individuals in 2022, which asked consumers to choose between hypothetical frying pans priced at between $25 and $150 manufactured with and without PFAS.[100] The study estimated the average willingness to pay to avoid PFAS in frying pans was between $60 and $100.[101] The study also found consumer demand for PFAS alternatives in sunscreen and outdoor pants.

Another study surveyed 1,304 U.S. consumers in 2022 to estimate their demand for PFAS-free disposable dinnerware. They estimate consumers would be willing to pay between $1.40 and $2.12 more on average for a pack of disposable plates made without PFAS, compared to a baseline price of between $3.99 and $6.99, suggesting most consumers would prefer to pay at least 20% more for PFAS-free alternatives.[102]

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[93] https://dtsc.ca.gov/scp/safer-food-packaging-cookware-act-of-2021
[94] There is a large literature on the effect of labeling on consumer behavior. See Purmehdi, et al. (2017) for one meta-analysis.
[95] https://pub.njleg.state.nj.us/Bills/2024/AL25/202_.PDF
[96] https://app.leg.wa.gov/WAC/default.aspx?cite=173-337
[97] https://www.economie.gouv.fr/entreprises/tout-savoir-sur-linterdiction-progressive-des-pfas
[98] https://environment.ec.europa.eu/topics/chemicals/pfas-pollution_en
[99] https://sustainabilitymag.com/news/overtaking-the-eu-swedens-plan-to-ban-forever-chemicals
[100] The study presented their estimates in Swedish Krona (SEK), which we convert here to U.S. Dollars at an approximate exchange rate of $0.1 per SEK.
[101] Ek and Wårell (2026)
[102] Rihn, et al. (2025)

4.5 Potential Costs of PFAS in Cookware and Kitchen Supplies

The market share of PFAS-free nonstick cookware and kitchen supplies has been growing dramatically in recent years and is expected to increase, due at least in part to regulations that restrict PFAS in cookware in Colorado, Maine, and Minnesota, and the anticipation of possible restrictions elsewhere. However, nonstick cookware and kitchen supplies that contain PFAS are still substantial parts of the markets in states that do not have a PFAS restriction, including Washington state as we outlined in section 4.4. If Washington were to restrict PFAS in cookware and kitchen supplies, we expect manufacturers would likewise remove any product lines that contain PFAS from the Washington market and continue to sell products that contain PFAS elsewhere while simultaneously continuing the broad industry-wide movement toward PFAS-free alternatives in cookware and kitchen appliances.

Based on reported prices and products among online retailers, states that have restricted PFAS in cookware do not appear to have noticeably fewer cookware products available compared to retail locations in nearby states without a restriction. Nor do retailers offer higher prices for the same products in retail locations where there is a PFAS restriction. This suggests consumers in Washington would not face a product shortage or be singled out for higher prices if PFAS were restricted in these products.

The cost of any potential restriction of PFAS in cookware and kitchen supplies depends on the manufacturers' compliance strategy. Broadly speaking, there are two potential strategies that manufacturers could choose to pursue, and they are not mutually exclusive:

- Maintain a constant production mix, in which case Washington retailers and consumers would receive only PFAS-free products while manufacturers would send a relatively higher proportion of products that contain PFAS to other states without a PFAS restriction. In general, we would expect this strategy if there was not enough time for manufacturers to change their production process before a restriction went into effect. There may be some costs associated with coordinating changes in the supply chain and transporting products. There may also be costs to consumers arising from mismatches between supply and consumer preferences: some consumers located in Washington who prefer a product made with PFAS would have more difficulty purchasing it while consumers outside of Washington who preferred PFAS-free alternatives may experience less availability on the margin. This strategy would also reduce the benefits of the restriction because, while this compliance strategy would change the geographical distribution of products that contain PFAS, it would not affect the overall amount of PFAS in consumer products.
- Change their production mix in a way that increases the relative volume of PFAS-free cookware and kitchen supplies produced compared to products that contain PFAS. This could involve increasing production of existing product lines that are PFAS-free while decreasing or ceasing production of product lines that contain PFAS. It could also involve reformulating products to remove PFAS. This is a longer-term strategy that may require

manufacturers to make investments to adjust their production process to increase their production of PFAS-free cookware and kitchen supplies. Additional fixed costs from this strategy on the production side could be due to investments in designing new products, purchasing new equipment, or otherwise expanding production for PFAS-free product lines. Ongoing per-unit costs associated with a PFAS restriction could be due to differences in the underlying costs of production inputs or differences in costs of the manufacturing process of PFAS-free products. There may also be ongoing costs for consumers in Washington who prefer products made with PFAS.

Chapter 5. cVMS in Cosmetic Products

5.1 Cosmetic Products Market Size

Retail sales of cosmetic products in Washington are recorded in the economic census under the NAPCS codes 5001450000 and 5001425000. NAPCS 5001450000 includes face creams, makeups, and scents. We expect any product in this category would be considered a cosmetic as defined by Ecology. However, not all of the products that Ecology would consider cosmetics are covered by this category. NAPCS 5001425000 includes nail products, deodorants, and toothpastes, which fall into Ecology's definition of cosmetics, but also includes products that Ecology would not consider cosmetics, such as disposable diapers and facial tissues.

To estimate the total market value of cosmetics in Washington, we take the whole of NAPCS 5001450000 and estimate a proportion of NAPCS 5001425000 that is applicable to cosmetics. To do this, we break up the total cosmetic product market revenue into product categories using consumer product data from the Mintel Global New Products database, a market intelligence database that catalogues products and information about those products, to calculate average price by weight in each product category. We also use the California Air Resources Board 2015 Consumer Spending Survey[103] as an estimate of relative weights of product categories purchased in the retail market. The estimated percent of revenue for each product category is the average price per ounce for that product category in the Mintel database multiplied by the total weight of retail sales in that category and normalized so that the proportions of revenue equal one. This gives us a proportion of revenue for each product category.

We use this relative proportion of revenue to divide up the estimated cosmetic sales by products covered by NAPCS 5001450000, and impute the total sales for nail products, deodorants, and toothpastes according to the relative revenue of those product categories compared to the sales of products covered by NAPCS 5001450000.

As of 2022, the economic census records $4 billion in sales for NAPCS 5001450000 and $1.8 billion for NAPCS 5001425000 within Washington state.[104] Given the calculations described above, we assume that approximately 61% of NAPCS 5001425000 would be considered cosmetic products by Ecology. Adding these totals together, we estimate that Washington had $5.1 billion in cosmetic sales in 2022.

To translate the 2022 estimate to 2026 U.S. dollars, we assume that the growth in cosmetics sales between 2022 and 2026 is equal to the growth rate in the "personal care products" spending in Washington, the product category that best represents cosmetics.[105] This dataset

[103] https://ww2.arb.ca.gov/our-work/programs/consumer-products-program/consumer-commercial-products-surveys

[104]https://data.census.gov/table/ECNNAPCSIND2022.EC2200NAPCSINDPRD?g=040XX00US53&codeset=napcs~5001425000:5001450000

[105] SAPCE3 Bureau of Economic Analysis Personal Consumer Spending by State

ends in 2024, so we assume that the average annual growth rate of 4.4% per year over the previous 20 years continued into 2026. Based on this assumption, we estimate that total cosmetic sales in Washington in 2026 is approximately $6.1 billion per year.

5.2 Prevalence of cVMS in Cosmetic Products

To estimate the proportion of cosmetic products in the Washington market, we rely on data from the Mintel Global New Products Database. Of the new products in the U.S. market recorded in Mintel between 2006 and November 2025, 8.1% contain at least one of the cVMS: cyclotetrasiloxane (D4), cyclopentasiloxane (D5), cyclohexasiloxane (D6), or cyclomethicone among the listed ingredients.

An analysis of a potential cVMS restriction conducted by the European Chemicals Agency (ECHA) in 2018 assumed 11% of cosmetic formulations in the European market contained cVMS. However, this is an older estimate. California announced a ban on D4 cosmetics in 2023 to go into effect in 2027,[106] and Mintel data suggests cVMS is becoming less prevalent in cosmetic formulations over the past 10 years. Given these changes in the market, we prefer to use the updated data from Mintel when calculating the proportion of the Washington cosmetics market that contains cVMS.

cVMS is particularly prevalent in deodorants, where at least one cVMS was listed in nearly 60% of deodorants recorded in Mintel in years 2015–2016, though this rate has since declined to roughly 20% of new deodorant products in more recent years. Apart from deodorants, cVMS has been listed in less than 5% of new products in all product categories in 2025.

5.3 Market Pricing of Safer Alternatives

An ECHA report that analyzed replacing D4, D5, or D6 in cosmetic formulations assumed that alternative chemicals would cost roughly twice as much as the cVMS they would be replacing.[107] The report estimates about 15% of the total cost of restricting cVMS in cosmetics would be due to higher ingredient prices. If production costs are higher for formulations without cVMS, then we might expect prices to be higher as well in order to pass on some of that production cost to the consumer.

We are not aware of any published analyses estimating the price difference between cosmetic formulations with cVMS compared to those without cVMS. We estimate potential price differences using price information from the Mintel products database. After controlling for the year that the product was recorded in Mintel and the category and subcategory of the cosmetic product, we do not find any evidence to suggest that a cosmetic without a cVMS listed among

[106] https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=HSC&sectionNum=108980

[107] European Chemicals Agency (2019). https://echa.europa.eu/documents/10162/23665416/rest_d4d5d6_axvreport_annex_12152_en.pdf/19cf4b63-6192-e781-1b78-5ee334ca1351

the ingredients are priced any differently than a cosmetic that includes one or more cVMS among the ingredients.

5.4 Demand for Safer Alternatives

In general, cosmetic manufacturers and brands may position their products as safer or as made with non-toxic alternatives.

cVMS appears less frequently in positioning claims than some other chemicals like BTEX, which we cover for in Chapter 10. However, some organizations, including cosmetic brands, maintain a restricted substances list and recognize products that do not use any chemical that appears on the restricted substances list. Some of these product recognition lists restrict D4, D5, and D6, including Credo Clean Standard and Equity and Wellness Collaborative. Other lists include only some cVMS, usually D4, such as Ulta Beauty's "made without list" and Target's "clean list." D4 is only one type of cVMS that may be used in cosmetic products. Products with labels that imply that they are a safer product may be made without any cVMS, but it depends on the labeling and position claims being made. These claims may be difficult for consumers to evaluate without additional resources.

The use of cVMS appears to be decreasing over the past ten years. This may be due to regulations outside of Washington. The EU has restricted D4 and D5 in wash-off cosmetics since 2018.[108] California has restricted D4 in cosmetics beginning January 1, 2027. In 2024, the EU announced plans to limit D4, D5, and D6 to 0.1% or less in all cosmetic products, a restriction in which takes effect June 2027.

Research finds that consumers may be sensitive to positioning claims that manufacturers make about the product's personal or environmental health relative to other products.[109] However, product claims can also be misleading, causing consumers to shape their preferences in a way that would be different if they had more complete and accurate information.[110] It makes sense that safety-conscious consumers may prioritize cosmetics without cVMS leading to greater consumer demand for products without these ingredients, but the magnitude of that preference and the ability of consumers to differentiate between these products amidst potentially misleading positioning claims is unclear.

5.5 Potential Costs of a cVMS Restriction in Cosmetics

While it is possible that manufacturers would remove products that contain cVMS from the state in response to a restriction, we expect it is more likely that manufacturers would reformulate their products to remove cVMS if it were to be restricted in Washington. The industry appears to be broadly moving away from cVMS and Europe and California have restricted or limited the use of some cVMS in cosmetic products, all of which make it more likely for manufacturers to comply with a restriction by reformulating their cosmetic products.

[108] https://eur-lex.europa.eu/eli/reg/2024/1328/oj/eng
[109] Szaban, et al. (2025)
[110] Vendruscolo, et al. (2025)

If they did so, it would likely be reformulated for the entire U.S. market, which would allow them to continue to sell the same product in all states without worrying about different supply lines or losing significant market share.

If manufacturers were to reformulate their products in response to a restriction, they would incur costs, including identifying their preferred regulatory response, product reformulation, product performance testing, packaging modification, production scale-up, and project management. We can use reformulation costs from the FDA reformulation model for food and cosmetics, first developed in 2002[111] and revised in 2015.[112] While the 2015 version of the model is specifically updated to reflect food reformulations, the initial model is applicable to both food and cosmetic formulations. These average reformulation costs are on the order of $253,469 to substitute a minor functional ingredient or $868,874 on average to substitute a major ingredient,[113] assuming a shelf-stable, low-complexity product as cosmetics generally are.

The number of reformulations prompted by the restriction would depend on the number of formulations on the market that contain cVMS and how many would be reformulated to remove cVMS even in the absence of any restriction in Washington. Manufacturers reformulate cosmetics in the normal course of business; not just to meet regulations or anticipated regulations, but also to meet changes in market demand, such as for performance or sustainability claims, or in response to changes in supply of ingredients. Given that cVMS use has been decreasing over the past ten years, we expect that many manufacturers would have removed cVMS within their normal reformulation schedule even if Washington chose not to restrict cVMS in cosmetics. This underlying change in the industry reduces the expected costs of a restriction since the number of reformulations that contain cVMS is declining regardless of regulatory changes.

Reformulation would be a one-time cost, incurred sometime between when the restriction was announced and when it went into effect. We noted earlier that an ECHA analysis assumed that any replacement for cVMS would be roughly twice as expensive. If that were the case, manufacturers would also have a greater ongoing production cost. However, we did not find any evidence that cosmetics without cVMS as a listed ingredient were priced higher. Regardless of whether the cost is a one-time formulation cost alone or whether there is an additional ongoing production cost, it is possible that some of this cost would be passed on to consumers in the form of higher prices.

[111] White, et al. (2002)
[112] Muth, et al. (2015)
[113] Muth, et al. (2015) provides an estimated average cost of $189,619 to reformulate to remove a minor functional ingredient and an average cost of $650,000 to reformulate a major ingredient in Sep 2015 U.S. dollars. We adjust this according to the producer price index for chemical manufacturers for Mar 2026 U.S. dollars.

Chapter 6: PFAS in Firefighting Personal Protective Equipment

6.1 Firefighting Personal Protective Equipment Market Size

Federal economic categories are not well-suited to capturing the firefighting personal protective equipment (PPE) market in Washington. While the economic census estimates the value of manufacturing personal safety equipment in the United States, this is not specific to firefighting equipment.

Instead of relying on census data, we can estimate the size of the market based on the number of firefighters in Washington and estimates of gear costs per firefighter. The Bureau of Labor statistics estimates that 7,560 firefighters were employed in Washington as of May 2025.[114] While there are no official published estimates of average gear cost or longevity, we use online sources as the only data available. A blog post in May 2026 from one firefighting PPE cleaning and decontamination service estimates that each set of firefighting turnout gear costs between $3,000-5,000 per firefighter, not including replacements and backups.[115] A firefighting news and information website summarizes manufacturer claims that firefighting PPE is expected to last approximately 5 to 7 years.[116]

Based on these numbers, the cost of purchasing firefighting PPE in Washington at a rate that is sufficient to replace older gear would cost roughly $3.2 million to $7.6 million per year. However, that assumes one set of firefighting gear per firefighter. This figure would be higher if we assume that replacement firefighting gear is kept in stock on an ongoing basis.

6.2 Prevalence of PFAS in Firefighting Personal Protective Equipment

It is difficult to assess the prevalence of PFAS in firefighting PPE. One study of four sets of firefighting turnout gear found measurable total fluorine[117] in the thermal liner, moisture barrier, and the outer layers of all four sets of gear.[118] Ecology has issued orders for information from several firefighting PPE manufacturers concerning intentionally-added PFAS in their products. The response to these orders suggests that the presence of PFAS in firefighting PPE is common, but many manufacturers have begun to offer PPE options that use alternatives to PFAS.

[114] https://data.bls.gov/oes/#/home
[115] https://etdecon.com/blog/turnout-gear-cost
[116] https://www.firerescue1.com/fire-products/personal-protective-equipment-ppe/articles/gear-expectations-firefighters-expect-more-from-their-turnouts-E8IMiPiVxbLI1p25
[117] This is the measure that Ecology currently uses to presume the presence of PFAS in WAC 173-337-110
[118] Muensterman, et al. (2022)

6.3 Market Pricing of Safer Alternatives

We do not have particular pricing data on firefighting gear, which is a specialty market without accessible online retail data. In a previous analysis using retail prices from 2023, Ecology estimated that prices for PFAS-free rain-resistant apparel was roughly 50% more expensive than apparel that contained intentionally added PFAS.[119] It is possible given the function of PFAS in firefighting PPE, that PFAS-free alternatives are likewise more expensive, however we do not have any pricing data to draw any firm conclusions.

Under 2025 National Fire Protection Association (NFPA) standards, firefighting gear is now limited to 100 ppm PFAS and some PFAS-free options are available.[120]

6.4 Demand for Safer Alternatives

There appears to be considerable awareness of the health risks of PFAS exposure among firefighters and commensurate demand for gear that has lower concentrations of PFAS. The International Association of Fire Fighters (IAFF) has issued a safety advisory concerning the presence of PFAS in firefighter turnout gear and provided some recommendations to reduce PFAS exposure when using gear.[121] A recent lawsuit against the NFPA was ended only after a revised safety standard limited the concentration of PFAS in firefighting gear to no more than 100 ppm and required the concentration to be verified using independent testing.[122,123,124,125]

However, there is also concern that some PFAS-free alternatives make use of regrettable substitutions that may be more hazardous than the PFAS being replaced. The IAFF's notice on PFAS-free gear reports that one PFAS-free moisture barrier contained high concentrations of decabromodiphenyl ethane; a chemical on NFPA's restricted substance list.[126]

6.5 Potential Costs of PFAS in Firefighting Personal Protective Equipment

In the event of a rule restricting PFAS in firefighting PPE sold in Washington, Ecology would conduct a benefit-cost analysis. In general, we expect that any PFAS restriction in firefighting PPE would result in the affected products being reformulated in order to meet the restriction. However, the extent to which action would be required depends on the details of the

[119] Ecology (2024)
[120] https://www.iaff.org/pfas
[121] https://www.iaff.org/pfas/pfas-advisory
[122] https://www.iaff.org/news/iaff-files-lawsuit-against-nfpa-to-remove-pfas-from-gear
[123] https://docinfofiles.nfpa.org/files/AboutTheCodes/1970/Proposed_TIA_1792_NFPA_1970.pdf
[124] https://www.firerescue1.com/fire-products/Personal-protective-equipment-ppe/a-new-age-of-ppe-pfas-restricted-substances-and-turnout-gear
[125] The NFPA regulation defines PFAS as an organic chemical with at least one fully fluorinated carbon atom. PFAS concentration is measured using total fluorine. Both the definition of PFAS and measure of PFAS concentration are consistent with current PFAS regulation in Chapter 173-337 WAC.
[126] https://www.iaff.org/wp-content/uploads/2025/08/2025-08-PurchasingPPE.pdf

restriction. While this is true for all products, it particularly holds for firefighting PPE where the industry safety standard already requires the total fluorine content to be limited to 100 ppm. If Ecology were to set a regulation likewise limiting PFAS concentrations in firefighting PPE to no more than 100 ppm, it would reinforce an existing safety standard but may not require substantial reformulation by manufacturers. However, if a restriction were to set the maximum concentration of PFAS lower than 100 ppm, it may require significant reformulation by manufacturers.

Given the lack of data on reformulation costs for this industry, we would not be able to estimate reformulation costs directly. While reformulation cost estimates are available for some industries, such as food and cosmetics, we do not have this information for the firefighting PPE industry. This is something industry could provide if they chose, and we would incorporate it into our cost analysis.

There may be some ongoing cost associated with producing gear with lower concentrations of PFAS. For some products we would gather information on retail prices as one indication of this ongoing production cost. However, for firefighting PPE, this data-gathering method is not usually available. We may need to engage in more direct outreach with both producers and consumers to gather data on relative costs of PPE.

In the absence of data, we would likely assume that manufacturers or product lines impacted by the restriction would be able to reformulate their product over a certain timeline, but that this reformulation may not be uniform across all manufacturers or complete by the time regulation becomes binding. Previous cost analyses for Safer Products regulations have taken this approach by assuming ranges of potential adaptation timelines and proportions of manufacturers impacted.[127] Regulatory costs would depend on the share of the market impacted by the restriction and for how long. For any rulemaking, Ecology would consider how long it would reasonably be expected for manufacturers to adapt and would use that information to inform the regulatory timeline in order to reduce costs.

In addition to greater consumer safety, there may be performance differences between firefighting PPE that contains PFAS and those that do not. PFAS imparts effective water- and oil-repellency for PPE. It is possible that gear manufactured with alternative chemicals would be more or less effective or be more or less durable. While specifics of product performance could differ for firefighting PPE that uses alternatives rather than PFAS, firefighting PPE that uses alternatives is still required to meet NFPA standards.

[127] Ecology (2023b)

Chapter 7: PFAS in Floor Waxes and Polishes

7.1 Floor Waxes and Polishes Market Size

There is no economic data that we are aware of that is specific to the floor waxes and polishes consumer market.

Grand View Research estimates the total value of floor care chemicals sold in 2025 in the U.S. was $4 billion.[128] While this report includes floor waxes and polishes, it also includes floor and carpet cleaners, disinfectants, and strippers, and the report suggests that floor waxes and polishes are a relatively small proportion of the total market value within the broader category.

On the manufacturing side, the 2017 economic census estimates that total manufacturing of household and industrial floor polishes in the U.S. amounted to $27 million and $150 million, respectively.[129,130] If we assume that the manufacturing value in the United States accurately reflects the sale value, we can assume Washington sales are roughly equal to the United States manufacturing market scaled to Washington. We use a scale of 0.026, the proportion of spending on household maintenance in Washington compared to the United States as a whole in 2017. From 2017 to 2024, we assume spending grew a total of 58%, equal to the total change in spending on household maintenance. From 2024 to 2026, we assume 4.4% annualized growth, equal to the growth in spending on household maintenance over the previous twenty years in Washington. This procedure suggests that sales of floor waxes and polishes in Washington is about $5 million in 2026.

We considered supplementing manufacturing data with trade data to better estimate the value of floor waxes and polishes sold in the United States, in addition to the value manufactured. Unfortunately, trade data are also not sufficiently precise to capture imports and exports of floor waxes and polishes. Imports and exports are categorized into the Harmonized System codes. HS commodities 3404 and 3405 refer to “artificial and prepared waxes” and “polishes and creams for leather, wood, etc.,” respectively, both of which include many product categories beyond the floor waxes and polishes in the Ecology product category.[131]

7.2 Prevalence of PFAS in Floor Waxes and Polishes

While we are not aware of any large-sample testing or reporting of PFAS in floor waxes, there are several published studies that measure particular PFAS among a select sample of products. One study of five floor waxes and hard surface sealants finds FTOH (a PFAS precursor) in each of them, ranging in concentration from 3 ppm to 429 ppm.[132] An earlier study in 2009 measuring

[128] https://www.grandviewresearch.com/industry-analysis/us-floor-care-chemicals-market-report
[129] https://data.census.gov/table?g=010XX00US&codeset=napcs~2007900006
[130] https://data.census.gov/table/ECNNAPCSIND2017.EC1700NAPCSINDPRD?codeset=napcs~2046300006
[131] https://usatradeonline.census.gov
[132] Liu, et al. (2015)

concentration of PFCA (a class of PFAS) in ten floor waxes and hard surface sealants found PFCA in each of them.[133]

Many companies, including floor wax manufacturers, have been working to replace PFAS with non-PFAS alternatives over the last decade. As of July 2026, two manufacturers have registered floor finishers that meet the EPA's Safer Choice Standard, which only allows intentionally added chemicals recognized as safer by EPA. To our knowledge, no PFAS chemicals have been listed on the EPA Safer Chemical Ingredient List, which lists chemicals eligible for use in EPA Safer Choice certified products. Ecology has issued orders for information from several floor wax manufacturers concerning intentionally added PFAS in their products. These orders are in the process of being filled.

Chapter 173-337 WAC requires that floor wax and polish manufacturers report any intentional use of PFAS in these products by January 31, 2027. At that time, Ecology will have more information on the number of companies still using PFAS in this product category.

We considered whether it is possible to determine whether a floor wax or polish contains PFAS based on positioning claims. This is possible for some products, such as cookware, where specific claims are used to advertise a product that does not contain PFAS. However, specific claims around PFAS are not yet sufficiently common in the floor wax sector to assess the overall market. PFAS helps to impart the product with certain properties, such water-, stain-, or oil-resistance. Floor waxes that contain PFAS may be more likely to be marketed with these claims, but there are alternative chemicals that impart the same properties, and there may be uses of PFAS that do not have an associated marketing claim.

7.3 Market Pricing of Safer Alternatives

As of right now, we are not aware of any information on systematic market price differences between floor waxes and polishes that contain PFAS and those that do not contain PFAS. While some waxes and polishes are specifically advertised as PFAS-free (such as those with a Green Seal certification), most of the market is not sufficiently transparent about whether a product contains PFAS in order to make positioning claims that would be amenable to large-scale analysis or drive differences in consumer pricing.

7.4 Demand for Safer Alternatives

News about PFAS contamination coupled with PFAS restrictions across a variety of different product lines may be increasing consumer demand for PFAS-free alternatives in many products. It might also be leading to more PFAS-free positioning claims in industries even when PFAS has not been restricted. Some manufacturers of floor waxes and polishes advertise PFAS-free options, which suggests they expect a potential consumer response from these positioning claims. While there is no data on floor waxes in particular, research shows considerable

[133] Guo, et al. (2009)

consumer demand for avoiding PFAS exposure,[134] suggesting a demand for PFAS-free alternative products more generally, including floor waxes and polishes.

While there is demand for PFAS-free consumer products, there may also be differences in product quality or performance for PFAS-free alternatives. There are alternatives to the beneficial qualities that PFAS imparts to a product, such as water resistance. Floor waxes and polishes that use these alternatives are available on the market and are advertised for the same applications as products that contain PFAS. At this time, we do not have any information to suggest there are qualitative differences in performance between products with PFAS and products manufactured using alternatives.

7.5 Potential Costs of PFAS in Floor Waxes and Polishes

In the event of a rule restricting PFAS in floor waxes and polishes sold in Washington, Ecology would conduct a benefit-cost analysis. We expect that any PFAS restriction in floor waxes and polishes would result in the affected products being reformulated in order to meet the restriction. While PFAS has not yet been restricted in floor waxes and sealers, PFAS is regulated in many consumer products in several states which could be leading manufacturers to consider alternative formulations.

Given the lack of data on reformulation costs for this industry, we would not be able to estimate reformulation costs directly. While reformulation cost estimates are available for some industries, such as food and cosmetics, we do not have this information for the floor waxes and polishes industry. This is something industry could provide if they chose, and we would incorporate it into our cost analysis.

In the absence of data, we would likely assume that manufacturers or product lines impacted by the restriction would be able to reformulate their product over a certain timeline, but that this reformulation may not be uniform across all manufacturers or complete by the time regulation becomes binding. Previous cost analyses for Safer Products regulations have taken this approach by assuming ranges of potential adaptation timelines and proportions of manufacturers impacted.[135] Regulatory costs would depend on the share of the market impacted by the restriction and for how long. For any rulemaking, Ecology would consider how long it would reasonably be expected for manufacturers to adapt and would use that information to inform the regulatory timeline in order to reduce costs.

In addition to greater consumer safety, there may be performance differences between floor waxes and polishes that contain PFAS and those that do not. A restriction could provide a performance benefit or performance cost for consumers, or it may simply be neutral. However, at this point we do not have any information to suggest whether or how product performance may be impacted by restricting PFAS floor waxes and polishes.

[134] Ek and Wårell (2026); Lemos, et al. (2024); Marcus and Mueller (2024)
[135] Ecology (2023b)

Chapter 8: PFAS in Hard Surface Sealers

8.1 Hard Surface Sealers Market Size

The total retail sales of stain, varnish, shellac, and other coatings in Washington amounted to $47 million in 2017, the last year that data for this sector was recorded.[136] However, NAPCS code 5001850009, which these retail sales fall under, includes many products that would not be included in Ecology's definition of hard surface sealers. This includes varnishes and lacquers, which are instead included in Ecology's architectural paints product category. Across the entire United States, retail sales under this NAPCS category amounted to $1.84 billion in 2017, suggesting that Washington accounted for about 2.6% of total sales in the United States.

The manufacture of solvent-thinned clear finishes and sealers is measured under NAPCS 2040325021 for exterior surfaces and 2040325048 for interior surfaces. In 2017, manufacturing of finishes and sealers across the entire United States was valued at $60 million for exterior sealers and $148 million for interior surfaces. If we assume that the manufacturing value in the United States accurately reflects the sale value, we can assume Washington sales are roughly equal to the United States manufacturing market scaled to Washington. We use a scale of 0.026, the proportion of spending on stain, varnish, shellac, and other coatings in Washington compared to the United States as a whole in 2017. From 2017 to 2024, we assume spending grew a total of 58%, equal to the total change in spending on household maintenance. From 2024 to 2026, we assume 4.4% annualized growth, equal to the growth in spending on household maintenance in Washington over the previous twenty years. This procedure suggests that sales of solvent-thinned exterior and interior clear finishes and sealers amounted to $9 million in Washington in 2026.

Manufacture of exterior water-thinned stains and sealers was valued at an additional $426 million in the U.S. in 2017, but stains are not covered under the Ecology product category. Any restriction would affect only a fraction of the market.

8.2 Prevalence of PFAS in Hard Surface Sealers

While we are not aware of any large-sample testing or reporting of PFAS in hard surface sealers, there are several published studies that measure particular PFAS among a select sample of products. One study of five floor waxes and hard surface sealants finds FTOH (a PFAS precursor) in each of them, ranging in concentration from 3 ppm to 429 ppm.[137] An earlier study in 2009 measuring concentration of PFCA (a class of PFAS) in ten floor waxes and hard surface sealants found PFCA in each of them.[138]

[136] https://data.census.gov/table/ECNNAPCSIND2017.EC1700NAPCSINDPRD?g=040XX00US53&codeset=napcs~5001850009

[137] Liu, et al. (2015)

[138] Guo, et al. (2009)

One study specific to hard surface sealers measured total fluorine, extractable organic fluorine (EOF), and PFAS in stone sealers collected from the U.S. in 2021.[139] The study reported detectable total fluorine in 29 of 35 samples (83% of samples) and detectable EOF in 28 of 35, indicating the potential presence of PFAS. Of the 35 products tested, only six stone sealers contained total fluorine less than 50 ppm (13% of samples), and below detection limits for EOF and PFAS. Another published analysis of total organic fluorine (TOF) in 54 hard surface sealers and found that 13 of the 54 samples (24% of samples) contained TOF in the range of 0.4-2500 ppm.[140] However, only four of the 13 samples contained TOF higher than 50 ppm.

Many companies, including hard surface sealer manufacturers, have been working to replace PFAS with non-PFAS alternatives over the last decade. As of July 2026, two manufacturers have registered floor finishers that meet the EPA's Safer Choice Standard, which only allows intentionally added chemicals recognized as safer by EPA. To our knowledge, no PFAS chemicals have been listed on the EPA Safer Chemical Ingredient List, which lists chemicals eligible for use in EPA Safer Choice certified products. Ecology has issued orders for information from several hard surface sealer manufacturers concerning intentionally added PFAS in their products. These orders are in the process of being filled.

Chapter 173-337 WAC requires that hard surface sealer manufacturers report any intentional use of PFAS in these products by January 31, 2027. At that time, Ecology will have more information on the number of companies still using PFAS in this product category.

We considered whether it is possible to determine whether a hard surface sealer contains PFAS based on positioning claims. This is possible for some products, such as cookware, where specific claims, such as "PTFE-free" or "ceramic-based non-stick" are used to advertise a product that does not contain PFAS. However, specific claims around PFAS are not yet sufficiently common in the hard surface sealer sector to assess the overall market. PFAS helps to impart the sealer with certain properties, such water, stain, or oil-resistance. These sealers may be more likely to be marketed with these claims, but there are alternative chemicals that impart the same properties, and there may be uses of PFAS that do not have an associated marketing claim.

8.3 Market Pricing of Safer Alternatives

As of right now, we are not aware of any information on systematic market price differences between hard surface sealers that contain PFAS and those that do not contain PFAS. While some sealers are specifically advertised as PFAS-free (such as those with a Green Seal certification), most of the market is not sufficiently transparent about whether a product contains PFAS in order to make positioning claims that would be amenable to large-scale analysis or drive differences in consumer pricing.

[139] Savvidou, et al. (2026)
[140] Liu, et al. (2025)

8.4 Demand for Safer Alternatives

News about PFAS contamination coupled with PFAS restrictions across a variety of different product lines may be increasing consumer demand for PFAS-free alternatives in many products. It might also be leading to more PFAS-free positioning claims in industries even when PFAS has not been restricted. Some manufacturers of hard surface sealers advertise PFAS-free options, which suggests they expect a potential consumer response from these positioning claims. While there is no data on hard surface sealers in particular, research shows considerable consumer demand for avoiding PFAS exposure,[141] suggesting a demand for PFAS-free alternative products more generally, including hard surface sealers.

While there is demand for PFAS-free consumer products, there may also be differences in product quality or performance for PFAS-free alternatives. There are alternatives to the beneficial qualities that PFAS imparts to a product, such as water resistance. Hard surface sealer products that use these alternatives are available on the market and are advertised for the same applications as products that contain PFAS. At this time, we do not have any information to suggest there are qualitative differences in performance between products with PFAS and products manufactured using alternatives.

8.5 Potential Costs of PFAS in Hard Surface Sealers

In the event of a rule restricting PFAS in hard surface sealers sold in Washington, Ecology would conduct a benefit-cost analysis. We expect that any PFAS restriction in hard surface sealers would result in the affected products being reformulated in order to meet the restriction. While PFAS has not yet been restricted in hard surface sealers, PFAS is regulated in many consumer products in several states which could be leading manufacturers to consider alternative formulations.

Given the lack of data on reformulation costs for this industry, we would not be able to estimate reformulation costs directly. While reformulation cost estimates are available for some industries, such as food and cosmetics, we do not have this information for the hard surface sealer industry. This is something industry could provide if they chose, and we would incorporate it into our cost analysis.

In the absence of data, we would likely assume that manufacturers or product lines impacted by the restriction would be able to reformulate their product over a certain timeline, but that this reformulation may not be uniform across all manufacturers or complete by the time regulation becomes binding. Previous cost analyses for Safer Products regulations have taken this approach by assuming ranges of potential adaptation timelines and proportions of manufacturers impacted.[142] Regulatory costs would depend on the share of the market impacted by the restriction and for how long. For any rulemaking, Ecology would consider how

[141] Ek and Wårell (2026); Lemos, et al. (2024); Marcus and Mueller (2024)
[142] Ecology (2023b)

long it would reasonably be expected for manufacturers to adapt and would use that information to inform the regulatory timeline in order to reduce costs.

In addition to greater consumer safety, there may be performance differences between hard surface sealers that contain PFAS and those that do not. A restriction could provide a performance benefit or performance cost for consumers, or it may simply be neutral. However, at this point we do not have any information to suggest whether or how product performance may be impacted by restricting PFAS in hard surface sealers.

Chapter 9: Cadmium and Lead in Jewelry and Accessories

9.1 Jewelry and Accessories Market Size

In total, in 2022, costume and novelty jewelry in Washington accounted for $155 million in retail sales value.[143] The value of fine jewelry and watches was much greater, roughly $1.54 billion in Washington in 2022.[144] On average, Washington imported $10 million of costume jewelry each year between 2020 and 2025.[145,146] Over 70% of these imports were from China.[147]

To translate the 2022 estimate to 2026 U.S. dollars, we assume that the growth in jewelry sales between 2022 and 2026 is equal to the growth rate in the "jewelry and watches" spending in Washington.[148] This dataset ends in 2024, so between 2024 and 2026 we assume that the jewelry sales grew at the same rate of the previous 20 years (3.7% annualized growth rate). Based on this assumption, we estimate that total sales of costume and novelty jewelry in Washington as of 2026 is roughly $174 million and the sales of fine jewelry and watches is $1.73 billion.

9.2 Prevalence of Cadmium and Lead in Jewelry and Accessories

Individual testing of jewelry is required to determine concentrations of cadmium and lead. The amount of lead and cadmium in each product may vary across products that appear very similar.

In Washington, the Children's Safe Products, Chapter 70A.430 RCW, generally prohibits the manufacture or sale of any children's products, including jewelry, that contain more than 40 ppm of cadmium or more than 90 ppm of lead. Ecology has conducted product testing to assess compliance with statute in 2015, 2018 and 2025. In each instance, children's jewelry was selected from retail stores in south Puget Sound and online retailers. The jewelry selected was

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[143] https://data.census.gov/table?g=040XX00US53&codeset=napcs~5000455000
[144] https://data.census.gov/table?g=040XX00US53&codeset=napcs~5000500000
[145] This represents the Custom Value, which is an estimate of the cost of acquiring goods for export to the United States plus packing costs and fees. The retail value is expected to be greater as the retail price would reflect additional costs, such as transportation, and a profit margin for any intermediaries in the supply chain.
[146] Under HS Code 7117 "Imitation jewelry" available at https://usatradeonline.census.gov
[147] Toy and jewelry imports from China have previously been recalled due to high levels of lead or cadmium, including a 2010 recall of over of 200,000 jewelry items due to cadmium levels, though production and trade processes may have changed in the interim. Sampling 80 jewelry items for cadmium in 2018, Kern (2024) identified nine pieces of jewelry with 13% cadmium or more. Of those, six were labeled as originating in China while the remaining three were not labeled with a country of origin.
[148] SAPCE4 Bureau of Economic Analysis Personal Consumer Spending by State

inexpensive and marketed to children, and included, among other categories, bracelets, necklaces, hair accessories, and jewelry that was sold as part of apparel.[149]

- In 2015, Ecology sampled 159 articles of jewelry.[150] After pre-screening samples for any detection of cadmium or at least 90 ppm of lead by an XRF analyzer, 38 total samples were tested for metals at a detection limit of 1ppm.
    - Cadmium was detected in 26 of the jewelry products (16% of the jewelry items collected). Four items had concentrations of cadmium between 39.7% and 98.4%. Apart from those four, no item had cadmium of more than 100 ppm.
    - Lead was detected in 37 of the jewelry products (23% of the items collected). Three items contained at least 90 ppm of lead, including one that was 5% lead.
- In 2018, Ecology purchased 78 children's products and, after pre-screening, submitted 38 samples from 33 products for analysis.[151]
    - Cadmium was detected in 30 samples, with 11 samples exceeding the 40 ppm statutory limit. 3 samples were more than 50% cadmium.
    - Lead was measured in 36 of the 38 samples, with 7 of the samples exceeding the 90-ppm statutory limit. 3 samples had over 9% lead.
    - In total, 17 samples exceeded the Children's Safe Products statutory restriction on cadmium, lead, or both.
- In 2025, Ecology purchased 50 products from 12 retail stores,[152] and 40 products from 10 online retailers.[153] 120 total samples were sent for analysis, 60 samples from items purchased in stores and 60 samples from items purchased online.
    - Cadmium was detected in 57 total samples. Four retail samples and six online samples (from four distinct products) exceeded the 40-ppm statutory limit. The maximum concentration of cadmium purchased in retail stores was 67.5 ppm, while two products purchased online had multiple components that exceeded 14% cadmium
    - Lead was detected in total 70 samples. Three retail samples and one online sample exceeded the 90-ppm statutory limit. One retail item had a lead concentration of 19.5% and another was nearly 2% lead.
    - In total, 11 products (12% of the total products purchased) exceeded the statutory restriction on cadmium, lead, or both.

[149] Ecology (2016) notes that this category included necklaces that were packaged together with children's dresses or shirts, and follow-up testing prioritized jewelry sold with apparel (Ecology 2023).
[150] https://apps.ecology.wa.gov/publications/documents/1603007.pdf
[151] https://apps.ecology.wa.gov/publications/documents/2303004.pdf
[152] https://apps.ecology.wa.gov/publications/documents/2603006.pdf
[153] https://apps.ecology.wa.gov/publications/documents/2603017.pdf

A separate peer-reviewed study of cadmium in jewelry from discount stores found that 32 of 80 tested items had measurable levels of cadmium. Nine items had cadmium that exceeded 30%.[154]

While these analyses provide some insight into the concentration of cadmium and lead in children's jewelry products, it is unclear to what extent these findings may generalize to adult jewelry and accessories. Fine jewelry is generally thought to have lower cadmium and lead levels than costume jewelry because the attributes that lead provides, such as weight, malleability, and as a base for thin finishes of gold or silver, are achieved through other, more expensive materials or manufacturing processes.[155]

9.3 Market Pricing of Safer Alternatives

We are not aware of any systematic study or database with reliable estimates of the relationship between pricing of an item of jewelry and its lead and cadmium levels. Anecdotally, there is an expectation that more expensive items generally have lower levels of harmful metals.

Cadmium and lead may both be used to add weight and brighten colors in a way that would otherwise require a more expensive manufacturing process.[156,157] The addition of either metal is used to provide attributes that are desirable to consumers. Removing lead and cadmium may decrease the price that retailers could get for the same item.

9.4 Demand for Safer Alternatives

Research has found that consumers are responsive to information about lead levels when making purchasing decisions. A study tracking consumer response to high-profile toy recalls in 2007, mainly due to lead levels, found that sales of toys in product categories for manufacturers included in the recalls dropped by about 30% during the winter holiday season compared to those that did not experience a recall.[158] Another study of lead remediation in homes found that the value of lead paint hazard remediation was over $26,000 per home due to the increase in the capitalized housing value from prospective buyers willing to pay more for reduced lead exposure.[159] While we are unaware of similar studies for cadmium, it is likely that the value of avoiding cadmium exposure is similar given the negative health impacts of cadmium exposure. As we noted above, lead and cadmium concentrations in jewelry generally cannot be determined without chemical analysis, making it impossible for consumers to express their preference in the market.

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[154] Kern, et al. (2021)
[155] https://detectlead.com/lead-in-jewelry
[156] https://intl.dtsc.ca.gov/toxics-in-products/lead-in-jewelry
[157] https://dtsc.ca.gov/toxics-in-products/cadmium-in-childrens-jewelry
[158] Freedman, et al. (2012)
[159] Billings and Schnepel (2017)

Regulations have likely impacted the market and raised consumer awareness for cadmium and lead levels in jewelry. Since 2011, jewelry sold in the European Union cannot contain more than 0.01% of cadmium; and since 2015, cannot contain more than 0.05% of lead.[160] The U.S. Consumer Product Safety Improvement Act (CPSIA) declares any children's product with more than 100 ppm of lead to be a banned hazardous substance.[161] Several states regulate lead and cadmium in jewelry, primarily for children's products. For example, California requires that any children's jewelry contain 100 ppm of lead or less, with surface coatings limited to 90 ppm or less. Likewise, California limits cadmium in children's jewelry to 300 ppm with any surface coating limited to 75 ppm.[162] Similarly, Chapter 70A.430 RCW Children's Safe Products requires that lead and cadmium in children's jewelry cannot exceed 90 ppm and 40 ppm, respectively.

9.5 Potential Costs of a Cadmium and Lead Restriction in Jewelry and Accessories

It is likely that any jewelry manufacturing changes as a result of lead and cadmium restrictions would either remove the heavy metals completely or replace them with a safer alternative. If lead and cadmium were simply removed, the resulting product may have less weight, shine, or bright colors; attributes that may be valued by consumers. If these metals were replaced by safer alternatives, it is possible these attributes would remain largely intact but at a higher price point. In either case, it is likely that, if the lead and cadmium content of items were disclosed to consumers, many would be willing to make that tradeoff.

[160] https://eur-lex.europa.eu/eli/reg/2015/628/oj
[161] https://www.cpsc.gov/s3fs-public/pdfs/blk_pdf_cpsia.pdf
[162]https://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=HSC&division=20.&title=&part=&chapter=6.5.&article=10.1.1.

Chapter 10: BTEX in Nail Products

10.1 Nail Products Market Size

Based on the procedure outlined in section 5.1 on cosmetic products, we use economic census data to estimate that retail spending on nail products in Washington was $69.2 million in 2022. As for cosmetics broadly, we assume a 4.4% growth between 2022 and 2026, which suggests an estimated $82 million in retail spending on nail products in Washington in 2026.

10.2 Prevalence of BTEX in Nail Products

BTEX comprises the chemicals benzene, toluene, ethylbenzene, and xylene. We focus our cost analysis on toluene because the other three chemicals appear to be generally phased out of nail products currently on the United States market. Testing from California Department of Toxic Substances Control (DTSC) on nail products purchased in 2019 found xylenes in only 19 of 156 total products, ethylbenzene in 10 products, and benzene in 5 products, although none listed these ingredients on the label.[163] The Global Mintel Database does not record any instances of BTEX other than toluene as a listed ingredient in nail products for the U.S. market at any time in the last twenty years, and is rarely listed even outside the U.S. market. The EPA's ChemExpo database lists only one product that contains ethylbenzene. The Environmental Working Group's Skin-Deep® database lists five nail products with xylene,[164] but only one of these appears to still be on the market and the ingredient list for that product on the brand's website does not include xylene, which suggests it may have been replaced in the product since it was first listed.

Toluene is still occasionally present in cosmetics, but its intentional use appears to have been largely phased out. Since 2023, California has designated nail products containing toluene as a Priority Product and used an Alternative Analysis Threshold of 100 ppm for toluene in cosmetic products, which makes manufacturers responsible for ensuring their products do not exceed this concentration. This represents a potential threshold for defining intentionally added toluene. Testing of nail products purchased in 2019 detected toluene in 27 of 156 products (17%), but just three products included toluene as a labeled ingredient, each with a concentration above 409 ppm.[165] More recent testing of 522 nail products in California published in 2025 found that 0.8% of products exceeded 1000 ppm of toluene while 5.2% exceeded 100 ppm.[166] None of the tested products included toluene as a listed ingredient on the label.

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[163] https://dtsc.ca.gov/wp-content/uploads/sites/31/2023/11/SCP-Report_Nail-Products-Lab-Study_Final-Accessible-New.pdf
[164] Retrieve July 2026, https://www.ewg.org/skindeep/browse/ingredients/724873-XYLENE/
[165] https://dtsc.ca.gov/wp-content/uploads/sites/31/2023/11/SCP-Report_Nail-Products-Lab-Study_Final-Accessible-New.pdf
[166] https://dtsc.ca.gov/wp-content/uploads/sites/31/2025/10/Testing-Nail-Products-in-California-for-Toluene_Summary-of-Findings.pdf

Data from the Global Mintel Database as of October 2026 suggests that the proportion of nail products that listed toluene as an ingredient globally was 6.4% thus far in 2026, down from 11% in 2025. Toluene has not been listed on a nail product recorded in Mintel for the U.S. market since 2012. A conservative assumption would be that the proportion of cosmetic nail products with toluene in the U.S. market could be between the 0.8% of nail products (the proportion above 1000 ppm in California testing) and the 6.4% of nail cosmetic products with listed toluene released in the global market thus far in 2026.

10.3 Market Pricing of Safer Alternatives

BTEX chemicals are currently present in nail products only in low levels and are rarely, if ever, labeled. Given both the infrequency with which BTEX chemicals are used in products and the difficulty in identifying those products without laboratory analysis, it would be difficult to estimate price differences between products that contain BTEX and those that do not. We are not aware of any data to suggest systematic price differences between products based on the presence or absence of BTEX.

10.4 Demand for Safer Alternatives

In general, cosmetic manufacturers and brands may position their products as safer or as made with non-toxic alternatives.

Consumers appear to be more broadly aware of BTEX, particularly toluene, as a potentially harmful ingredient in cosmetic products. Toluene is listed as one of the "toxic trio" in different popular sources,[167,168] and toluene-free positioning claims are common in cosmetics, often under the label "3-free."[169]

Research finds that consumers may be sensitive to positioning claims that manufacturers make about the product's personal or environmental health relative to other products.[170] However, product claims can also be misleading, causing consumers to shape their preferences in a way that would be different if they had more complete and accurate information.[171] Safety-conscious consumers may prioritize nail products without BTEX, leading to greater consumer demand for products without these ingredients, but the magnitude of that preference and the ability of consumers to differentiate between these products amidst potentially misleading positioning claims is unclear.

[167] https://www.makeupsolve.com/2025/11/what-is-toxic-trio-in-nail-polish-and.html
[168] https://dtsc.ca.gov/wp-content/uploads/sites/31/2017/09/News-Release-T-04-12.pdf
[169] https://sustainablykindliving.com/best-non-toxic-nail-polish-brands-for-healthy-chip-free-mani
[170] Szaban, et al. (2025)
[171] Vendruscolo, et al. (2025)

10.5 Potential Costs of a BTEX in Nail Products

Given that toluene is becoming very infrequently used in the U.S. market, and states like California are restricting its use, we expect any products that contain intentionally added toluene would be reformulated for the market rather than withdrawn. We also assume that manufacturers would not necessarily remove toluene solely due to a Washington restriction on toluene in nail cosmetics. Rather, it would be a decision based on the larger regulatory and economic environment. California has also restricted toluene in nail products above 100 ppm, and use of toluene has been decreasing more generally due to health concerns. As a result of these several factors, we would assume that any cost associated with reformulating all nail products in the Washington market to remove toluene could reasonably be scaled by the relative proportion of Washington within the total U.S. "personal care" market: 2.15%.[172]

If manufacturers were to reformulate their products in response to a restriction, they would incur costs, including identifying their preferred regulatory response, product reformulation, product performance testing, packaging modification, production scale-up, and project management. As in the case of cosmetics, we can use reformulation costs from the FDA reformulation model for food and cosmetics, first developed in 2002[173] and revised in 2015.[174] The reformulation cost model breaks estimated costs into different bins based on the importance of the ingredient being replaced. In general, a "major ingredient" is assumed to represent at least 2% of the total product. Toluene concentration is generally much lower than that, so we assume that reformulations would generally be to substitute a "minor functional ingredient." We also assume it would be a low complexity reformulation because the final product is generally shelf-stable. In that case, the reformulation model suggests an average reformulation cost of roughly $259,158.[175]

The number of reformulations prompted by the restriction would depend on the number of formulations on the market that contain toluene and how many would be reformulated even in the absence of any restriction in Washington. Even without a restriction, manufacturers may continue to remove toluene from nail cosmetic formulations. In that case, costs associated with a restriction would be reduced because the number of reformulations caused by any restriction would be lower.

[172] Bureau of Economic Analysis SAPCE3 Personal consumption expenditures (PCE) by state by type of product for "Personal Care Products" in year 2024
[173] White, et al. (2002)
[174] Muth, et al. (2015)
[175] Muth, et al. (2015) provides an estimated average cost of $189,619 in Sep 2015 U.S. dollars. We adjust this according to the producer price index for chemical manufacturers for Mar 2026 U.S. dollars.

Chapter 11: Ortho-phthalates in Sealants, Caulks, and Adhesives

11.1 Sealants, Caulks, and Adhesives Market Size

Retail sales of sealants, caulks, and adhesives are not tracked by any economic codes. However, the wholesale market for sealants, caulks, and adhesives is reported in the economic census under NAPCS 4005482000. Wholesale data is not available for Washington specifically and would not necessarily be indicative of state-specific retail sales. For the entire United States, the estimated wholesale value of adhesives, sealants, and glues is $14.37 billion.[176]

We assume that total end-user sales in Washington is roughly equal to the United States wholesale market scaled to Washington. We use a scale of 0.028, the proportion of spending on household maintenance in Washington compared to the United States as a whole. While this assumption may not precisely capture Washington spending, it represents the market category for which we have information that matches the product category most precisely. From 2022, we assume 4.4% annualized growth in this spending category, equal to the growth in spending on this category in Washington over the twenty years before 2024. This procedure suggests that sales of sealants, caulks, and adhesives in Washington is about $431 million in 2026.

11.2 Prevalence of Ortho-phthalates in Sealants, Caulks, and Adhesives

The Cycle 2 report contains examples of products in the product category that contain ortho-phthalates. While there is no definitive estimate of the prevalence of ortho-phthalates, the EPA ChemExpo database may give some indication of the prevalence of specific ortho-phthalates in product categories. Among the two most common ortho-phthalates listed in the Cycle 2 report:

- Benzylbutyl phthalate was present in 14% of the caulks and sealants and 14% of the construction adhesives where it was screened for.
- Di(2-ethylhexyl) phthalate was present in 11% of the caulks and sealants and 11% of the construction adhesives where it was screened for.

In 2023, Ecology Center and Toxic Free Future tested a set of 33 caulks and sealants for phthalate content. While this is not a peer-reviewed scientific publication, they found that six of the products (18%) contained ortho-phthalates.[177] If we take this sample as representative of the Washington market, we expect that between 9% and 27% of caulks and sealants contain ortho-phthalates.

[176] https://data.census.gov/table?codeset=napcs~4005482000
[177] https://www.ecocenter.org/our-work/healthy-stuff-lab/reports/phthalates-caulks-and-sealants

11.3 Market Pricing of Safer Alternatives

The testing done by the Ecology Center and Toxic Free Future recorded the price of each product they tested.[178] There was no evidence from this price data that phthalate-free sealants and caulks would be more expensive than products that contain phthalates, either overall or within a particular category of sealant. However, it is not clear to what extent this testing is representative of the broader market.

As of right now, we are not aware of any other information on systematic market price differences between sealants, caulks, and adhesives that contain ortho-phthalates and those that do not contain ortho-phthalates. While some products are specifically advertised as phthalate-free, most of the market is not sufficiently transparent about whether a product contains phthalates in order to make positioning claims that would be amenable to large-scale analysis or drive differences in consumer pricing.[179]

11.4 Demand for Safer Alternatives

Manufacturers of sealants, caulks, and adhesives have made phthalate-free product claims,[180,181] even if these claims are not yet sufficiently widespread in the industry to inform most consumer decision-making. This suggests that manufacturers expect a potential consumer response to these positioning claims that may increase purchases of phthalate-free alternatives. Testing and outreach by advocacy groups[182] can also make the issue of phthalates in products a more salient issue for consumers in purchasing products. In addition, the EPA has announced its intent to more closely regulate certain phthalates, [183] which could potentially increase both demand for, and supply of, alternatives.

11.5 Potential Costs of an Ortho-phthalate Restriction in Sealants, Caulks, and Adhesives

We expect that any restriction of ortho-phthalates in sealants, caulks, and adhesives would result in these products being reformulated in order to meet the restriction. Even in the absence of a restriction in Washington, it is possible the market would be moving to phthalate-

[178] https://www.ecocenter.org/sites/default/files/2023-04/Caulks-and-Sealants-Test-Results-Ecology-Center.pdf

[179] There are products that contain adhesives, such as adhesive-backed vinyl flooring, that advertise as phthalate-free. However, in this case, a price comparison is not useful in distinguishing these products because the main concern for phthalates in the product is the vinyl flooring itself rather than the adhesive backing.

[180] https://www.henkel.com/press-and-media/press-releases-and-kits/2025-08-21-phthalate-free-sealing-henkel-introduces-new-pvc-based-compounds-for-pail-and-drum-applications-2082886

[181] https://specialfluids.totalenergies.com/en/hydroseal-hy-phthalate-free-plasticizer-hybrid-sealant

[182] For example, https://toxicfreefuture.org/blog/harmful-chemicals-found-in-sealants-commonly-used-for-construction-and-remodeling

[183] https://www.epa.gov/newsreleases/epa-announces-intent-regulate-dozens-uses-five-phthalate-chemicals-protect-workers-and

free alternatives given the regulation or restriction of phthalates in other products and the recognition of the health impacts of phthalate exposure.

In the event of a restriction, there are several strategies Ecology may use to estimate the potential costs of product reformulation in response to a restriction. At this time, there is no evidence that production costs would be different after a restriction, so any costs associated with a restriction would be one-time costs to reformulate the product. Given the lack of data on reformulation costs, we would not be able to estimate the cost of reformulating products directly. While this is available for some industries, such as food and cosmetics, we do not have this information for the sealant, caulk, and adhesive industry. This is something industry could provide if they chose, and we would incorporate it into our cost analysis. In the absence of data, we would likely assume that manufacturers or product lines impacted by the restriction would be able to reformulate their product over a certain timeline, but that this reformulation may not be uniform across all manufacturers or complete by the time regulation becomes binding. Previous cost analyses for Safer Products regulations have taken this approach by assuming ranges of potential adaptation timelines and proportions of manufacturers impacted.[184] Regulatory costs would depend on the share of the market impacted by the restriction and for how long. For any rulemaking, Ecology would consider how long it would reasonably be expected for manufacturers to adapt and would use that information to inform the regulatory timeline to reduce costs.

There may also be performance differences between products that contain ortho-phthalates and those that do not, which could impact consumer satisfaction. However, at this point we do not have any information to suggest whether or how product performance may be impacted by restricting ortho-phthalates in sealants, caulks, and adhesives in Washington. There may be performance costs to consumers or there may be benefits or a mix, depending on whether and how product performance is affected.

[184] Ecology (2023b)

12. 1,4-dichlorobenzene in Solid Deodorizers

12.1 Solid Deodorizer Market Size

A prevalent use of 1,4 dichlorobenzene (1,4-DCB) is as an indoor space deodorizer, with historic consumption pattern data from 1997 estimating a use of 35 to 55% of 1,4 dichlorobenzene used to produce space deodorant (HSDB, 1997). Currently in the Unites States, bathroom and toilet deodorizers do not have any federal law requiring ingredient disclosure. However, some companies do voluntarily disclose their ingredients.

Deodorizers do not fall neatly into any economic category tracked by state or federal government sources. Deodorizer manufacturers may fall into the NAICS category for "polish and other sanitation good manufacturing," which includes a variety of disinfectants and cleaners in addition to deodorants.[185] Given that deodorizers are a small part of this economic category, reporting the businesses or sales revenue associated with the entire category would dramatically overestimate the market impacted by any potential restriction.

According to one market research report, the total North American market for urinal deodorizer blocks was $430 million in 2024.[186] If we assume Washington state is a roughly at the mean level of consumption for North America, we can scale this continent-wide market estimate to the state of Washington using a ratio of Washington population to the population of North America, a scale of 0.0156.[187] This assumption would suggest total annual sales of urinal deodorizer blocks in Washington of about $6.7 million. While there may be other solid deodorizers not specific to urinals, a search of online retailers for indoor deodorizers suggests that urinal and toilet deodorizers are by far the largest segment of the market.

An EPA report sampled products in 2017 that contain 1,4-DCB.[188] The sample included urinal and toilet deodorizers, many of which were nearly entirely made up of p-Dichlorobenzene. Included in the sample were products made by the following companies:

- Big D. Industries
- Essendant Co.
- Jasol
- Fresh Products, LLC
- Interline Brands, Inc.
- Spartan Chemical Company, Inc.
- Triple S

[185] https://www.census.gov/naics/?input=325612&year=2022&details=325612
[186] https://growthmarketreports.com/report/urinal-deodorizer-block-market
[187] https://www.census.gov/popclock/world
[188] https://downloads.regulations.gov/EPA-HQ-OPPT-2018-0446-0024/content.pdf

Because manufacturing deodorizers does not fall neatly into a single manufacturing category that is tracked by either state or federal governments, a list of companies gives us some indication of the impacted parties. If a restriction were to be enacted in rule, we would gather primary market data from online retailers to supplement this list of producers to identify any additional businesses impacted by the restriction.

12.2 Prevalence of 1,4-dichlorobenzene in Solid Deodorizers

One study of 287 homes in Michigan in 2013 found measurable levels of 1,4-DCB in 95% of homes, and the authors note that room deodorizers are one potential source with most toilet deodorizers containing 1,4-DCB.[189] However, the study does not trace back the measurement to a particular source. While we are confident that products that contain 1,4-DCB exist in the solid deodorizer market, particularly for urinal and toilet deodorizing, we are not aware of any dataset that we could use to make assumptions about the proportion of the Washington solid deodorizer market that contains 1,4-DCB.

12.3 Market Pricing of Safer Alternatives

As of right now, we are not aware of any information on systematic market price differences between solid deodorizers that contain 1,4-DCB and those that do not. Pilot testing of alternative deodorizers in Erie County, New York in 2002 noted that a deodorizer without paradichlorobenzene or ammonium quaternary compounds cost roughly $0.83 more per block.[190] However, that is a single data point from more than twenty years ago, so we cannot use this to draw broad conclusions about the market.

12.4 Demand for Safer Alternatives

Several states restrict the manufacture or sale of solid air fresheners or toilet/urinal care products that contain 1,4-DCB, including California, Connecticut, and Maryland, among others. Restrictions increase the demand for alternatives within regulatory areas and may influence the broader market if it encourages the viability of some manufacturers or manufacturing processes. However, we currently do not have any information on how demand may exist for alternatives outside of areas where 1,4-DCB is already regulated in deodorizers.

12.5 Potential Costs of an 1,4-dichlorobenzene Restriction in Solid Deodorizers

We expect that any restriction of 1,4-DCB in solid deodorizers would result in these products being reformulated in order to meet the restriction. Even in the absence of a restriction in Washington, it is possible the market would be moving to alternatives that were free of 1,4-DCB given the regulation or restriction of 1,4-DCB in solid deodorizers in some states.

[189] Chin, et al. (2013)
[190] https://irp-cdn.multiscreensite.com/22c98fa0/files/uploaded/39849782-Deodorant-Blocks.pdf

In the event of a restriction, costs to produce solid deodorizers that do not contain 1,4-DCB may be different. There may also be performance differences between products that contain 1,4-DCB and those that do not, which could impact consumer satisfaction. An early pilot of an alternative product manufactured without 1,4-DCB suggested the alternative was more expensive – the equivalent of about $1.57 per block in 2026 U.S. dollars.[191,192] However, the pilot test also noted that that the alternative product lasted several times as longer than the product formulated with 1,4-DCB, potentially making it more cost-effective for consumers. Observations about both the expense and longevity of the alternative product are now over twenty years old. Products may have changed in the interim and, given the small product sample, these observations may not have been representative of the market even at the time they were made. At this point we do not have any information to suggest whether or how the manufacturing price or performance of solid deodorizers might change if 1,4-DCB is restricted in these products in Washington.

If we were to estimate the costs of a restriction for manufacturers, we would not be able to estimate the cost of reformulating products directly given the lack of data. While this is available for some industries, such as food and cosmetics, we do not have this information for the solid deodorizer industry. This is something industry could provide if they chose, and we would incorporate it into our cost analysis. In the absence of data, we would likely assume that manufacturers or product lines impacted by the restriction would be able to reformulate their product over a certain timeline, but would lose market share if that reformulation was not complete before the regulation was in force. Regulatory costs would depend on the share of the market impacted by the restriction and for how long.[193] For any rulemaking, Ecology would consider how long it would reasonably be expected for manufacturers to adapt and would use that information to inform the regulatory timeline in order to reduce costs until that reformulation was complete.

[191] https://irp-cdn.multiscreensite.com/22c98fa0/files/uploaded/39849782-Deodorant-Blocks.pdf
[192] Translated from $10 per dozen blocks in 2001 U.S. dollars.
[193] Ecology (2023b)

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