Final Regulatory Analyses:

Including the:

- Final Cost-Benefit Analysis
- Least-Burdensome Alternative Analysis
- Administrative Procedure Act Determinations
- Regulatory Fairness Act Compliance

Chapter 173-337 WAC

Safer Products Restrictions and Reporting (Cycle 1.5: PFAS)

By

Adam L. Hayes and Emma Diamond

For the

Hazardous Waste and Toxics Reduction Program

Washington State Department of Ecology

Olympia, Washington

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Contact Information

Hazardous Waste and Toxics Reduction Program

P.O. Box 47600
Olympia, WA 98504-7600
Phone: 360-584-5661
Website: Washington State Department of Ecology[1]

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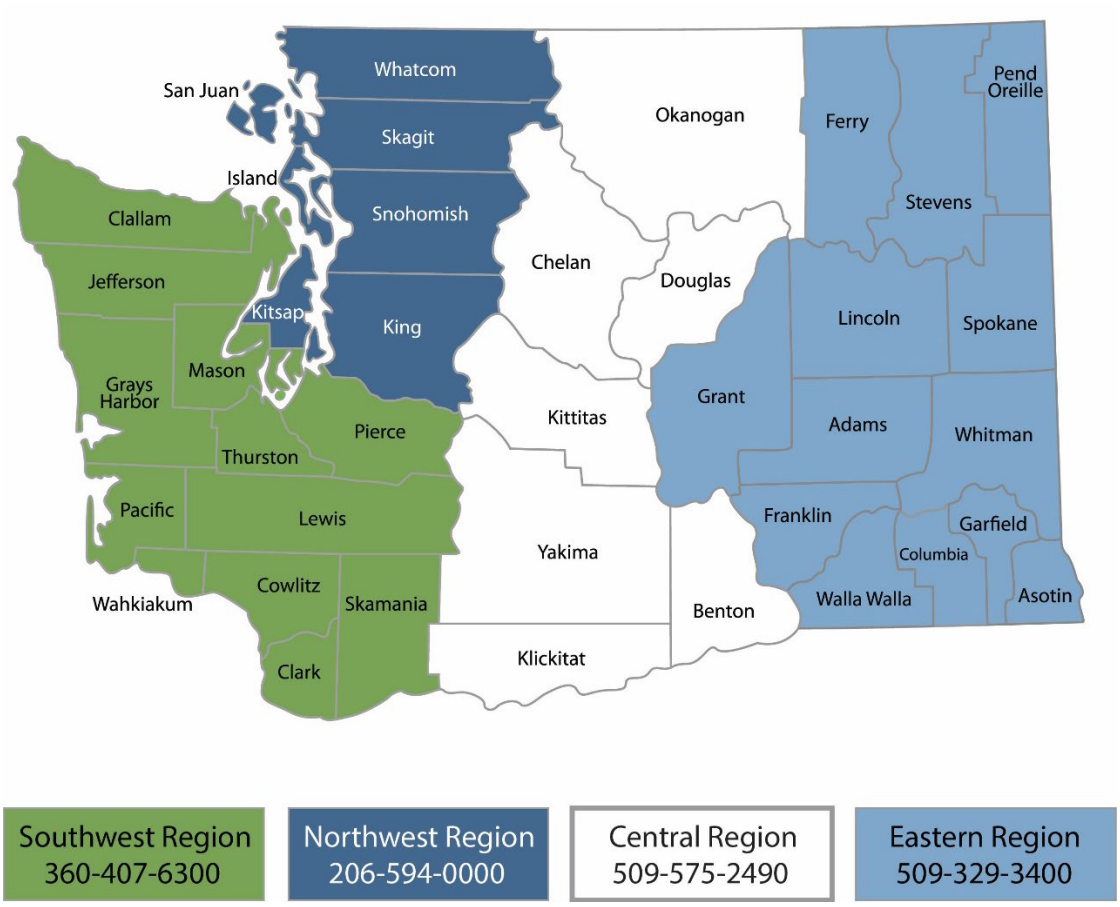

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Headquarters	Across Washington	P.O. Box 47600 Olympia, WA 98504	360-407-6000

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DEPARTMENT OF
ECOLOGY
State of Washington

Table of Contents

Tables

Abbreviations and Acronyms

APA	Administrative Procedure Act
CAS RN	Chemical Abstract Services Registry Number
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
ECHA	European Chemicals Agency
Ecology	Washington Department of Ecology
EPA	U.S. Environmental Protection Agency
FDA	U.S. Food and Drug Administration
HPCDS	High Priority Chemicals Data System
IC2	Interstate Chemical Clearinghouse
ng/g	Nanograms per gram
ng/L	Nanograms per liter
PFAS	Perfluoroalkyl and Polyfluoroalkyl Substances
PFNA	Perfluorononanoic Acid
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctane Sulfonate
ppm	Parts per million
RCW	Revised Code of Washington
RFA	Regulatory Fairness Act
WAC	Washington Administrative Code

Executive Summary

This report presents the determinations made by the Washington State Department of Ecology as required under Chapters 34.05 RCW and 19.85 RCW, for the amendments to the Safer Products Restrictions and Reporting rule (Chapter 173-337 WAC; the "rule"). This includes the:

- Final Cost-Benefit Analysis
- Least-Burdensome Alternative Analysis
- Administrative Procedure Act Determinations
- Regulatory Fairness Act Compliance

The adopted rule amends the Safer Products Restrictions and Reporting rule, Chapter 173-337 WAC, which is intended to reduce the use of priority chemicals in consumer products and increase transparency of product ingredients. The rule amendments restrict apparel and accessories, automotive washes, and cleaning products from being manufactured, distributed, or sold in Washington if Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) are intentionally added. It also requires manufacturers to report the concentration range of intentionally added PFAS in nine other product categories to an Ecology-designated chemical reporting database. The existing rule already restricts intentionally added PFAS in aftermarket stain- and water-resistance treatments as well as carpets and rugs as of January 1, 2025, and is set to restrict PFAS in indoor leather and textile furniture and furnishings starting January 1, 2026.

The adopted rule amendments:

- Restrict intentionally added PFAS in the following priority product categories:
    - Apparel and accessories
    - Automotive washes
    - Cleaning products
- Require reporting of intentionally added PFAS in the following priority product categories:
    - Apparel intended for extreme and extended use
    - Footwear
    - Gear for recreation and travel
    - Automotive waxes
    - Cookware and kitchen supplies
    - Firefighting personal protective equipment (PPE)
    - Floor waxes and polishes
    - Hard surface sealers
    - Ski waxes

PFAS restrictions are in place, or are scheduled to be in place in the next few years, in several U.S. states, representing large segments of the market for consumer products. We cannot be certain whether the response of any manufacturer, whether operating within the state of Washington or elsewhere, to remove PFAS would be due to the PFAS restrictions in the rule or due to restrictions or planned restrictions elsewhere. For the purposes of analyzing the rule impact, we assume the impacts of the rule are scaled to the state of Washington within the broader U.S. market.

Manufacturers add PFAS to apparel to provide stain and water resistance. We assume that the cost of complying with a PFAS restriction for apparel primarily falls on outdoor apparel manufacturers who would need to change their production process to remove any intentionally added PFAS. Given that the vast majority of apparel sold in the United States is manufactured elsewhere, we also assume the costs would be borne by apparel wholesalers who would need to contract with manufacturers to ensure PFAS is removed. For any apparel that is not water- or stain-resistant, we assume that the presence of PFAS is not required and can be removed from the supply chain as part of the contracting process between manufacturers or distributors and their suppliers. We expect manufacturers of automotive washes and cleaning products would also reformulate any product that includes intentionally-added PFAS. PFAS in cleaning products is generally used as a surfactant and many alternatives are readily available, which helps to reduce the reformulation cost.

To satisfy a reporting requirement under the rule, the responsible party – either a manufacturer, marketer, or distributor of a product made or sold in Washington that contains intentionally added PFAS – would need to submit an annual report in the Interstate Chemicals Clearinghouse High Priority Chemicals Data System. While we assume that the maximum possible number of reporting parties is the total number of manufacturers and wholesalers in the United States operating within each industry affected by the notification requirement, the actual number of reporting parties is likely far less than this maximum.

Table 1. Estimated present value of quantified costs (in $millions)

Rule Costs	Low Estimate	High Estimate
PFAS Restriction: Water-resistant apparel and accessories	50.8	359.9
PFAS Restriction: Other apparel and accessories	0.3	1.1
PFAS Restriction: Automotive washes and cleaning products	0.2	1.8
PFAS Restriction: Total	**51.3**	**362.7**
PFAS Reporting: Total	**n/a**	**6.6**

We expect there will be public and environmental health benefits associated with the rule amendment. PFAS exposure is associated with a number of negative health impacts, and we expect that restricting PFAS through the rule amendments would reduce those health impacts, including:

- Cancer, including kidney, lung, and testicular cancers
- Immune toxicity, including decreased vaccination response

- Developmental effects, including low birth weight
- Cardiovascular disease
- Endocrine effects, including thyroid disease
- Liver effects
- Diabetes

To partially quantify these benefits, we first adopt estimates of the expected health benefits for consumers associated with removing all PFAS from the environment. We then scale that number by the relative PFAS exposure from consumer products for which the rule amendment restricts intentionally added PFAS.

Table 2. Estimated present value of quantified benefits (in $millions)

Benefits	Low Estimate	High Estimate
PFAS Restriction: Apparel and accessories	377.6	7,980.0
PFAS Restriction: Automotive washes and cleaning products	3.5	228.0
PFAS Restriction: Total	**381.5 + Qualitative**	**8,208 + Qualitative**
PFAS Reporting: Total	**Qualitative**	**Qualitative**

Qualitative benefits may include:

- Benefits of the reporting requirement for market transparency and state and local government rules and programs.
- Additional benefits of PFAS reduction in the environment beyond the household-level benefits to PFAS reduction that were quantified in this analysis, including health benefits of reducing workplace PFAS exposure and reducing exposure among other species in the environment.
- The avoided cost that might otherwise be incurred if PFAS removal were to take place after it had already been released into the environment.

We conclude, based on a reasonable understanding of the quantified and qualitative costs and benefits likely to arise from the adopted rule amendments, as compared to the baseline, that the benefits of the rule amendments are greater than the costs.

Chapter 1: Background and Introduction

1.1 Introduction

This report presents the determinations made by the Washington State Department of Ecology as required under Chapters 34.05 RCW and 19.85 RCW, for the adopted amendments to the Safer Products Restrictions and Reporting rule (Chapter 173-337 WAC; the "rule"). This includes the:

- Final Cost-Benefit Analysis
- Least-Burdensome Alternative Analysis
- Administrative Procedure Act Determinations
- Regulatory Fairness Act Compliance

The Washington Administrative Procedure Act (APA; RCW 34.05.328(1)(d)) requires Ecology to evaluate significant legislative rules to "determine that the probable benefits of the rule are greater than its probable costs, taking into account both the qualitative and quantitative benefits and costs and the specific directives of the law being implemented." Chapters 1 - 5 of this document describe that determination.

The APA also requires Ecology to "determine, after considering alternative versions of the rule…that the rule being adopted is the least burdensome alternative for those required to comply with it that will achieve the general goals and specific objectives" of the governing and authorizing statutes. Chapter 6 of this document describes that determination.

The APA also requires Ecology to make several other determinations (RCW 34.05.328(1)(a) - (c) and (f) - (h)) about the rule, including authorization, need, context, and coordination. Appendix A of this document provides the documentation for these determinations.

The Washington Regulatory Fairness Act (RFA; Chapter 19.85 RCW) requires Ecology to evaluate the relative impact of rules that impose costs on businesses in an industry. It compares the relative compliance costs for small businesses to those of the largest businesses affected. Chapter 7 documents that analysis, when applicable.

1.1.1 Background

PFAS are a class of thousands of chemicals that are remarkably persistent in the environment, so much so that they are colloquially termed "forever chemicals." They are found in a wide variety of consumer products including non-stick coatings in cookware, clothing, shoes, cosmetics, automotive and ski waxes, and more. PFAS also have many industrial and commercial applications, such as certain firefighting foams. PFAS exposure is linked to negative health impacts for humans and the broader environment, but for many products the amount of PFAS they contain and the extent of human or environmental exposure from them is unclear. The widespread use and persistence of PFAS means that they are now found in the environment, animals, and people throughout the world.

The adopted rule amends the Safer Products Restrictions and Reporting rule, Chapter 173-337 WAC, which is intended to reduce the use of priority chemicals in priority consumer products and increase transparency of product ingredients. The rule amendments restrict apparel and accessories, automotive washes, and cleaning products from being manufactured, distributed, or sold in Washington if any PFAS is intentionally added. It also requires manufacturers to report the concentration range of intentionally added PFAS in nine other product categories to an Ecology-designated chemical reporting database. The existing rule already restricts intentionally added PFAS in aftermarket stain- and water-resistance treatments as well as carpets and rugs as of January 1, 2025, and is set to restrict PFAS in indoor leather and textile furniture and furnishings starting January 1, 2026.

Production and use of long-chain PFAS, such as perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA), have declined among U.S. manufacturers due to concerns over their persistence in the human body and negative human health impacts. These older PFAS are generally referred to as "legacy" PFAS. While manufacturers report they have generally been phased out from use, they are still detected in some new products and they are highly persistent in the environment. Newer PFAS, usually short-chain PFAS, are now being used in place of legacy PFAS. The toxicity of these new PFAS are still being studied, but other replacement PFAS are often found to have similar toxicity and persistence as the legacy PFAS they replace.

With these rule amendments, Washington joins several other states in restricting the use of PFAS in apparel, cleaning products, or both, including California, Colorado, Connecticut, Minnesota, and New York.

1.2 Reasons for the rule amendments

Ecology, in conjunction with the Washington Department of Health, administers Safer Products for Washington, a program that implements Chapter 70A.350 RCW. The law is designed to reduce the exposure of the public to toxic chemicals from consumer products, in particular toxic chemicals that are of high concern due to specific criteria outlined in the statute such as environmental persistence or the potential to harm sensitive groups.

The law defines five-year regulatory cycles to identify priority chemicals (Phase 1), identify priority products (Phase 2), determine regulatory actions (Phase 3), and adopt rules to implement the regulatory actions (Phase 4). The Safer Products Restrictions and Reporting Rule, Chapter 173-337 WAC, was adopted in May 2023, concluding the first Safer Products for Washington cycle.

The adopted rule amendments are the result of statutory amendments to Chapter 70A.350 RCW in 2022, which require Ecology to make additional regulatory determinations and adopt rules for consumer products containing PFAS. For this rulemaking, any product identified in the PFAS Chemical Action Plan[2] could be considered a priority product. Ecology finalized a

[2] https://apps.ecology.wa.gov/publications/summarypages/2104048.html

regulatory determinations report[3] in May 2024, completing Phase 3. The adopted rule amendments implement the determined regulatory actions, which the statute directs Ecology to adopt by December 1, 2025.

Because the statutory amendments targeting PFAS (RCW 70A.350.090) identify both the priority chemical and the products, they bypass Phases 1 and 2 of the normal Safer Products cycles. The abbreviated cycle for PFAS is wedged between Cycles 1 and 2, so Ecology refers to it as "Cycle 1.5."

Safer Products for Washington Cycle 2 is currently ongoing and is not the subject of the rule amendments. Ecology identified priority chemicals[4] and priority products[5] for Cycle 2, completing Phases 1 and 2 in May 2024 and June 2025, respectively. Ecology expects to publish and invite formal public comment on a draft regulatory determinations report for Phase 3 of Cycle 2 in late 2026. More details are available on the Safer Products webpage.[6]

1.3 Summary of the rule amendments

The adopted rule amendments:

- Restrict intentionally added PFAS in the following priority product categories:
    - Apparel and accessories
    - Automotive washes
    - Cleaning products
- Require reporting of intentionally added PFAS in the following priority product categories:
    - Apparel intended for extreme and extended use
    - Footwear
    - Gear for recreation and travel
    - Automotive waxes
    - Cookware and kitchen supplies
    - Firefighting personal protective equipment (PPE)
    - Floor waxes and polishes
    - Hard surface sealers
    - Ski waxes

[3] https://apps.ecology.wa.gov/publications/summarypages/2404023.html
[4] https://apps.ecology.wa.gov/publications/SummaryPages/2404025.html
[5] https://apps.ecology.wa.gov/publications/SummaryPages/2504030.html
[6] https://ecology.wa.gov/waste-toxics/reducing-toxic-chemicals/washingtons-toxics-in-products-laws/safer-products

1.4 Document organization

The chapters of this document are organized as follows:

- **Chapter 2 - Baseline and the rule amendments:** Description and comparison of the baseline (what would occur in the absence of the rule amendments) and the adopted rule requirements.
- **Chapter 3 - Likely costs of the rule amendments:** Analysis of the types and sizes of costs we expect impacted entities to incur as a result of the adopted rule amendments.
- **Chapter 4 - Likely benefits of the rule amendments:** Analysis of the types and sizes of benefits we expect to result from the adopted rule amendments.
- **Chapter 5 - Cost-benefit comparison and conclusions:** Discussion of the complete implications of the cost-benefit analysis.
- **Chapter 6 - Least-Burdensome Alternative Analysis:** Analysis of considered alternatives to the contents of the rule amendments.
- **Chapter 7 - Regulatory Fairness Act Compliance:** When applicable. Comparison of compliance costs for small and large businesses; mitigation; impact on jobs.
- **Appendix A - APA Determinations:** RCW 34.05.328 determinations not discussed in chapters 5 and 6.

Chapter 2: Baseline and Rule Amendments

2.1 Introduction

We analyzed the impacts of the rule amendments relative to the existing rule, within the context of all existing requirements (federal and state laws and rules). This context for comparison is called the baseline and reflects the most likely regulatory circumstances that entities would face if Ecology did not adopt the rule.

2.2 Baseline

The baseline for our analyses generally consists of existing laws and rules. This is what allows us to make a consistent comparison between the state of the world with and without the rule amendments.

For this rulemaking, the baseline includes:

- The existing Safer Products Restriction and Reporting Rule, Chapter 173-337 WAC.
- The authorizing statute, Chapter 70A.350 RCW.
- Federal Reporting and Recordkeeping Requirements for Certain Per- and Polyfluoroalkyl Substances, 40 CFR 705.
- Current and anticipated manufacturing practices due to recent economic and regulatory changes, including:
    - Growing public recognition of the environmental and health hazards of PFAS.
    - The recognition of certain PFAS as hazardous within the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).
    - Restriction of PFAS in select consumer products across several other states.

2.2.1 Safer Products Restriction and Reporting Rule

The existing Safer Products Restriction and Reporting Rule, Chapter 173-337 WAC, established important definitions, including for “intentionally added.”

“Intentionally added priority chemical” or “intentionally added” means a chemical that serves an intended function in the final product or in the manufacturing of the product or part of the product. Chemicals present from the use of recycled materials are not considered “intentionally added priority chemicals.”

The rule also establishes features of the reporting requirements, including:

- A hierarchy to determine the party responsible for reporting to Ecology.
- The timing of the notification.
- The content of the notification.

2.2.2 Chapter 70A.350 RCW

Chapter 70A.350 RCW[7] defines "Perfluoroalkyl and polyfluoroalkyl substances" or "PFAS Chemicals" as a "class of fluorinated organic chemicals containing at least one fully fluorinated carbon atom." The statute gives Ecology authority to "restrict or prohibit a priority chemical or members of a class of priority chemicals in a priority consumer product when it determines:

(a) Safer alternatives are feasible and available; and

(b) (i) The restriction will reduce a significant source of or use of a priority chemical; or

(ii) The restriction is necessary to protect the health of sensitive populations or sensitive species."

Engrossed Substitute House Bill 1694 passed in 2022 amended Chapter 70A.350 RCW. It directs Ecology to determine regulatory actions and adopt rules related to PFAS in consumer products.

> **PFAS Chemicals**
>
> (1) For purposes of the regulatory process established in this chapter, the department may consider any product identified in the department's final PFAS chemical action plan dated November 2021 as a source of or use of PFAS chemicals to be a priority consumer product under this chapter. No additional action, including publication in the Washington State Register, is required for the department to designate such a product as a priority consumer product for purposes of this chapter. For such products, the department may, under the process established in RCW **70A.350.040**, determine regulatory actions and adopt rules to implement those regulatory determinations.
>
> (2) Firefighting personal protective equipment, as defined in RCW **70A.400.005**, is established as a priority consumer product for PFAS chemicals.
>
> (3) For the products identified in this section, the department is directed to:
>
> > (a) Determine an initial set of regulatory actions under this chapter by June 1, 2024; and
> >
> > (b) Adopt rules to implement the initial set of determinations of regulatory actions under (a) of this subsection by December 1, 2025.

2.2.3 Federal Reporting and Recordkeeping Requirements for PFAS

The EPA has adopted a rule to require all businesses who have manufactured or imported PFAS, including PFAS contained in other articles, to report information on the PFAS supply chain, including identifying information for the business that manufactured or imported PFAS, the specific PFAS chemical, and how that chemical is used.[8] Businesses that only import PFAS

[7] https://app.leg.wa.gov/rcw/default.aspx?cite=70A.350

[8] https://www.epa.gov/system/files/documents/2024-05/tsca-8a7-reporting-instructions_may2024.pdf

contained in other articles are included in this reporting requirement, but are allowed to use a streamlined reporting form that reports less information.

Any entity that has manufactured or imported PFAS is required to report data on PFAS or articles containing PFAS for each year since 2011. The reporting deadline is currently set for April 13, 2026, for most entities. The deadline for small manufacturers[9] that are solely reporting PFAS contained in other articles is April 13, 2027.[10] The TSCA PFAS reporting webpage has additional details on the reporting requirements.

The EPA's technical definition of PFAS is somewhat narrower than the definition used by Ecology. From 40 CFR 705.3:

> "Any chemical substance or mixture containing a chemical substance that structurally contains at least one of the following three sub-structures:
>
> (1) R-(CF_2)-CF(R')R", where both the CF_2 and CF moieties are saturated carbons.
>
> (2) R-CF_2OCF_2-R', where R and R' can either be F, O, or saturated carbons.
>
> (3) $CF_3C(CF_3)$R'R", where R' and R" can either be F or saturated carbons."

While this definition would not include some chemicals that Ecology considers PFAS, such as trifluoroacetic acid, there is considerable overlap between the definition in federal rule and the definition in Chapter 70A.350 RCW. We are not aware of trifluoroacetic acid use as an ingredient in products, but it is a common persistent breakdown product of other PFAS.

2.2.4 Current and anticipated manufacturing practices

The EPA designated two PFAS chemicals, PFOS and PFOA, as hazardous substances under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) 2024.[11] While this does not restrict the use of these PFAS in consumer products, it does impose liability in the event a hazardous substance is released. Given this additional financial risk to manufacturers in the event of a chemical release, this may incentivize a change in production to alternative chemicals.

Several other states are regulating, or are in the process of regulating, PFAS in consumer products. Comments from manufacturers during rule development suggest that the larger PFAS regulatory environment will affect their compliance strategy. Many manufacturers may adjust

[9] The definition of small manufacturers is taken from 40 CFR 704.3 and is based on either total annual sales revenue (less than $12 million) or a combination of annual sales revenue and PFAS quantity (less than $120 million and less than 100,000 pounds, respectively).
[9] The definition of small manufacturers is taken from 40 CFR 704.3 and is based on either total annual sales revenue (less than $12 million) or a combination of annual sales revenue and PFAS quantity (less than $120 million and less than 100,000 pounds, respectively).
[10] https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/tsca-section-8a7-reporting-and-recordkeeping
[11] https://www.govinfo.gov/content/pkg/FR-2024-05-08/pdf/2024-08547.pdf[12] California, Colorado, Connecticut, Maine, Minnesota, and New York all use the same definition of PFAS as Chapter 70A.350 RCW.

their production process to match the most protective regulations rather than maintaining separate product lines for different states depending on PFAS regulation. Multiple states have restricted, or have committed to restrict, PFAS in the following consumer product categories:

- Apparel, accessories, and other textiles
- Automotive washes and waxes
- Cleaning products
- Cookware
- Floor polishes and maintenance products
- Outdoor apparel for severe wet weather conditions
- Ski waxes

The definition of PFAS chemicals in other state statutes and rules generally aligns with the definition in Chapter 70A.350 RCW.[12] However, states have different definitions for when PFAS in products may be covered by state laws or rules. For example, California Assembly Bill 1817 defines regulated PFAS as either:

> "(1) PFAS that a manufacturer has intentionally added to a product and that have a functional or technical effect in the product, including the PFAS components of intentionally added chemicals and PFAS that are intentional breakdown products of an added chemical that also have a functional or technical effect in the product.
>
> (2) The presence of PFAS in a product or product component at or above the following thresholds, as measured in total organic fluorine:
>
> (A) Commencing January 1, 2025, 100 parts per million.
>
> (B) Commencing January 1, 2027, 50 parts per million."[13]

While there is a similarity between this definition and the definition of "intentionally added" PFAS under Chapter 173-337 WAC, they are not completely aligned.

2.3 Rule amendments

The rule amendments:

- Restrict intentionally added PFAS in the following priority product categories:
    - Apparel and accessories

[12] California, Colorado, Connecticut, Maine, Minnesota, and New York all use the same definition of PFAS as Chapter 70A.350 RCW.
[13] https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=202120220AB1817[14] Fenton, et. al. (2021)

- Automotive washes
- Cleaning products

- Require reporting of intentionally added PFAS in the following priority product categories:
  - Apparel intended for extreme and extended use
  - Footwear
  - Gear for recreation and travel
  - Automotive waxes
  - Cookware and kitchen supplies
  - Firefighting personal protective equipment (PPE)
  - Floor waxes and polishes
  - Hard surface sealers
  - Ski waxes

2.3.1 Restrict intentionally added PFAS in priority products

Baseline

While other states have restricted, or scheduled restrictions, on the use of PFAS in apparel and cleaning products and the definition of PFAS is largely the same across states, the definition of "intentionally added" differs somewhat. We assume for the purposes of this analysis that rules in other states will not necessarily be binding on businesses operating in Washington.

A federal rule is scheduled to require importers of PFAS, including PFAS within articles, to report the use of PFAS. While the definition of PFAS in federal rule includes many of the same chemicals defined as PFAS by Chapter 70A.350 RCW and statutes in other states, it is a narrower definition and some chemicals considered PFAS by states will not be covered under the federal reporting requirement.

As adopted

No person may manufacture, sell, or distribute the following priority consumer products that contain intentionally added PFAS starting January 1, 2027, in the following consumer product categories.

- Apparel and accessories made from leather, natural textiles, synthetic textiles, or technical textiles, including but not limited to costumes, dresses, formal wear, gloves, hats, jackets, leggings, pants, scarves, shirts, skirts, socks, swimwear, and underwear (including reusable underwear for incontinence and reusable period underwear). The restriction **does not** apply to apparel and accessories intended to be disposed of after each use, firefighting PPE, footwear, apparel intended for extreme and extended use, gear intended to be used for recreation or travel, and apparel and accessories with

specific performance standards or criteria to protect the user from biological hazards or chemical hazards.

- Automotive washes, including products that clean the exterior of automobiles, including but not limited to the body, windshield, mirrors, lights, and grills. Automobiles include but are not limited to boats, buses, cars, emergency response vehicles, motorcycles, recreational vehicles, and trucks. This product category **does not** include automotive washes applied during automotive manufacturing, automotive waxes, all-in-one products designed to wash and wax automobiles, and products intended to clean an engine.
- Formulated cleaning products intended for residential, commercial, and institutional uses, including but not limited to all-purpose cleaning products, cleaning products with disinfectants, and cleaning products for glass, bathrooms, dishes, and tiles. The restriction **does not** apply to automotive washes, cleaning products that are intended only for use in industrial facilities, and pesticidal products not marketed as cleaning products. The restriction also does not apply to PFAS that is used as a propellant.

Ecology presumes the detection of total fluorine above 50 ppm indicates the intentional addition of PFAS. Manufacturers may rebut this presumption by submitting a statement to Ecology that PFAS were not intentionally added along with credible evidence supporting that statement.

Expected impact

As discussed in Section 2.2.4, PFAS restrictions are in place or are scheduled to be in place in the next few years in several U.S. states, representing large segments of the market for consumer products. We cannot be certain whether the response of any manufacturer, whether operating within the state of Washington or elsewhere, to remove PFAS would be due to the PFAS restrictions in the rule or due to restrictions or planned restrictions elsewhere.

Public comments received as part of the regulatory determination report suggest that most manufacturers will change their manufacturing process to exclude PFAS if large portions of the market have restricted PFAS in the product. It is likely that any change in the use of PFAS in the market as a whole is not necessarily due to regulation in any one particular state but as a cumulative impact of the regulatory environment. For the purposes of analyzing the rule impact, we assume the impacts of the rule are scaled to the state of Washington within the broader U.S. market.

There are some differences in how “intentionally added PFAS” is defined across states, potentially causing differences in which PFAS would be restricted across states. However, all definitions of intentionally added include PFAS chemicals that have an intended effect or function in the product. Because we expect that the overwhelming majority of PFAS in these product categories is intentionally added to produce some desired effect in the product, differences in the definition of “intentionally added” across states may have a relatively minimal impact on manufacturer responses in practice.

We expect the rule amendments will result in public and environmental health benefits as well as additional costs for manufacturers and distributors.

PFAS are highly resistant to degradation, with many persisting in the environment effectively indefinitely. Many PFAS chemicals are persistent in the bodies of animals, including humans. PFAS has been linked to numerous adverse human health outcomes that we believe may be partially mitigated by the rule, including, among others:[14-15]

- Cancer, including kidney, lung, and testicular cancers[16]
- Immune toxicity, including decreased vaccination response[17]
- Developmental effects, including low birth weight[18]
- Cardiovascular disease[19]
- Endocrine effects, including thyroid disease[20]
- Liver effects[21]
- Diabetes[22]

In addition to humans, PFAS have also been found in wildlife throughout ecosystems globally. Studies suggest many other organisms may have adverse health impacts from PFAS contamination, including in both aquatic and terrestrial species.[23] The rule will also serve to mitigate negative ecosystem effects of PFAS.

The rule amendments place additional restrictions on manufacturers and distributors, generating higher costs. In the case of automotive washes, cleaning products, and some apparel we expect these to be one-time costs associated with reformulating a product to exclude intentionally added PFAS.

In automotive washes and cleaning products, PFAS can function as a surfactant. In these cases, manufacturers are required to undertake the time and expense of altering their chemical formulation to replace PFAS while maintaining product performance standards. While we expect there will be a cost to this reformulation process, Ecology has identified many

[14] Fenton, et. al. (2021)
[15] Interstate Technology & Regulatory Council (2023)
[16] Sassano, et al. (2024); Seyyedsalehi and Boffetta (2023); C8 Science Panel: http://www.c8sciencepanel.org/pdfs/Probable_Link_C8_Cancer_16April2012_v2.pdf
[17] Grandjean, et al. (2012); Grandjean, et al. (2017); NTP (2016)
[18] Steenland, et al. (2018); Wikström, et al. (2020)
[19] Biggeri, et al. (2024); Meneguzzi, et al. (2021)
[20] C8 Science Panel: http://www.c8sciencepanel.org/pdfs/Probable_Link_C8_Thyroid_30Jul2012.pdf
[21] Maerten, et al. (2024); C8 Science Panel: http://www.c8sciencepanel.org/pdfs/Probable_Link_C8_Liver_29Oct2012.pdf
[22] Biggeri, et al. (2024)
[23] Interstate Technology & Regulatory Council (2023)

alternative surfactants.[24] We do not expect any alternative PFAS-free formulation will have different performance or higher production costs in these product categories.

In the case of apparel that does not require oil- or water-repellence, intentionally added PFAS does not provide an essential function. We expect manufacturers, potentially in coordination with distributors, will remove the restricted chemicals from the production process without any additional cost apart from the expense in contracting with suppliers to specify particular textile standards. The federal PFAS reporting requirements in the baseline may serve to reduce the costs of complying with the rule because manufacturers and distributors will be required to know and document the ways in which they have imported PFAS into the United States in apparel items. Nearly all apparel sold in the United States is imported,[25] so we expect most apparel manufacturers and distributors will be aware of how and where they utilize PFAS in their products as a result of the EPA reporting requirement.

PFAS has a function in some apparel, such as rain or ski jackets sold by outdoor apparel brands where PFAS provides water-repellence. PFAS can also be used to impart oil-resistance to work clothing. We expect outdoor apparel brands and others will be able to comply with the restrictions adopted in the rule amendment, though there may be some additional unit cost to production. Some manufacturers have developed alternative durable water repellant treatments and fabrics that can be used in the production of water- and oil-resistant apparel without the need for PFAS. However, an Ecology analysis in 2023 found that these products were priced higher, possibly reflecting higher production cost.[26] In that case, manufacturer and distributor costs would be ongoing over time.

The rule relies on a rebuttable presumption of intentional use based on total fluorine concentration, which we expect to help minimize compliance costs for regulated entities. The rule gives manufacturers significant flexibility in how they rebut our presumptions. In some cases, it could be a certified letter from their suppliers; in other cases, it could be product testing. Product testing may not be necessary if manufacturers have sufficient transparency across their supply chains, or if they undertake actions to improve supply chain transparency.

2.3.2 Require reporting of intentionally added PFAS in priority product categories

Baseline

The EPA will require all businesses who have manufactured or imported PFAS, including PFAS contained in other articles, to report information on the PFAS supply chain, including identifying information for the business that manufactured or imported PFAS, the specific PFAS chemical, and how that chemical is used. This will create a more transparent supply chain for PFAS and

[24] Table 5 in Ecology (2023b)
[25] https://www.usitc.gov/research_and_analysis/tradeshifts/2013/textiles_and_apparel.htm
[26] Ecology (2023b)

allow the intentional addition of PFAS within the supply chain to be identified more easily than it currently is.

PFAS is restricted, or is scheduled to be restricted, in certain product categories in other states, including ski waxes, cookware, automotive waxes, floor waxes and polishes, and textiles. To the extent that this restriction requires manufacturers to examine their products and supply chain for PFAS, or to remove PFAS from their production process, this will reduce the burden of the reporting requirement on regulated entities.

The baseline includes an Ecology process for reporting the presence of priority chemicals in priority products that has been used for products and chemicals requiring reporting under Cycle 1 of the Safer Products Restrictions and Reporting rule.

As adopted

A manufacturer must provide a notice to Ecology by January 31, 2027, and annually thereafter, for any of the following consumer product categories that contain intentionally added PFAS manufactured on or after January 1, 2026.

- Apparel intended for extreme and extended use made from leather, natural textiles, synthetic textiles, or technical textiles. Apparel for extreme and extended use means outdoor apparel designed to retain waterproofness when immersed in water (or other liquids) or snow, is intended for use in extreme weather, including, but not limited to, offshore fishing, offshore sailing, whitewater kayaking, or mountaineering, and is not marketed for general consumer use. This definition aligns with the definition of "outdoor apparel for severe wet conditions" in California Health and Safety Code Section 108970.[27] It **does not** include apparel for extreme and extended use intended to be disposed of after each use, firefighting PPE, footwear, apparel and accessories, gear intended to be used for recreation or travel, and apparel intended for extreme and extended use with specific performance standards or criteria to protect the user from biological hazards or chemical hazards.
- Footwear made from leather, natural textiles, synthetic textiles, or technical textiles. This includes, but is not limited to boots, sandals, shoes, and water shoes. It **does not** include footwear intended to be disposed of after each use.
- Gear for recreation and travel made from leather, natural textiles, synthetic textiles, or technical textiles. This includes but is not limited to backpacks, bags, climbing ropes, luggage, panniers, sleeping bags, sleeping pads, tents, and totes. It **does not** include firefighting PPE or gear that is designed to be disposed of after each use.
- Automotive waxes used to protect and enhance the exterior of automobiles. Automotive waxes include but are not limited to waxes that are part of all-in-one formulas that also clean automobiles. Automobiles include but are not limited to boats, buses, cars, emergency response vehicles, motorcycles, recreational vehicles, and

[27]https://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=HSC&division=104.&title=&part=3.&chapter=13.5.&article=

trucks. This product category does not include automotive waxes applied during automotive manufacturing.

- Cookware and kitchen supplies, defined as durable houseware items intended to contact food or beverages and used to prepare, dispense, or store food, foodstuffs, or beverages. This includes but is not limited to baking molds, baking sheets, bowls, cooking utensils, grills, lids, pans, pots, rice cookers, skillets, trays, and waffle makers. This product category does not include disposable or single-use cookware and kitchen supplies, major kitchen appliances, and internal components of cookware and kitchen supplies that do not contact food, foodstuffs, or beverages.
- Firefighting personal protective equipment (PPE), is defined in accordance with Chapter 70A.400.005 RCW and includes any clothing designed, intended, or marketed to be worn by firefighting personnel in the performance of their duties, designed with the intent for the use in fire and rescue activities, including jackets, pants, shoes, gloves, helmets, and respiratory equipment.
- Floor waxes and polishes intended to polish, protect, or enhance floor surfaces. Floor waxes and polishes can be used on a variety of floor types including but not limited to linoleum, stone, tile, vinyl, and wood.
- Hard surface sealers intended to seal hard porous surfaces to provide a barrier to protect such surfaces from liquids and soils including but not limited to concrete, hardwood, linoleum, stone, tile, and vinyl flooring.
- Ski waxes, defined as a lubricant applied to the bottom of snow runners to improve their grip or glide properties, including but not limited to hot wax, spray wax, rub-on wax, and related tuning products for snow runners like skis and snowboards.

Ecology presumes the detection of total fluorine above 50 ppm indicates the intentional addition of PFAS. Manufacturers may rebut this presumption by submitting a statement to Ecology that PFAS were not intentionally added and providing credible evidence to support that statement.

The notice to Ecology is the same for other consumer products with reporting requirements in the baseline Chapter 173-337 WAC. The existing rule defines a hierarchy to determine who is responsible for ensuring that Ecology is notified of any intentionally added PFAS in the priority product categories for which reporting is required:

1. The person or entity that had the priority consumer product manufactured unless it has no presence in the United States.
2. The person or entity that marketed the priority consumer product under their name or trademark unless it has no presence in the United States.
3. The first person or entity, whether an importer or a distributor, who owned the priority consumer product in the United States.

The rule states the reporting party may be:

- The manufacturer of the priority consumer product (or the marketer or distributor if the manufacturer does not have a presence in the United States), or
- A trade organization representing the reporting party.

The adopted rule amendments require the reporting party to submit a notification to Ecology by January 31, 2027, and annually thereafter by January 31. The reporting party may submit a revised notification to Ecology when a priority consumer product no longer contains an intentionally added priority chemical.

The notification must include the following information about a priority consumer product containing an intentionally added priority chemical, that is sold or offered for sale in Washington state during the prior calendar year, including:

- The name of the PFAS that is intentionally added as well as the CAS RN (Chemical Abstracts Service Registry Number) of the PFAS, if it has a CAS RN.
- The product category or product categories that contains the PFAS. The product category means the "brick" level of the GS1 Global Product Classification (GPC) standard, which identifies products that serve a common purpose, are of a similar form and material, and share the same set of category attributes.
- The product component within the product category that contains PFAS. The product component means a uniquely identifiable material or coating (including ink or dye) that is intended to be included as a part of a finished priority consumer product.
- A description of the function of the PFAS.
- The concentration range of each intentionally added PFAS in each product component in each product category. The reporting party may report the concentration in ranges rather than the exact concentration. If there are multiple concentrations for a given product component in a particular product category, the reporting party must report the highest concentration.
- The reporting ranges are:
    - Less than 100 ppm (0.01 percent).
    - Equal to or more than 100 ppm (0.01 percent), but less than 500 ppm (0.05 percent).
    - Equal to or more than 500 ppm (0.05 percent), but less than 1,000 ppm (0.1 percent).
    - Equal to or more than 1,000 ppm (0.1 percent), but less than 5,000 ppm (0.5 percent).
    - Equal to or more than 5,000 ppm (0.5 percent), but less than 10,000 ppm (1.0 percent).
    - Equal to or more than 10,000 ppm (1.0 percent).
- Contact information

- The name and address of the reporting party.
- The name, address, phone number, and electronic mail address of the contact person for the reporting party.
- When a trade organization serves as the reporting party, the notification must include a list of the manufacturers they report for and all the required information.
- Which option in the hierarchy in the rule best represents the reporting party.

- Any other information the reporting party deems relevant to the appropriate use of the product.

Expected impact

Reporting parties will need to notify Ecology when they use PFAS in a specific priority consumer product. To do this, reporting parties will need to create an account in the Interstate Chemical Clearinghouse (IC2) High Priority Chemicals Data System (HPCDS),[28] create their inventory, and then create their annual report.

We expect that reporting parties will generally be aware of whether and where PFAS is intentionally added to their products due to federal reporting requirements as well as regulations in other states. Despite the differences in the definition of PFAS between state and federal rules, we expect that most uses of PFAS that will require Ecology to be notified under the rule amendments would also need to be reported under the upcoming federal requirements. Even so, they may need to gather information along the supply chain to help identify some of the reporting requirements of the rule amendment, which will result in some labor costs.

We believe the rule will result in an informational benefit, both to consumers and government entities. The reporting requirement may help make consumers more aware of the chemicals included in their products, either directly or through advocacy organizations publicizing information from the HPCDS. This may help empower consumers when making market decisions. It may also help Ecology programs or other local or state governments when establishing programs, setting rules, or approving permits to identify potential sources of PFAS contamination and the potential exposure from those sources.

[28] https://www.theic2.org/hpcds/

Chapter 3: Likely Costs of the Rule Amendments

3.1 Introduction

We analyzed the likely costs associated with the rule amendments, as compared to the baseline. The rule amendments and the baseline are discussed in detail in Chapter 2 of this document.

Ecology estimates costs of rulemakings using a twenty-year time horizon. Industry costs in the future are discounted to the present value using a real annual discount rate of 5.3%. This means that a cost that occurs in one year will be worth 5.3% more than if it had occurred in the following year. This discount rate is determined by taking the EPA estimates of the corporate discount rate used in the economic benefit of non-compliance model[29] over the past 18 years, 7.9%. This model assumes the corporate discount rate is equal to the average weighted cost of capital, or the average minimum earnings necessary for a business to service debt, pay shareholders, and the cost of any other securities. Subtracting the increase in producer price index for manufacturing[30] over the previous 20 years, 2.6%,[31] from the corporate discount rate results in the real corporate discount rate after adjusting for inflation.

3.2 Cost analysis

The rule amendments:

- Restrict intentionally added PFAS in the following priority product categories:
    - Apparel and accessories
    - Automotive washes
    - Cleaning products
- Require reporting of intentionally added PFAS in the following priority product categories:
    - Apparel intended for extreme and extended use
    - Footwear
    - Gear for recreation and travel
    - Automotive waxes
    - Cookware and kitchen supplies
    - Firefighting personal protective equipment (PPE)

[29] We choose 18 years because this is the maximum allowable in the model. BEN 2024.0.0. https://www.epa.gov/enforcement/penalty-and-financial-models
[30] https://fred.stlouisfed.org/series/PCUOMFGOMFG
[31] Calculated from August 2005 to August 2025

- Floor waxes and polishes
- Hard surface sealers
- Ski waxes

3.2.1 Restrict intentionally added PFAS in priority products

The restrictions to intentionally added PFAS in apparel and accessories, automotive washes, and cleaning products being made or sold in Washington are similar to rules or statutes in other states restricting intentionally added PFAS in similar consumer products. We expect the cumulative effect of these state-level restrictions will alter the general market in the United States, leading to the general phase out of PFAS chemicals in these consumer product categories.

There are cumulative benefits of this rule to human health and the environment. However, we expect the cumulative impact of the rule, together with similar rules in other states, to also impact costs for suppliers, manufacturers, distributors, and retailers.

Apparel and Accessories

The rule will restrict intentionally added PFAS in apparel and accessories beginning January 1, 2027. Examples of apparel and accessories include:

- Costumes
- Dresses
- Formal Wear
- Gloves, hats, and scarves
- Jackets, including rain and ski jackets
- Pants and leggings
- School uniforms
- Shirts
- Skirts
- Socks
- Swimwear
- Underwear, including reusable underwear for incontinence or period underwear

PFAS in apparel and accessories are also restricted, or scheduled to be restricted, in California, Colorado, Connecticut, Maine, and New York.

PFAS chemicals are generally used in apparel and other textiles to impart water resistance. It is particularly common in rain jackets and other outdoor wear advertised as water-proof or water-resistant. A 2022 analysis by Toxic-Free Future found 34 of 47 (72%) of products marketed as stain- or water-resistant contained PFAS.[32] In the same study, no products without a stain- or water-resistant marketing claim tested positive for PFAS. Other studies have similarly

[32] Schreder and Goldberg (2022)

said that textiles without any water- or stain-resistant claims generally do not test positive for PFAS.[33]

Water-resistance is a particularly desirable feature in jackets and other outdoor apparel. A 2023 study found detectable PFAS in 35 of 56 jackets (63%).[34] Manufacturers may also use PFAS in activewear fabrics to impart some degree of water repellence that may be marketed as "moisture wicking," though information from industry representatives claims that moisture wicking as a feature is counter to the normal functions of PFAS.[35] While there have been few studies of activewear that we are aware of, a 2022 analysis by Mamavation found 8 of 32 (25%) yoga pants in their sample tested positive for PFAS.[36]

Given the important function of PFAS in some outdoor apparel, it is not surprising that indoor apparel brands are able to change production more quickly and easily to reduce or eliminate PFAS compared to outdoor brands. A 2022 study by the National Resource Defense Council (NRDC) surveyed 30 top U.S.-based apparel and apparel retail brands, including both indoor and outdoor apparel sectors.[37] The NRDC graded brands, in part, based on their PFAS phaseout timeline and the range of products covered by PFAS policies. In a 2023 market analysis, Ecology used Dun and Bradstreet market data to analyze the market share of brands included in the NRDC survey. The analysis found that 83% of the indoor apparel brands by market share that were included in the survey had already phased out all PFAS or had established a timeline for phasing out all PFAS.[38] By contrast, only 32% of outdoor apparel and gear brands by market share had made any PFAS commitments, and most of those were only a partial PFAS phaseout.

Since 2022, several other outdoor brands have announced they have phased out PFAS or are in the process of phasing out intentionally added PFAS. These brands include REI,[39] Patagonia,[40] Cotopaxi,[41] and Outdoor Research.[42] In addition to government regulation, a growing recognition of PFAS as environmentally persistent, widely used in outdoor apparel, and dangerous to human and environmental health has contributed to a greater market share voluntarily phasing out PFAS use.

We assume that the cost of complying with a PFAS restriction for apparel primarily falls on outdoor apparel manufacturers and wholesalers. Given the number of outdoor apparel brands switching to PFAS-free alternatives, it is clear that PFAS-free water-resistant apparel technology

[33] Rodgers, et al. (2022)
[34] Strakova, et al. (2023)
[35] Personal Communication. American Apparel and Footwear Association.
[36] https://mamavation.com/product-investigations/non-toxic-activewear-guide-pfas-workout-leggings-yoga-pants.html
[37] Natural Resource Defense Council (2022)
[38] Ecology (2023a)
[39] REI announced a phase-out timeline for PFAS in Product Impact Standards Version 3.1, but in light of new restrictions instead require compliance with PFAS regulation https://www.rei.com/dam/18549043_product_impact_standards.pdf
[40] https://www.patagonia.com/our-footprint/pfas.html
[41] https://www.cotopaxi.com/pages/common-thread-story/pfas-faqs
[42] https://www.outdoorresearch.com/blogs/stories/what-is-pfas?

is available on the market. However, it is possible that alternatives to PFAS may be relatively costly even if they are generally available. A 2023 Ecology market analysis of water-resistant apparel estimated that PFAS-free items were priced nearly 50% higher than similar products.[43] We assume this represents the additional cost associated with manufacturing PFAS-free rain and snow apparel compared to manufacturing processes that use PFAS. Given the lack of specific cost data, we believe this represents a reasonable starting place for cost analysis. While we use this as our initial cost estimate, attributing the entire PFAS-free premium to higher cost is likely pessimistic. The price increase could be a method of price differentiation,[44] increasing producer revenue by raising the price for consumers who are responsive to PFAS-free positioning claims.

The rainwear[45] and snow apparel[46] markets represented an estimated $710 million and $4.7 billion in 2022, respectively, annually in the United States. Translating these numbers to 2025 dollars[47] and scaling the number to the Washington population[48] results in a total estimated market of $204.5 million per year for which water-resistance is an integral feature for the apparel.

We expect production costs of PFAS-free water-resistant apparel and gear to decrease over time relative to the alternatives with PFAS that would be restricted by the rule. A standard feature of many production innovations is that manufacturers are able to integrate a novel technology into their production process and reduce production cost as it becomes more widely adopted and used.[49]

We expect that all manufacturers will be able to contract with suppliers to switch to PFAS-free alternative fabrics or to develop their own PFAS-free waterproofing process by the time the restriction goes into effect. Without any specific information about the costs of product switching or PFAS-free water-resistant material production, we assume the cost is 50% higher as of January 2025 when PFAS restrictions in textiles went into effect in some states. As noted above, this is a very conservative assumption. In the absence of information on cost dynamics of PFAS-free water-resistant apparel technology, we assume this 50% higher cost will decrease linearly over time, until the manufacturing cost is on par with alternatives that contain PFAS in 10 years with a potential range of 5 to 20 years, representing the low- and high-cost scenarios, respectively.

Combining our assumptions of cost dynamics with estimates of the Washington market for rainwear and snow apparel, we estimate the additional cost of removing PFAS from production of outdoor apparel would have been roughly $63.1 million per year as of January 1, 2025. However, we assume this additional cost declines over time and would be between $37.9 and

[43] Ecology (2023a)
[44] Armstrong and Vickers (2001)
[45] https://www.grandviewresearch.com/horizon/outlook/rainwear-market/united-states
[46] https://www.grandviewresearch.com/horizon/outlook/snow-apparel-market/united-states
[47] https://fred.stlouisfed.org/series/CPIAUCSL
[48] https://www.census.gov/quickfacts/fact/table/US,WA/PST045224
[49] Huggett and Ospina (2001)

$56.8 million per year when the restriction takes effect on January 1, 2027. The value of the estimated cost, discounting future cost to the present value using the discount rate discussed in section 3.1 is $166 million (with a range of $51 million to $360 million).

For any apparel that is not water- or stain-resistant, we assume that PFAS can be removed from the supply chain as part of the contracting process between manufacturers or distributors and their suppliers. We assume this will take between 10 and 40 hours of labor for each manufacturer and wholesaler. Based on the nature of the work, we assume a cost of $52.38 per hour for the business, which includes the median hourly wage rate for buyers and purchasing agents in Washington[50] adjusted for inflation with an additional 30% expense for overhead.

We identified 8,888 apparel manufacturers and 12,774 apparel wholesalers located in the United States using Dun and Bradstreet market data. Scaling this value to Washington, we estimate the total one-time cost of the PFAS restriction in the rule amendments associated with PFAS restriction in apparel that is not marketed as water-resistant is between $265 thousand and $1,061 thousand. See Table 1 for a summary of the total cost of compliance for apparel industries.

Table 3. Apparel and accessories compliance costs

Compliance Type	Low Estimate	High Estimate
Water-resistant apparel	$50.8 million	$359.9 million
Other apparel	$0.3 million	$1.1 million
Total apparel	$51.1 million	$360.9 million

Automotive Washes and Cleaning Products

The rule amendments restrict intentionally added PFAS in cleaning products and automotive washes, beginning January 1, 2027. While these two product categories are considered separate priority product categories in the rule amendments, we consider them together here as well as in Section 4.2.1 due to the similarity in the product categories, the similar function of PFAS in both product categories, and because these two product categories are combined in some PFAS research and reporting.

The definition of cleaning products in the rule includes formulated cleaning products intended for residential, commercial, and institutional uses. The definition includes but is not limited to all-purpose cleaning products, cleaning products with disinfectants, and cleaning products for glass, bathrooms, dishes, and tiles.

Automotive washes are defined as products that clean the exterior of automobiles including but not limited to, the body, windshield, mirrors, lights, and grills. Automobiles include a variety of vehicles, including but not limited to boats, buses, cars, emergency vehicles, motorcycles, recreational vehicles, and trucks. The definition of automotive washes in the rule does not include automotive washes applied during automotive manufacturing, automotive waxes, all-in-one products that both wash and wax, or products intended to clean an engine.

[50] https://data.bls.gov/oes/#/area/5300000

PFAS in cleaning products are most often used as a surfactant.[51] A surfactant lowers the surface tension of a liquid, so it can be more easily spread across and wet the surface that is being cleaned. Surfactants provide an essential function in these products, but it is a function that can be easily replaced by other, safer alternative surfactants.[52] In general, it is thought that the function of PFAS in cleaning products, including automotive washes, is straightforward to replace.[53] PFAS may also be used as a propellant, a mechanical component, or as part of the container in a cleaning product. However, these functions are not restricted in the rule.

PFAS in cleaning products, including automotive washes, are also restricted or scheduled to be restricted in Colorado, Connecticut, Maine, and Minnesota.

PFAS-free options for cleaning products are widespread. The EPA Safer Choice program,[54] which is designed to help consumers identify products that have fewer adverse consequences for the environment and human health, restricted products that contain PFAS from receiving certification as of 2022.[55] Over 2,000 products are currently certified. Among certified cleaning products are more than 300 all-purpose cleaners, more than 100 dish cleaners, 80 bathroom cleaners, and 15 car care products.

There are few estimates of PFAS prevalence in cleaning products. PFAS in cleaners may generally not be widespread other than for ones that advertise 'stain protection', especially carpet cleaners.[56] It is also possible that it is used in such low quantities that it is not widely reported, as little as 0.1% of the formulation.[57] A study of Swedish cleaners purchased in 2012-2013 found detectable PFAS in 8% of tested products.[58] By contrast, a study that tested 9 cleaning agents found that few contained PFOS or PFOA, but that 3 of them tested positive for FTOH.[59] These are older estimates, and the market may have changed considerably since these products were tested.

Given the lack of data, we assume that anywhere between 2% and 20% of cleaning products could contain PFAS. We use 10% to represent a middle value. We find nearly 3,000 household cleaning products have been added over the past ten years to the Mintel Global New Products Database for the United States market, and we take that as the number of current cleaning product formulations on the market. This suggests that between 60 and 600 cleaning products will be affected if the entire product category complies with the restriction in the rule by reformulating to remove PFAS.

Without any specific data on reformulation costs for cleaning products, we use estimates from another domain for which reformulation costs are available. The FDA has developed and

[51] Ecology (2023b)
[52] Table 4 in Ecology (2023b)
[53] Glüge, et al. (2021)
[54] https://www.epa.gov/saferchoice
[55] https://www.epa.gov/newsreleases/epa-continues-take-actions-address-pfas-commerce
[56] Personal Communication. Household and Commercial Products Association. June 2024.
[57] Gaines (2023)
[58] Favreau, et al. (2017)
[59] Kotthoff, et al. (2015)

published a model of reformulation costs in food and cosmetic formulations.[60] There are similar considerations across these industries for quality and consistency of chemical formulations which we believe makes for a reasonable approximation of reformulation costs in cleaning products.

According to the FDA model, the estimated average reformulation cost to replace a minor functional ingredient in a low complexity product is $256,652 after adjusting for inflation. While there is a range of potential reformulation costs, we take the average and allow all the uncertainty in the analysis to be in the number of products that will be reformulated under the rule amendments. Given the relative availability of substitute ingredients for PFAS in cleaning products and the absence of many of the regulatory and safety requirements for cleaning products compared to the food and cosmetic industries for which the model was originally estimated, we revise these estimates down by 50%.

After adjusting for inflation and scaling from the U.S. market to the Washington market, the estimated one-time cost to comply with the rule for cleaning products and automotive washes is $901 thousand with an estimated range of between $180 thousand and $1,802 thousand.

3.2.2 Require reporting of intentionally added PFAS in priority product categories

The rule amendments require manufacturers, or another responsible party defined by the hierarchy outlined in 2.3.2, to report the intentional use of PFAS in specific priority products by January 31, 2027. This reporting requirement applies to the following priority products:

- Apparel intended for extreme and extended use made from leather, natural textiles, synthetic textiles, or technical textiles. Apparel for extreme and extended use means outdoor apparel designed to retain waterproofness when immersed in water (or other liquids) or snow, is intended for use in extreme weather, including, but not limited to, offshore fishing, offshore sailing, whitewater kayaking, or mountaineering, and is not marketed for general consumer use. This definition aligns with the definition of "outdoor apparel for severe wet conditions" in California Health and Safety Code Section 108970.[61]
- Footwear made from leather, natural textiles, synthetic textiles, or technical textiles. This includes, but is not limited to boots, sandals, shoes, and water shoes.
- Gear for recreation and travel made from leather, natural textiles, synthetic textiles, or technical textiles. This includes but is not limited to backpacks, bags, climbing ropes, luggage, panniers, sleeping bags, sleeping pads, tents, and totes.

[60] Muth, et al. (2015)

[61] https://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=HSC&division=104.&title=&part=3.&chapter=13.5.&article=

- Automotive waxes used to protect and enhance the exterior of automobiles. Automotive waxes include but are not limited to waxes that are part of all-in-one formulas that also clean automobiles. Automobiles include but are not limited to boats, buses, cars, emergency response vehicles, motorcycles, recreational vehicles, and trucks. This product category does not include automotive waxes applied during automotive manufacturing.
- Cookware and kitchen supplies, defined as durable houseware items intended to contact food or beverages and used to prepare, dispense, or store food, foodstuffs, or beverages. This includes but is not limited to baking molds, baking sheets, bowls, cooking utensils, grills, lids, pans, pots, rice cookers, skillets, trays, and waffle makers. This product category does not include disposable or single-use cookware and kitchen supplies, major kitchen appliances, or internal components of cookware and kitchen supplies that do not contact food, foodstuffs, or beverages.
- Firefighting personal protective equipment (PPE), is defined in accordance with Chapter 70A.400.005 RCW and includes any clothing designed, intended, or marketed to be worn by firefighting personnel in the performance of their duties, designed with the intent for the use in fire and rescue activities, including jackets, pants, shoes, gloves, helmets, and respiratory equipment.
- Floor waxes and polishes intended to polish, protect, or enhance floor surfaces. Floor waxes and polishes can be used on a variety of floor types including but not limited to linoleum, stone, tile, vinyl, and wood.
- Hard surface sealers intended to seal hard porous surfaces to provide a barrier or to protect such surfaces from liquids and soils including but not limited to concrete, hardwood, linoleum, stone, tile, and vinyl flooring.
- Ski waxes, defined as a lubricant applied to the bottom of snow runners to improve their grip or glide properties, including but not limited to hot wax, spray wax, rub-on wax, and related tuning products for snow runners like skis and snowboards.

The rule does not require testing, and we assume that regulated parties will use other methods to assess the PFAS content of their products, such as knowledge of their supply chain and their manufacturing process. In many cases reporting parties may have already gathered much of this information to comply with federal PFAS reporting requirements. Retailers who act as importers or distributors of products made by companies with no presence in the United States may also need to report, but Ecology assumed the number of importing companies reporting (rather than their manufacturers or manufacturers reporting on their behalf) will be minimal.

These estimates do not account for regulations in other states or other domains that may reduce reporting costs for specific product categories. California restricts PFAS in all textiles as of January 1, 2025, including textiles used in footwear or in gear for recreation. The only exception to this restriction is for outdoor apparel for severe wet conditions. California has a population nearly five times greater than Washington with a commensurate larger portion of

the U.S. apparel market.[62] As one of the largest U.S. markets, PFAS regulations in California will likely have an outsized impact on producer behavior. Colorado and Maine will also implement similar restrictions on PFAS in apparel in the next several years. Automotive waxes, cookware and kitchen supplies, ski waxes, floor waxes and polishes, and many hard surface sealers that contain PFAS are restricted, or scheduled to be restricted, in Colorado, Connecticut, Maine, and Minnesota. Collectively, the population of these states is more than twice that of Washington.[63] Fluorinated ski waxes are also restricted at certain ski areas and prohibited in International Ski and Snowboard Federation events. Given these restrictions in addition to the federal reporting requirements, some businesses may have considerable information about the PFAS content of their products.

To comply with the reporting requirement, the reporting party will need to create an account in the Interstate Chemicals Clearinghouse High Priority Chemicals Data System, create their inventory, and create and submit the annual report. We assume that reporting costs are roughly equivalent to the costs estimated in the previous regulatory analysis for Chapter 173-337 WAC, although we have reduced the estimated total labor time required for reporting by 25%. The federal PFAS reporting requirements and regulatory actions in other states concerning PFAS should reduce the amount of labor necessary to comply with reporting requirements compared to the previous rulemaking. We assume the reporting requirement would take up to 2 hours of labor for an administrative manager (with a median hourly wage of $65.92) and up to an hour of a chemist working in manufacturing (with a median hourly wage of $45.71) to submit the report to Ecology. The wage assumptions are consistent with the regulatory analyses for the first cycle of the Safer Products for Washington rulemaking[64] but may be somewhat conservative. Ecology's previous experience with existing reporting requirements in other products and chemicals suggests the notification may be completed by a non-managerial employee at a lower hourly wage rate. We adjust both wage rate estimates to account for overhead expenses, which we assume represents 30% of the wage.

The hierarchy in the existing rule that identifies the responsible party for notifying Ecology is:

1. The person or entity that had the priority consumer product manufactured unless it has no presence in the United States.
2. The person or entity that marketed the priority consumer product under their name or trademark unless it has no presence in the United States.
3. The first person or entity, whether an importer or a distributor, who owned the priority consumer product in the United States

This suggests that either a manufacturer, marketer, or distributor (or a trade organization representing these businesses) may be the party responsible for notifying Ecology if a product made or sold in Washington contains intentionally-added PFAS. We assume that the maximum possible number of reporting parties is the total number of manufacturers and wholesalers in

[62] https://www.census.gov/quickfacts/fact/table/WA,CA/PST045224
[63] https://www.census.gov/quickfacts/fact/table/WA,CO,MN,ME,CT/PST045224
[64] Kniazeva, et al. (2023)

the United States operating within each industry affected by the notification requirement. We also make the simplifying assumption that all reporting parties will face roughly the same total cost associated with the notification. Larger manufacturers or wholesalers may have considerably more products to report which could increase their costs. However, they may also have specific resources associated with the scale of their business, such as information technology or specialty technical expertise, that would reduce the unit cost of each notification. Without specific information, we assume the notification costs across all parties are effectively equal.

We note that the actual number of reporting parties is likely far less than the maximum possible number. The existing rule specifies that only a single party is responsible for notifying Ecology. This means that if a U.S. company manufactures a covered product that contains intentionally-added PFAS and a wholesaler sells that product in Washington, then the manufacturer alone would be responsible for notifying Ecology. Furthermore, not every manufacturer and wholesaler in the U.S. operates in Washington. Among those that do, a considerable number may notify Ecology through a trade organization as permitted by the rule, which we expect would reduce the cost considerably as it is likely that average per unit reporting costs decrease as the number of reported products increases. For that reason, we consider our estimate to be a maximum estimated total cost.

We use the Economic Census data on the number of establishments associated with each North American Product Classification System (NAPCS) to identify manufacturers and wholesalers who may be required to notify Ecology under the rule amendments. In most product categories the NAPCS code included many establishments that would be beyond the definition of the product category in the rule, notably apparel intended for extreme and extended use, gear for recreation and travel, automotive waxes, firefighting PPE, floor waxes and polishes, hard surface sealers, and ski waxes. This makes the count of manufacturers and wholesalers in these industries an extremely conservative one and again emphasizes that this is a maximum potential cost of the rule amendments.

The Census data reports on the number of establishments rather than number of businesses. Because the rule would permit a single notification if the same product is manufactured or sold at several locations owned by the same business, we adjust the number of establishments according to the general ratio of number of wholesale establishments to number of wholesale firms,[65] which results in a reduction in the count by 29% for each product category.

In all, we identified a maximum of 28,515 businesses that operate in the United States among the covered industries and therefore may have to report to Ecology. Multiplying this count by the expected costs for each business, $230.82 from the three hours of work across two employees and an additional 30% overhead, and adjusting the cost to account for discounting, results in a total reporting cost of up to $6.6 million. Although the actual cost will likely be far lower for the reasons discussed previously.

[65] https://data.census.gov/table/ECNSIZE2022.EC2200SIZEEMPEST

3.2.3 Distribution of Costs

We expect any costs associated with the rule for non-water resistant apparel and accessories, automotive washes, cleaning products, and all of the priority product categories that will be required to report intentionally-added PFAS will not substantially impact businesses apart from modest one-time costs associated with product reformulation or reporting. We do not expect the rule amendment to have a substantial impact on product availability or price for these products.

However, an Ecology analysis has found that water-resistant apparel made without intentionally added PFAS is significantly more expensive than alternatives that include PFAS. We expect this price disparity to dissipate over time, but that process may take months or years. While our cost analyses in sections 3.2.1 and 3.2.2 assume that any additional costs associated with the rule amendments will fall primarily on manufacturers and wholesalers associated with the impacted industries, it is likely that a significant increase in manufacturing costs will likely be passed on, at least partially, to consumers as higher prices. While the rule may impact each consumer roughly equitably in absolute terms and water-resistant apparel is often a small expense relative to other spending, it may still impact lower income individuals disproportionately as a proportion of total income.

Among Washingtonians, those who identify their race as Hispanic or Latino, American Indians and Alaskan Natives, Native Hawaiians and Other Pacific Islanders, and Black or African American, as well as other races and those that identify as two or more races have incomes below the average for the state.[66] Cumulatively, these groups account for about 53% of the Washington population, and it is possible they may be more negatively impacted by the rule amendments.

[66] https://data.census.gov/table/ACSST1Y2023.S1902

Chapter 4: Likely Benefits of the Rule Amendments

4.1 Introduction

We analyzed the likely benefits associated with the rule amendments, as compared to the baseline. The adopted rule amendments and the baseline are discussed in detail in Chapter 2 of this document.

Ecology estimates costs and benefits of rulemakings using a twenty-year time horizon. Benefits in the future are discounted to the present value using a real annual discount rate of 0.41%. This means that a benefit that occurs in one year will be worth 0.41% more than if it had occurred in the following year. This discount rate is determined by using the average return on U.S. Treasury I-Bonds[67] and subtracting changes in inflation measured by the consumer price index,[68] resulting in the real average annual return over the previous twenty years on an investment that can be considered essentially risk-free.

4.2 Benefits analysis

The rule amendments:

- Restrict intentionally added PFAS in the following priority product categories:
    - Apparel and accessories
    - Automotive washes
    - Cleaning products
- Require reporting of intentionally added PFAS in the following priority product categories:
    - Apparel intended for extreme and extended use
    - Footwear
    - Gear for recreation and travel
    - Automotive waxes
    - Cookware and kitchen supplies
    - Firefighting personal protective equipment (PPE)
    - Floor waxes and polishes
    - Hard surface sealers

[67] https://www.treasurydirect.gov/savings-bonds/i-bonds/i-bonds-interest-rates/
[68] https://www.bls.gov/cpi/

- Ski waxes

Hazards of Per- and Polyfluoroalkyl Substances (PFAS)

PFAS is a large class of thousands of chemicals[69] defined in Chapter 70A.350 RCW as containing at least one fully fluorinated carbon atom. The bonds between carbon and fluorine do not easily break down under natural conditions, which is why PFAS are generally referred to as "forever chemicals."[70] This resistance to degradation causes these chemicals to persist and accumulate in the environment, terrestrial and aquatic plants and animals, and people. People may be exposed to PFAS through drinking contaminated water, eating contaminated foods, breathing contaminated air or dust particles, or coming into skin contact with a contaminated surface. Nursing infants may also be exposed through breast milk.[71]

The persistence of PFAS in the environment results in continued toxic exposure even if they are removed from products. Sources of long-chain "legacy" PFAS, such as PFOS and PFOA, have largely been replaced by newer alternative PFAS that generally have shorter carbon chains. But legacy PFAS continue to accumulate in the environment as well as in landfills and wastewater treatment plants, which are generally not equipped to remove them effectively.[72]

Legacy PFAS are generally the most well-studied, especially PFOS and PFOA. Both chemicals are immunotoxins, associated with a suppressed immune response and reduced infectious disease resistance,[73] including reduced immune response to childhood vaccinations.[74]

Research has found a link between PFAS and certain cancers. The C8 Science Panel, which studied the link between PFOA exposures and health impacts in the Mid-Ohio Valley between 2005-2013, concluded a probable link between PFOA exposure and testicular and kidney cancers.[75] A subsequent meta-analysis that included additional studies likewise found a link between PFAS and testicular and kidney cancers.[76] A more recent meta-analysis found evidence that PFAS is linked to lung cancer as well, though not thyroid or other head and neck cancers.[77] A large study of PFAS drinking water in the United States similarly found an association between drinking water contamination and cancer rates.[78] A study of a release of PFOS and PFOA into an aqueduct supplying drinking water to parts of Italy over several decades found it caused an increase in cancers in the affected area, as well as cardiovascular disease and diabetes.[79]

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[69] U.S. EPA. PFAS Listed in OECD Global Database: https://comptox.epa.gov/dashboard/chemical-lists/PFASOECD (accessed 2025 Apr 17)
[70] Kwiatkowski, et al. (2020)
[71] Zheng, et al. (2021)
[72] Brase, et al. (2021); Pan, et al. (2016)
[73] NTP (2016)
[74] Grandjean, et al. (2017); Grandjean, et al. (2012)
[75] C8 Science Panel (2012)
[76] Seyyedsalehi and Boffetta (2023)
[77] Sassano, et al. (2024)
[78] Li, et al. (2025)
[79] Biggeri, et al. (2024)

The C8 project did not find evidence linking PFOA exposure to low birthweight. However, a more recent meta-analysis of 24 studies found a negative association between cord blood PFOA concentration and birth weight, suggesting that birth weight decreases as PFOA exposure increases.[80] A study of pre-natal exposure to 7 different PFASs found that greater PFAS exposure was associated with lower birth weight for 5 of them.[81]

In the broader environment, PFAS has been found to accumulate in apex predators, many of whom face other environmental hazards, including Southern Resident Killer Whales.[82] Studies suggest many other organisms may have adverse health impacts from PFAS contamination, including in both aquatic and terrestrial species.[83] These species may be valuable not only for their role in the ecosystem but also intrinsically, through recreation or existence value.

While newer shorter chain PFAS have been marketed as safer alternatives to legacy PFAS, research has generally shown newer PFAS have similar persistence and accumulation[84] and may even be more persistent and mobile than legacy PFAS in some environments.[85] While some shorter chain PFAS remain in the human blood for less time than longer chain PFAS, some may still persist for months or years[86] causing impacts to human health. The studies that exist for newer PFAS show that some health impacts may be similar.

While PFOS, PFOA and other perfluoroalkyl acids makeup only about 1% of all PFASs, Bălan et al. (2021)[87] argues that perfluoroalkyl acids "are the terminal degradation, metabolism, or combustion products, manufacturing aids, feedstocks, or impurities of nearly all other PFAS class members" (p. 3) and therefore the hazards associated with perfluoroalkyl acids are relevant to every PFAS. If PFAS were not treated as a single class, it could permit the use of certain PFAS chemicals that ultimately have similar environmental and human health impacts. The newer generation of PFAS chemicals replaced legacy chemicals largely due to toxicity concerns. Restricting PFAS as a single class avoids the risk that restricted PFAS chemicals will be replaced with other similarly hazardous PFAS.

Based on health concerns associated with PFAS exposure, numerous uses of PFAS are already regulated in Washington state. The existing Safer Products Restrictions and Reporting rule, Chapter 173-337 WAC, restricts the use of PFAS in carpets and rugs and aftermarket stain and water-resistance treatments as of January 1, 2025, and in indoor leather and textile furniture and furnishings beginning in 2026. The Toxic Free Cosmetics Act (Chapter 70A.560 RCW) restricts intentionally added PFAS in cosmetics as of January 1, 2025. Earlier actions include restricting PFAS in food packaging in 2023 (Chapter 70A.222 RCW) and firefighting foam in 2020 (Chapter 70A.400 RCW). PFOS and its salts, part of the larger PFAS chemical class, is recognized

[80] Steenland, et al. (2018)
[81] Wikström, et al. (2020)
[82] Lee, et al. (2022)
[83] Interstate Technology & Regulatory Council (2023)
[84] Pérez, et al. (2013); Shi, et al. (2016)
[85] Brendel, et al. (2018); Li, et al. (2020)
[86] Xu, et al. (2020)
[87] Bălan, et al. (2021)

as a persistent bioaccumulative toxic (Chapter 173-333 WAC) and a chemical of high concern to children (Chapter 173-334 WAC).

4.2.1 Restrict intentionally added PFAS in priority products

PFAS exposure from consumer products can take place at any part of the lifecycle of the product, including the manufacture, use, and disposal of products. Manufacturing PFAS can result in direct discharge of PFAS through wastewater.[88] Airborne emissions can also deposit PFAS on land which can leach into the soil and groundwater or contaminate nearby water through runoff.[89] The use of products containing PFAS can result in exposure, particularly if the product is used in wet conditions as water can wash off water-soluble PFAS.[90] This might also lead PFAS to directly enter the environment when exposed to rain. PFAS in consumer products can also contaminate landfills after they have been discarded. One study found more than 50% of tested samples of landfill leachate contained PFAS.[91]

In most cases, tracing an individual's PFAS exposure to a particular source is impossible due to lack of testing of exposure pathways and due to the mobility of PFAS in the environment. Some researchers modeling PFAS contamination have recommended using presumptive contamination to target interventions due to lack of testing.[92] One predictive model finds that urban land area is the best predictor of whether drinking water will be contaminated, more than proximity to suspected contaminated sites,[93] suggesting something about the concentration of people and consumer products may increase the risk of PFAS in the water supply even if the exact method of contamination is unknown.

Due to the difficulty in linking restrictions in particular consumer products to particular exposure instances, we first identify estimates of the total cost of PFAS contamination which would constitute the benefits of PFAS removal in Washington. We then estimate the proportion of PFAS exposure attributable to each consumer product category to derive a total estimate of benefits associated with restrictions in the particular product categories. While the rule does not remove PFAS already in the environment, we assume that restricting PFAS in the product category will result in a reduction in PFAS in the environment over the long-term that is roughly proportional to the amount of PFAS used in the product category and we take that as the basis for our benefits analysis.

Benefits from PFAS Removal

To estimate the benefit of restricting PFAS in the particular consumer products in the rule, we first generate estimates of the total value of removing all PFAS. In the following sections we

[88] Davis, et al. (2007)
[89] Davis, et al. (2007)
[90] Schellenberger, et al. (2002)
[91] Lang, et al. (2017)
[92] Salvatore, et al. (2022)
[93] Tokranov, et al. (2024)

estimate the fraction of the total PFAS removal benefit that we expect to achieve from restricting the PFAS source in the rule amendments.

Quantifying the economic value of PFAS restrictions can take many different forms. Revealed preference studies look at actual consumer behavior to infer how much consumers are willing to spend for a particular quality or result. In this case, the value of avoiding PFAS contamination. Hedonic analysis is one form of revealed preference study. The market price of a particular product responds to characteristics, and a hedonic analysis estimates the impact of those characteristics on the sale price to inform the value of each product characteristic. The change in sales price of a home in response to discovery of PFAS contamination in drinking water is one way to estimate the cost of PFAS. While eliminating PFAS in drinking water would not remove all sources of PFAS exposure, it is likely the largest source for anyone served by a contaminated water supply.[94] Home buyers may also be more aware of drinking water contamination as a source of PFAS compared to other exposure pathways given the relatively wide reporting that PFAS contamination in drinking water receives.

A well providing drinking water to Paulsboro, New Jersey was found to be contaminated with a particular PFAS chemical called PFNA in 2013. In this case, PFNA testing revealed concentrations of between 96 and 150 ng/L, far above the scale of contamination of other water sources, and the news of serious PFAS contamination was widely publicized in news outlets. Researchers estimate home prices for homes in Paulsboro fell by between 29 and 40 thousand dollars compared to similar housing markets elsewhere in the state following news stories of water contamination.[95] However, this was a particularly well-publicized and severe case of PFAS contamination and may not be representative of PFAS contamination more generally.

A larger scale analysis, currently in pre-print, of more than 150,000 home sales between 2010 and 2022 in Pennsylvania estimated that the values of homes served by a public water system contaminated by PFAS were between $5.5 and $10 thousand less than other similar houses that did not have drinking water contamination.[96] Applying this analysis to the number of homes in Washington,[97] and scaling the estimate by inflation using the consumer price index[98] results in an estimated value of between $24.4 billion and $45.6 billion associated with removing all PFAS contamination.

A weakness of these studies is that they are not necessarily representative of the population as a whole, only home buyers. Home buyers may also not be aware of PFAS contamination or the potential health impacts of PFAS contamination when buying a home.

In contrast to revealed preference studies, stated preference studies present respondents with scenarios and ask how much they would be willing to pay for the scenario to be realized. Stated

[94] ATSDR (2024); Wee and Aris (2023)
[95] Marcus and Mueller (2024)
[96] Islam and Heintzelman (2023)
[97] https://www.census.gov/quickfacts/fact/table/WA/INC110223
[98] Consumer Price Index for All Urban Consumers: All Items Less Food and Energy in U.S. City Average: https://fred.stlouisfed.org/series/CPILFESL

preference studies can often be useful when the value of an outcome of interest is difficult to infer from consumer behavior. A survey of New Hampshire public water users in 2021 presented respondents with a list of potential increases to monthly water bills and were asked whether they would be willing or unwilling to pay each amount to avoid health consequences associated with PFAS consumption. The survey results suggest respondents would be willing to pay about $13 per month to avoid PFAS contamination.[99] Applying this estimate to Washington households over a 20-year time horizon results in a present-value estimate of $11.8 billion.

Because these benefit estimates only consider the economic value of individuals protecting themselves or their household from PFAS exposure, they may be significant underestimates of the true benefits of removing PFAS contamination. These benefit estimates do not account for reductions in work-related exposure because they are focused on the value of removing or preventing PFAS contamination of residential water supplies. They may also underestimate benefits if survey respondents and homebuyers in the underlying studies did not adequately account for the health impacts of PFAS exposure. They also do not account for benefits related to a decrease in PFAS exposure for the broader ecosystem. For example, there is a large public willingness to pay to protect some key species, such as Southern Resident Killer Whales.[100] PFAS has been measured in these species,[101] and the potential willingness to pay for PFAS restriction may be much greater if PFAS contamination risks the survival of the population.

These benefit estimates also do not take into account that reducing PFAS contamination through restrictions in consumer products is a relatively cost-effective approach compared to removing PFAS once it is already in the environment. One estimate of the total cost of removing all PFAS throughout the world exceeded total worldwide GDP.[102] A 2023 analysis of the cost of removing PFAS in wastewater treatment in Minnesota estimated it would cost at least $14 billion.[103]

Benefits from Restricting PFAS in Apparel and Accessories

PFAS in apparel can directly cause PFAS exposure. Research has found concentrations of PFAS in dryer lint[104] and apparel may contribute to household dust, an important exposure route, particularly for children.[105] Children may also be exposed by mouthing clothing that contains PFAS, especially school uniforms which have a particularly high concentration of PFAS.[106] PFAS in apparel can also be difficult to avoid, as green or eco-labelling of apparel items is not a reliable indicator of whether it contains PFAS.[107] Washing apparel that contains PFAS can cause PFAS to enter wastewater.[108] Wastewater is treated to remove many harmful chemicals before

[99] Lemos, et al. (2024)
[100] Wallmo and Lew (2016)
[101] Lee, et al. (2022)
[102] Ling (2024)
[103] Barr Engineering Co., Hazen & Sawyer (2023)
[104] Shoeib, et al. (2011)
[105] DeLuca, et al. (2022)
[106] Xia, et al. (2022)
[107] Rodgers, et al. (2022)
[108] Cui, et al. (2020)

it is discharged into the environment, but PFAS is not destroyed by the water treatment process. It can re-enter the environment in the treated water,[109] although PFAS concentrations in wastewater are generally below the state action levels.[110] It may also be present in biosolids that result from the treatment process and that may be applied to soil, potentially contaminating soil and groundwater.

A difficulty in quantifying the benefits of PFAS reduction from a particular consumer product category, such as apparel and accessories, is in apportioning exposure to particular sources. In some cases, PFAS exposure may stem from widely publicized sources such as drinking water contamination by industrial production or firefighting activity. But exposure routes for each individual are generally unknown.

We base our estimate of relative PFAS exposure from apparel on an estimate of total PFAS emissions from new products in 2020 produced by the European Chemicals Agency (ECHA). They report that 31% of PFAS emissions from the use phase of products are attributable to the textile sector, with a range of 20-38%[111]. We assume any exposure from the waste storage phase of the product is similar. The estimate of PFAS emissions from ECHA aggregates textiles across different product categories, including rugs and carpets, towels, and bedsheets, as well as apparel and accessories.

We apportion PFAS emissions within the larger textile industry according to estimates of relative PFAS concentration and relative total product weight. Carpets, rugs, and upholstery are often marketed as stain resistant, suggesting a greater concentration of PFAS than in apparel. Results from one study of children's outdoor wear suggests a median PFAS concentration of 111 ng/g,[112] while another study measuring many of the same PFAS found a median concentration of 572 ng/g in carpets in children's daycare.[113] A study comparing household dust to concentrations of PFAS in dryer lint found dryer lint to have roughly 10% the concentration of household dust.[114] By contrast, PFAS testing in carpets show roughly equal concentration of PFAS as house dust.[115] This suggests that PFAS in apparel is likely 10-19% that of other textiles, though we adjust this range to 5-29% due to the high uncertainty between these estimates and actual exposure.

We base total product weight of apparel compared to other textiles in the United States on EPA data of municipal solid waste under the assumption that solid waste disposal is a reasonably representative sample of consumer textiles. EPA data suggests clothing accounts for 76% of all textiles in municipal solid waste by weight as of 2018.[116] Waste characterization studies for

[109] Ecology (2022b)
[110] https://ecology.wa.gov/waste-toxics/reducing-toxic-chemicals/addressing-priority-toxic-chemicals/pfas/wastewater
[111] ECHA (2023)
[112] Xia, et al. (2022)
[113] Wu, et al. (2020)
[114] Shoeib, et al. (2011)
[115] Wu, et al. (2020)
[116] https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling

Washington show similar relative weights.[117] Based on these relative weights and relative PFAS concentrations, we assume that apparel and accessories comprise between 16 and 46% of PFAS emissions across all textiles.

Given the estimated range of PFAS emissions from textiles, we estimate eliminating PFAS from apparel and accessories would result in between 3.2% and 17.5% of the total benefits from completely eliminating PFAS exposure. Our assumption is that restricting PFAS in apparel and accessories would then reduce long-run exposure to PFAS by this relative amount, generating benefits equal to reducing PFAS in the environment by between 3.2 and 17.5% of the total cost of PFAS exposure.

Based on the economic analyses identified earlier, we adopt an estimate of the value associated with removing all PFAS contamination in Washington as between $11.8 billion and $45.6 billion with a middle value of $24.4 billion. Based on the estimated proportion of PFAS emissions from apparel and accessories, the present value benefit of restricting intentionally added PFAS in apparel and accessories is between 3.2% of $11.8 billion and 17.5% of $45.6 billion, or between $378 million and $7,980 million.

It is again worth noting that this range of estimated benefits does not include anything beyond household-level consumer behavior in the market in response to PFAS water contamination. It does not include more generalized benefits of PFAS reduction, such as reducing risks to workers or vulnerable environments or species.

Benefits from Restricting PFAS in Cleaning Products and Automotive Washes

As in the cost analysis in Section 3.2.1, while these product categories are separated in the rule, we consider them together in the benefits analysis due to the similarity in the product categories, the similar function of PFAS in both product categories, and because these two product categories are combined in some PFAS research and reporting.

Cleaning with products that contain PFAS can cause PFAS to be breathed in if it is aerosolized as a spray, and can leave residual PFAS on the skin, resulting in some level of dermal absorption.[118] PFAS in cleaning products is correlated with concentrations of PFAS in household dust, an important exposure pathway particularly for children.[119] Partially used cleaning products may leach into the environment from landfill disposal or manufacturer discharge. The EPA has listed runoff from car washes in particular as a potential source of PFAS contamination.[120]

As was the case for apparel, apportioning the total cost of PFAS contamination, and therefore the total benefit of eliminating PFAS contamination, to particular product categories can be challenging. PFAS is generally used less in cleaning products than in apparel. One study estimates that approximately 0.5% of the total PFAS contained in products manufactured or

[117] Ecology (2022)
[118] Poothong, et al. (2019)
[119] Poothong, et al. (2019)
[120] https://frtr.gov/pdf/meetings/nov18/presentations/gaines-presentation.pdf

imported into Sweden in 2004 was used in cleaning agents.[121] Another study based on data from the Toxic Release Inventory suggested that about 0.03% of PFAS are used in solvents or cleaning compounds.[122] These are the only two studies we are aware of to estimate this number, so we use these as potential high and low values of the proportion of PFAS use in cleaning products.

Combining the total estimated benefits of eliminating PFAS exposure scaled to the state of Washington with the estimates of the proportion of benefits from eliminating PFAS exposure through cleaning products and automotive washes, we estimate the range of potential benefits from restricting PFAS in cleaning products and automotive washes is between 0.03% of $11.8 billion and 0.5% of $45.6 billion, or between $3.5 million and $228 million. As in the apparel and accessories benefit estimate, this benefit estimate does not include more generalized benefits of PFAS reduction, such as reducing risks to workers or to vulnerable environments or species, nor does it include the additional benefits associated with avoiding the expense of removing PFAS once it has entered the environment.

4.2.2 Require reporting of intentionally added PFAS in priority product categories

Reporting the presence, function, and concentration range of PFAS in consumer products will allow this information to be available to the public. Additional information on potential hazards in consumer products will help consumers make consumption choices that align with their risk preferences and reduce uncertainty in consumer purchasing decisions. In the absence of the rule, consumers who otherwise might be willing to pay more for a PFAS-free product may not have the information to make an informed decision. We believe that the rule will allow for a more transparent market, benefiting consumers by allowing them to behave in line with their preferences for product attributes and risk.

There may be informational benefits for governments as well. A reporting requirement may inform future research and rulemakings by allowing Ecology and other agencies to have some information on the extent to which PFAS is used in consumer products. Local governments initiating safer products programs may also take advantage of the information to target certain product categories that may be relatively harmful to their population. Programs within Ecology and elsewhere administering permits or cleanup projects may also use this information to target particular emission sources. Information provided as a result of the rule is expected to either reduce the costs or increase the benefits of these governmental activities.

4.2.3 Distribution of Benefits

We expect the benefits of the rule amendments to be broadly experienced by the public, although some groups may be particularly impacted. People who work in industries that use or produce products for which intentionally-added PFAS is now restricted may disproportionately

[121] KemI (2006)
[122] Glüge, et al. (2020)

benefit from the rule as their exposure is expected to decrease more than average. Individuals who live or work near areas that are contaminated with PFAS from consumer products, including landfills,[123] may also have greater than average decreased exposure. However, identifying the individual groups that will benefit most is challenging due to the difficulty in tracing PFAS exposure to its ultimate source for most people.[124]

Children are likely to receive greater benefits from the rule amendments than the average population. Exposure to apparel and accessories that contain PFAS and household dust inhalation[125] are two PFAS exposure pathways that disproportionately impact children. We expect that restricting intentionally added PFAS in apparel and accessories will directly reduce PFAS exposure by reducing dermal exposure to apparel items that have particularly high concentrations of PFAS, such as school uniforms.[126] We also expect the rule to reduce PFAS exposure associated with mouthing clothing.[127] PFAS in apparel and cleaning products are also likely contributors to PFAS measured in household dust. House dust is responsible for a greater proportion of PFAS exposure in children compared to adults.[128]

[123] Salvatore, et al. (2022)
[124] Tokranov, et al. (2024)
[125] Egeghy and Lorber (2011)
[126] Xia, et al. (2022)
[127] Holder, et al. (2023)
[128] DeLuca, et al. (2022)

Chapter 5: Cost-Benefit Comparison and Conclusions

5.1 Summary of costs and benefits of the rule amendments

As discussed in Section 2.2.4, PFAS restrictions are in place, or are scheduled to be in place in the next few years, in several U.S. states, representing large segments of the market for consumer products. We cannot be certain whether the response of any manufacturer, whether operating within the state of Washington or elsewhere, to remove PFAS will be due to the PFAS restrictions in the rule or due to restrictions or planned restrictions elsewhere. For the purposes of analyzing the rule impact, we assume the impacts of the rule are scaled to the state of Washington within the broader U.S. market.

5.1.1 Costs (from Chapter 3)

Table 4. Estimated present value of quantified costs (in $millions)

Rule Costs	Low Estimate	High Estimate
PFAS Restriction: Water-resistant apparel and accessories	50.8	359.9
PFAS Restriction: Other apparel and accessories	0.3	1.1
PFAS Restriction: Automotive washes and cleaning products	0.2	1.8
PFAS Restriction: Total	**51.3**	**362.7**
PFAS Reporting: Total	**n/a**	**6.6**

We only include a high estimate for the PFAS reporting requirement. As discussed in Section 3.2.2, we believe the realized costs will be far lower than the estimates here though we are unable to accurately quantify a low estimate. We leave the low estimate blank as a result.

As discussed in Section 3.2.3, the distribution of costs may be an additional consideration. While the cost analyses assume the cost of compliance is primarily on manufacturers and wholesale businesses, some of these costs may be passed on to consumers. This is particularly true for water-resistant apparel and accessories. For that reason, individuals with below average incomes may also face relatively higher costs associated with the rule amendments.

5.1.2 Benefits (from Chapter 4)

Table 5. Estimated present value of quantified benefits (in $millions)

Rule Benefits	Low Estimate	High Estimate
PFAS Restriction: Apparel and accessories	377.6	7,980.0
PFAS Restriction: Automotive washes and cleaning products	3.5	228.0
PFAS Restriction: Total	**381.5 + Qualitative**	**8,208 + Qualitative**
PFAS Reporting: Total	**Qualitative**	**Qualitative**

As discussed in sections 4.2.1 and 4.2.2, additional qualitative benefits may include:

- Benefits of the reporting requirement for market transparency and state and local government rules and programs.
- Additional benefits of PFAS reduction in the environment beyond the household-level benefits to PFAS reduction that were quantified in this analysis, including health benefits of reducing workplace PFAS exposure and reducing exposure among other species in the environment.
- The avoided cost that might otherwise be incurred if PFAS removal were to take place after it had already been released into the environment.

As discussed in Section 4.2.3, the distribution of benefits may be an additional consideration. While the benefits are expected to be experienced to some extent by most Washington residents, children may be particularly benefited by the rule amendments. The intentionally-added PFAS restrictions would be expected to reduce some key pathways of PFAS exposure for children.

5.2 Conclusion

We conclude, based on a reasonable understanding of the quantified and qualitative costs and benefits likely to arise from the rule amendments, as compared to the baseline, that the benefits of the rule amendments are greater than the costs.

Chapter 6: Least-Burdensome Alternative Analysis

6.1 Introduction

RCW 34.05.328(1)(c) requires Ecology to "…[d]etermine, after considering alternative versions of the rule and the analysis required under (b), (c), and (d) of this subsection, that the rule being adopted is the least burdensome alternative for those required to comply with it that will achieve the general goals and specific objectives stated under (a) of this subsection." The referenced subsections are:

> (a) Clearly state in detail the general goals and specific objectives of the statute that the rule implements;
>
> (b) Determine that the rule is needed to achieve the general goals and specific objectives stated under (a) of this subsection, and analyze alternatives to rule making and the consequences of not adopting the rule;
>
> (c) Provide notification in the notice of proposed rulemaking under RCW 34.05.320 that a preliminary cost-benefit analysis is available. The preliminary cost-benefit analysis must fulfill the requirements of the cost-benefit analysis under (d) of this subsection. If the agency files a supplemental notice under RCW 34.05.340, the supplemental notice must include notification that a revised preliminary cost-benefit analysis is available. A final cost-benefit analysis must be available when the rule is adopted under RCW 34.05.360;
>
> (d) Determine that the probable benefits of the rule are greater than its probable costs, taking into account both the qualitative and quantitative benefits and costs and the specific directives of the statute being implemented.

In other words, to be able to adopt the rule, we must determine that the requirements of the rule are the least burdensome set of requirements that achieve the goals and objectives of the authorizing statute(s).

We assessed alternative rule content, and determined whether they met the goals and objectives of the authorizing statute(s). Of those that would meet the goals and objectives, we determined whether those chosen for inclusion in the rule amendments were the least burdensome to those required to comply with them.

6.2 Goals and objectives of the authorizing statute

The authorizing statute for this rule is Chapter 70A.350 RCW. Its goals and objectives are to:

- Regulate priority chemicals, including PFAS, to increase transparency and to reduce the use of priority chemicals in priority consumer products.
- Consider the availability and feasibility of safer alternatives.

- Consider the potential exposure to priority chemicals by sensitive populations or sensitive species when the consumer product is used, disposed of, or has decomposed.

6.3 Alternatives considered and why they were excluded

We considered the following alternative rule requirements and did not include them in the rule amendments. This list includes alternatives that were suggested by the public during development of the rule, with the intent of mitigating negative impacts, including environmental harms, on sensitive populations and people with higher exposure levels, and equitably distributing benefits. Each of the following sections explains why we did not include these alternatives.

- Exclude reusable menstrual underwear
- Exempt FDA regulated medical devices
- Exclude cleaning products with disinfectants
- Not establishing a de minimis threshold in the compliance strategy
- Use total organic fluorine instead of total fluorine in the compliance strategy
- Include disposable apparel
- Include PFAS used as a propellant
- Include cleaning products regulated by Minnesota
- Include disposable utensils
- Include contaminants
- Limit product category definitions and applicability to items listed in the rule
- Restrict PFAS in products from recycled content
- Provide additional time for reformulation and regulatory approval for cleaning products with disinfectants
- Include a grace period for inadvertent noncompliance
- Specify an analytical method to determine intentionally added PFAS
- Define “credible evidence”

6.3.1 Exclude reusable menstrual underwear

We considered excluding reusable menstrual underwear from the rule. However, there is a potential for exposure to PFAS from reusable menstrual underwear in sensitive populations, including people of childbearing age. The Safer Products team found safer alternatives for apparel and accessories including reusable menstrual underwear, so we included them in the

apparel and accessories product category.[129] This alternative rule requirement would not have met the goal of considering the exposure to priority chemicals by sensitive populations or sensitive species when the consumer product is used or disposed of.

6.3.2 Exempt FDA regulated medical devices

We considered exempting FDA regulated medical devices. The law excludes drug or biological products regulated by the FDA; however, it does not exclude medical devices. The Safer Products team did not choose to broadly exempt FDA regulated medical devices because of the potential to expose sensitive populations to unnecessary PFAS. The Safer Products team will consider exemptions from businesses on a case-by-case basis. This alternative rule requirement would not have met the goal of considering exposure to priority chemicals by sensitive populations or sensitive species when the consumer product is used or disposed of.

6.3.3 Exclude cleaning products with disinfectants

We considered excluding cleaning products with disinfectants from regulated consumer products. The Safer Products team found safer alternatives for cleaning products, including cleaning products that also disinfect, so we included them in the cleaning products product category. We do note that pesticidal products not marketed as cleaning products are excluded from the cleaning products category. This alternative rule requirement would not have met the goal of considering the exposure to priority chemicals by sensitive populations or sensitive species when the consumer product is used or disposed of.

6.3.4 Not establishing a de minimis threshold in the compliance strategy

We considered not including a de minimis threshold in the rule's compliance strategy. In response to formal comments, we adopted a de minimis threshold of 50 ppm total fluorine in the rebuttable presumption. This approach aligns with the EU's proposed PFAS restriction.

Based on Ecology's analyses, the de minimis threshold will capture the intentional uses of PFAS in product categories regulated in Cycle 1.5. If total fluorine is detected above 50 ppm, we will presume PFAS was intentionally added. If total fluorine is detected below 50 ppm, we will presume it isn't the result of intentionally added PFAS. Not including a de minimis threshold would be more burdensome for those required to comply with the rule.

6.3.5 Use total organic fluorine instead of total fluorine in the compliance strategy

We considered using total organic fluorine testing instead of total fluorine testing in the compliance strategy in the rule. The compliance strategy in the rule focuses on intentionally

[129] https://apps.ecology.wa.gov/publications/documents/2404023.pdf

added PFAS. When we conduct analytical testing on regulated consumer products, we first measure total fluorine instead of organic fluorine.

Total organic fluorine testing doesn't accurately capture all organic fluorine; organic fluorine from polymers is often underestimated in total organic fluorine testing.[130] Using total fluorine testing ensures we don't miss non-compliant products. However, as some commentors have pointed out, by using total fluorine testing, we may capture products that have inorganic fluorine present from pigments or plastic manufacturing processes. In these cases, the manufacturer may rebut our presumption by submitting information to Ecology such as the use of any fluorinated ingredients or inorganic fluorine test results. This approach aligns with the European Union's recently proposed PFAS restriction. Under the European Union proposal, if total fluorine is detected above 50 ppm, the manufacturer must provide proof for the fluorine measured as either PFAS or non-PFAS.[131] This alternative would not have met the goal of regulating priority chemicals in priority consumer products.

6.3.6 Include disposable apparel

We considered including disposable apparel, such as shoe covers, in the rule. The Safer Products team did not find safer alternatives for disposable apparel, so we could not include them in the apparel and accessories product category. This alternative rule would not have met the goal of considering the availability and feasibility of safer alternatives.

6.3.7 Include PFAS used as a propellant

We considered regulating PFAS used as a propellant. We excluded propellants from this analysis because they are used across a variety of product categories, not just cleaning products, and therefore evaluating alternatives could be done more completely in a future cycle when we can review the breadth of product use. Evaluating propellants at this time would not as effectively have met the goal of considering the availability and feasibility of safer alternative products.

6.3.8 Include cleaning products regulated by Minnesota

We considered including all cleaning products regulated by Minnesota. The Safer Products team did not evaluate safer alternatives for all cleaning products regulated by Minnesota, so we could not include them all in the cleaning products product category. This alternative would not have met the goal of considering the availability and feasibility of safer alternatives.

6.3.9 Include disposable utensils

We considered including disposable utensils in the rule. However, we did not include disposable items because we wanted to generally align with other state regulations. The team did not

[130] Schultes et al. (2019)
[131] ECHA (2023)

evaluate alternatives for cookware or kitchen supplies during this cycle but intends to evaluate these consumer products more comprehensively in a future cycle. Evaluating this product category at this time would not as effectively have met the goal of considering the availability and feasibility of safer alternative products.

6.3.10 Include contaminants

We considered regulating contaminants in addition to intentionally added PFAS. At this point in time, removing contamination from priority consumer products may overly burden industry, and it is not clear from current information the degree of benefits this would achieve. As the program progresses, the Safer Products team can consider regulating contamination. We note that the definition of intentionally added does include chemicals used in the manufacturing process that are present in the product distributed and sold in Washington.

6.3.11 Limit product category definitions and applicability to items listed in the rule

We considered limiting product category definitions and applicability to the items listed in the rule. However, we did not remove the phrase “including but not limited to” from relevant definitions or applicability sections because we wanted to ensure no relevant products were unintentionally excluded. We did revise the definitions of cookware and kitchen supplies and gear for recreation and travel for clarity. This alternative rule requirement would not have met the goal of considering the exposure to priority chemicals by sensitive populations or sensitive species when the consumer product is used or disposed of.

6.3.12 Restrict PFAS in products from recycled content

We considered restricting recycled product content containing PFAS from use in products. However, as more PFAS-free textiles enter the recycling stream, clothing made using recycled content will contain less PFAS. Restricting PFAS in recycled clothing would create a barrier to recycling. Using safer chemicals upstream will allow for safer use of recycled materials. This alternative rule requirement would have been more burdensome for parties required to comply with the rule.

6.3.13 Provide additional time for reformulation and regulatory approval for cleaning products with disinfectants

We considered providing additional time for reformulation and U.S. EPA regulatory approval for cleaning products that also disinfect. However, if a cleaning product containing PFAS can’t meet the compliance deadline due to unique circumstances, manufacturers may submit a temporary exemption request. Section 020 in the rule explains the process for requesting exemptions. Additionally, we excluded pesticidal products not marketed as cleaning products from the rule. This alternative rule requirement would not have met the goal of considering the exposure to

priority chemicals by sensitive populations or sensitive species when the consumer product is used or disposed of.

6.3.14 Include a grace period for inadvertent noncompliance

We considered providing a grace period for inadvertent noncompliance with the rule. However, the amended rule restricts products based on the date of manufacture. This provides retailers a way to manage existing stock without having to catalog or remove products from shelves. It also reduces the potential that noncompliant products become waste subject to designation, and potentially management, under the State Dangerous Waste Regulations. The compliance dates in rule provide manufacturers and retailers sufficient time to procure compliant products. For these reasons, we didn't include a grace period the rule. This alternative rule requirement would not have met the goal of considering the exposure to priority chemicals by sensitive populations or sensitive species when the consumer product is used or disposed of.

6.3.15 Specify an analytical method to determine intentionally added PFAS

We considered specifying an analytical method to distinguish between intentionally added PFAS and naturally-occurring or trace fluorine compounds in the rule. However, we want to offer flexibility to regulated entities. Companies can rebut the presumption that total fluorine detected above 50 ppm indicates intentionally added PFAS by providing evidence the fluorine is from a source other than PFAS, such as inorganic fluorine. Regulated entities can demonstrate this through supply chain transparency, such as documentation from suppliers, or through analytical testing. By allowing multiple ways to rebut the presumption of intentional addition of PFAS and demonstrate compliance, regulated entities can provide information they may already have. This reduces the burden on parties that are required to comply with the rule compared to requiring evidence from a single specific analytical method. This alternative rule requirement would have been more burdensome for parties required to comply with the rule.

6.3.16 Define 'credible evidence'

We considered defining what credible evidence may be used to rebut our presumption of intentionally added PFAS. However, one reason we did not define credible evidence in the amended rule is to allow companies the flexibility to leverage existing compliance strategies and best practices. By maintaining flexibility in what relevant sources of information manufacturers may submit, manufacturers may rely on methods they already use to establish compliance across the supply chain. We may offer additional guidance through compliance support documents as restriction deadlines approach. This alternative rule requirement would have been more burdensome for parties required to comply with the rule.

6.4 Conclusion

After considering alternatives, within the context of the goals and objectives of the authorizing statute, we determined that the rule amendments represent the least-burdensome alternative of possible rule requirements meeting the goals and objectives.

Chapter 7: Regulatory Fairness Act Compliance

7.1 Introduction

The Regulatory Fairness Act (RFA; RCW 19.85.070) requires Ecology to perform a set of analyses and make certain determinations regarding the rule amendments. This chapter presents the:

- Analysis of relative compliance cost burden.
- Consideration of lost sales or revenue.
- Cost-mitigating elements of the rule, if required.
- Small business and local government consultation.
- Industries likely impacted by the rule.
- Expected impact on jobs.

A small business is defined by the RFA as having 50 or fewer employees, at the highest ownership and operator level. Estimated compliance costs are determined as compared to the baseline (the regulatory environment in the absence of the rule amendments, limited to existing federal and state requirements). Analyses under the RFA only apply to costs to "businesses in an industry" in Washington State. This means the impacts, for this part of our analyses, are not evaluated for government agencies.

7.2 Analysis of relative compliance cost burden

We calculated the estimated per-business costs to comply with the rule amendments, based on the costs estimated in Chapter 3 of this document. In this section, we estimate compliance costs per employee.

The overwhelming majority of the expected cost of compliance with the rule amendments falls on the apparel and accessories industry, so we focus on that industry in this section. Because the rule amendments are part of a set of restrictions across several states, we expect that the overwhelming majority of the U.S. market will comply with the rule amendments or similar restrictions. To capture Washington's impact on the compliance cost, we scale the expected impacts to just Washington's portion of the U.S. apparel and accessories market. We do not have specific firm-level data that would indicate whether a company would be differentially impacted by a PFAS restriction on water-resistant apparel, such as an indicator of whether a business is focused on outdoor or indoor apparel. Without this data, we assign the costs in proportion to business-level U.S. sales revenue for apparel manufacturers and wholesalers, where the business is aggregated to the largest U.S.-based owner-operator level. Costs associated with the restriction on PFAS in other (non-water-resistant) apparel are a fixed cost attributed equally to each firm. The number of businesses we report reflect all businesses in the industry across the United States while the expected rule costs are scaled to the size of the Washington market as compared to the nationwide market.

The average affected small business likely to be covered by the rule amendments employs about 5 people. The largest ten percent of affected businesses employ an average of 5,112 people. However, due to the highly concentrated nature of the apparel and accessories manufacturing and wholesale markets, the largest 10% of the industry includes businesses with as few as 21 employees. Any business with between 21 and 50 employees counts as both a small business and one of the largest 10% of large businesses. Based on cost estimates in Chapter 3, we estimated the following compliance costs per employee.

Table 6. Apparel and accessories compliance costs

Type of cost (or total cost)	Small Businesses	Largest 10% of Businesses
Average employment	5	5,112
Average compliance cost (low)	$20	$23,287
Average compliance cost (high)	$100	$164,807
Cost per employee (low)	$4	$5
Cost per employee (high)	$21	$32

The quantitative estimates suggest that small businesses are not disproportionately impacted by the rule. However, this result is attributable to the assumption that the costs of the PFAS restriction are identically proportional to U.S. sales revenue for all apparel manufacturers and wholesalers. While this matches the aggregated quantitative cost estimates from Chapter 3, it is possible that small businesses may bear a disproportionate cost for reasons that are difficult to quantify due to data limitations. In particular, larger businesses may have greater resources to develop a proprietary water-resistant fabric system. The scale of production of larger businesses may also make this compliance strategy more economical for them. Suppliers may also prioritize larger apparel manufacturers or wholesalers when filling orders, potentially delaying PFAS-free water-resistant supplies for smaller businesses.

We conclude that the rule amendments may have disproportionate impacts on small businesses, though we cannot quantify to what degree because we are unable to estimate some of the potential additional costs for small businesses. In the eventuality the rule amendments impose disproportionate costs on small businesses, Ecology would need to include elements in the rule amendments to mitigate this disproportion, as far as is legal and feasible. We outline those actions in Section 7.3.

7.3 Action taken to reduce small business impacts

The RFA (RCW 19.85.030(2)) states that:

> "Based upon the extent of disproportionate impact on small business identified in the statement prepared under RCW 19.85.040, the agency shall, where legal and feasible in meeting the stated objectives of the statutes upon which the rule is based, reduce the costs imposed by the rule on small businesses. The agency must consider, without limitation, each of the following methods of reducing the impact of the proposed rule on small businesses:

a) Reducing, modifying, or eliminating substantive regulatory requirements;

b) Simplifying, reducing, or eliminating recordkeeping and reporting requirements;

c) Reducing the frequency of inspections;

d) Delaying compliance timetables;

e) Reducing or modifying fine schedules for noncompliance; or

f) Any other mitigation techniques including those suggested by small businesses or small business advocates."

We considered all of the above options, and the goals and objectives of the authorizing statutes (see Chapter 6). We limited compliance cost-reduction methods to those that:

- Are legal and feasible.
- Meet the goals and objectives of the authorizing statute.

Inspection procedures are not defined by the rule so cannot be adjusted in order to reduce costs for small businesses. Changing reporting requirements, fine schedules, or delaying compliance timetables for small businesses would not have met the goal of considering the exposure to priority chemicals by sensitive populations or sensitive species when the consumer product is used or disposed of.

Instead, we included the following element in the rule amendments to reduce costs to small businesses.

- Businesses may request an exemption from substantive regulatory requirements of the rule. The exemption to these requirements may be approved if they are deemed necessary by Ecology. Exemptions are considered on a case-by-case basis and reasons for exemptions are not limited.

7.4 Small business and government involvement

We involved small businesses and local governments in development of the rule amendments, using:

- Meetings with the PFAS Action Group, GreenTheme, Beyond Surface Technologies, Milliken, Bolger and O'Hearn, Safety Components, Nicca Chemical, Sciessant, HeiQ, Helly Hansen, Rudolf Chemical Group, and Toxic-Free Future.
- Email announcements to our distribution list of stakeholders.
- Webinars open to the public and stakeholders.
- Presentations and engagement with the public and individual groups including the Fenestration and Glazing Industry Alliance, Ecology's Pollution Prevention Assistance partners, Mother Africa, Affiliated Tribes of Northwest Indians (ATNI), Yakima Valley Community College Climate and Environment Club, People of Color Legislative Alliance of WA, Glenn Acres senior housing, La Casa Hogar, Inspire Center, Catholic

Charities/PREPARES, Chuck Austin Plan, Nuestra Casa, and the South Puget Intertribal Planning Agency.

- Tabling and outreach at events such as the Yakima and Sunnyside Health Fairs, MOSAIC multicultural festival, Deldridge Community Farmers Market, ATNI conference, the 32nd Centennial Accord, and the Latinx Youth Summit.

7.5 North American Industry Classification System (NAICS) codes of impacted industries

The rule amendments likely impact the following industries, with associated NAICS codes. NAICS definitions and industry hierarchies are discussed at https://www.census.gov/naics/.

- 315250 – Cut and Sew Apparel Manufacturing (except Contractors)
- 315990 – Apparel Accessories and Other Apparel Manufacturing
- 316210 – Footwear Manufacturing
- 316990 – Other Leather and Allied Product Manufacturing
- 325510 – Paint and Coating Manufacturing
- 325611 – Soap and Other Detergent Manufacturing
- 325612 – Polish and Other Sanitation Good Manufacturing
- 326199 – All Other Plastics Product Manufacturing
- 332215 – Metal Kitchen Cookware, Utensil, Cutlery, and Flatware (except Precious) Manufacturing
- 335210 – Small Electrical Appliance Manufacturing
- 339113 – Surgical Appliance and Supplies Manufacturing
- 339920 – Sporting and Athletic Goods Manufacturing
- 423220 – Home Furnishing Merchant Wholesalers
- 423620 – Household Appliances, Electric Housewares, and Consumer Electronics merchant Wholesalers
- 423850 – Service Establishment Equipment and Supplies Merchant Wholesalers
- 423910 – Sporting and Recreational Goods and Supplies Merchant Wholesalers
- 424340 – Footwear Merchant Wholesalers
- 424350 – Clothing and Clothing Accessories
- 424690 – Other Chemical and Allied Products Merchant Wholesalers

7.6 Loss of sales or revenue and impacts on jobs

Businesses that will incur costs could experience reduced sales or revenues if the rule amendments significantly affect the prices of the goods they sell. The degree to which this could happen is strongly related to each business's production and pricing model (whether additional lump-sum costs would significantly affect marginal costs), as well as the specific attributes of the markets in which they sell goods, including the degree of influence each firm has on market prices, as well as the relative responsiveness of market demand to price changes. Finally, overall shifts in economic activity in the state, including competition within markets and attributes of the labor market simultaneously adjust in response to changes in compliance costs.

Similarly, employment within directly impacted industries, other industries in Washington, the labor market within and outside of the state, and in the state as a whole will also adjust in response to a change in costs.

We used the REMI E3+ model for Washington State to estimate the impact of the rule amendments on directly affected markets, accounting for dynamic adjustments throughout the economy. The model accounts for variables including but not limited to: inter-industry impacts; price, wage, interstate and international trade, and population or labor market changes; and dynamic adjustment of all economic variables over time.

In Chapter 3 we limit our analysis to the U.S. market, where we assume costs will be experienced most directly by both manufacturers and wholesalers. Because the REMI model includes international trade, for the purposes of the model we assign the costs of PFAS restrictions in the apparel and accessories industry to their most direct source: an increase in the costs of imports as well as domestic manufacturing rather than for wholesalers. Although we expect an increase in costs for manufacturers will result in additional costs throughout the supply chain, the REMI model incorporates these economic linkages with more accurate detail than the simplified assumption that any cost applied to manufacturers would be passed on entirely to wholesalers.

Within the baseline structure of the REMI model, 94.8% of apparel and related industries are imported into Washington from outside the U.S. over the years 2026-2030, while 3.4% of products are made in Washington and remain in the state. We assign the costs of PFAS restriction in apparel identified in Chapter 3 in proportion to their assumed share of the Washington market in the REMI model. The remaining 1.8% of costs would fall on manufacturers within the U.S. but outside of Washington. The structure of the model does not permit an increase in costs for the domestic industry outside of Washington, so the potential impact of this cost on the Washington economy is not accounted for in our simulation.

Direct compliance costs were inputted in the following REMI categorized industries:

- Cutlery and handtool manufacturing (high-cost scenario only)
- Medical equipment and supplies manufacturing (high-cost scenario only)
- Other miscellaneous manufacturing (high-cost scenario only)

- Apparel, leather, and allied product manufacturing
- Apparel, leather, and allied product manufacturing foreign imports
- Paint, coating, and adhesive manufacturing (high-cost scenario only)
- Soap, cleaning compound, and toilet preparation manufacturing
- Wholesale trade

To partially account for the benefits of reducing PFAS exposure under the rule amendments, we included an increase in survival rate of $8.2x10^{-6}$ and $6.7x10^{-5}$ percentage points for all ages at least 15 years old for the high- and low-cost scenarios, respectively, due to a decrease in cancer-related deaths in Washington.[132]

The results of the REMI E3+ model show that the impact of the rule will vary by industry (see Table 7, below), costing the Washington economy an estimated $29 million to $104 million per year at the peak impact on economic output (total amount of goods and services produced by Washington businesses) across all sectors. In the fourth quarter of 2024, Washington state's annual GDP was estimated at $868 billion.[133] $100 million is equivalent to 0.01 percent of the state's GDP. We expect the rule to have additional economic impacts not quantified by the model. For example, the rule may decrease days of work missed due to reductions in cancer rates. Or there may be additional economic redistribution from medical expenses to other consumer spending due to a decrease in low-birth-weight incidence. But because these were not quantified in Chapter 4, they were not included in the REMI simulation even though it may be expected to increase the state economic output. This means the negative economic outputs in Table 7 are likely overestimated.

Output losses are projected to be greatest in 2028 in the low-cost scenario and in 2034 in the high-cost scenario. This is just after the peak cost associated with PFAS restriction in apparel compliance costs in the rule amendments, which we assume will be in 2027. REMI incorporates economic adjustment periods and the peak output loss after this year could be due to initial cost increases affecting other industries through economic linkages in the model. The high-cost scenario assumes that production costs decrease more slowly, which explains the extended period of output loss. Peak projected economic output loss is $29 million per year in the low-cost scenario and $104 million per year in the high-cost scenario. Losses decline after the peaks in each of the scenarios. In both scenarios, the economic losses stabilize near zero around 2035 before increasing slightly and then staying roughly steady until the end of the 20-year simulation period. In both scenarios, there are some gains in economic output compared to the baseline by 2038 which are likely attributable to decreasing rule costs and a slight increase in

[132] This comes from the 4,626 to 6,864 cancer cases associated with PFAS contamination in the U.S. drinking water supply estimated in Li, et al. (2025), which is then scaled to Washington and to the expected reduction in PFAS under the rule amendments. The 5-year survival rate for kidney cancer among individuals under 65 years old is assumed in setting the increase in survival rate.
[133] https://www.bea.gov/data/gdp/gdp-state

total population compared to the baseline due to the positive public health impacts of the rule amendment.

Apparel manufacturing and construction are impacted most among all industries. Apparel manufacturing is the industry with by far the most direct costs, so this impact is understandable. The construction industry does not incur direct compliance costs from the rule amendments, but it is not unusual for the construction industry to have high projected impacts from a rule as the construction industry tends to be indirectly sensitive to any changes in the market in REMI models.

Table 7. Modeled economic impact (in $millions)

Industry	2028 (low)	2033 (high)	2038 (low)	2038 (high)
Whole State	-29	-104	+3	+13
Apparel Manufacturing	-8	-35	0	-1
Construction	-5	-11	+1	+8
Retail Trade	-2	-5	0	0
Real Estate	-2	-9	0	0
Wholesale Trade	-2	-7	0	0

The rule will result in transfers of money within and between industries, as compared to the baseline. The modeled impacts on employment are the result of these transfers and the way in which REMI projects these transfers to be utilized within the broader economy as well as changes to prices and other economic variables across all industries in the state. The REMI simulations project a peak state-wide loss of 199 full-time equivalent positions (FTEs) under the low-cost scenario, and a loss of 707 FTEs under the high-cost scenario. Losses decrease thereafter until, similar to economic output, the job market stabilizes around 2035 under both the low- and high-cost scenarios and becomes slightly positive thereafter. Under the high-cost scenario, this is a projected state-wide job loss under 0.02 percent of state-wide FTEs at the scenario's peak loss in 2033.[134] Under both the low- and high-cost scenarios, total employment is projected to increase slightly within 10 years of the rule amendments' effects.

[134] Assuming unchanged total employment from May 2024. https://data.bls.gov/oes/#/area/5300000

As with economic output, the apparel manufacturing and construction sectors are projected to be the most heavily impacted industries in terms of employment, jointly accounting for about 60 percent of the state-wide job loss at the peak for both the low- and high-cost scenarios. Industries that are most heavily impacted are listed in Table 8.

Table 8. Modeled impact on jobs

Industry	2028 (low)	2033 (high)	2038 (low)	2038 (high)
Whole State	-199	-707	+13	+66
Apparel Manufacturing	-83	-376	-1	-4
Construction	-34	-70	+7	+50
Retail Trade	-13	-31	0	0
Real Estate	-6	-22	0	-1
Wholesale Trade	-5	-16	0	+1

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Appendix A: Administrative Procedure Act (RCW 34.05.328) Determinations

A. **RCW 34.05.328(1)(a): Clearly state in detail the general goals and specific objectives of the statute that this rule implements.**

See Chapter 6.

B. **RCW 34.05.328(1)(b)**

1. **Determine that the rule is needed to achieve the general goals and specific objectives of the statute.**

See chapters 1 and 2.

2. **Analyze alternatives to rulemaking and the consequences of not adopting this rule.**

Chapter 70A.350 RCW[135] directs Ecology to develop rules to implement the regulatory actions identified in the Final Regulatory Determinations Report to the Legislature (May 2024). Ecology must adopt these regulatory actions in rule by December 1, 2025, as directed by RCW 70A.350.090.[136]

See the Least Burdensome Alternative Analysis, Chapter 6 of this document, for discussion of alternative rule content considered.

C. **RCW 34.05.328(1)(c): A preliminary cost-benefit analysis was made available.**

When filing a rule proposal (CR-102) under RCW 34.05.320, Ecology provides notice that a preliminary cost-benefit analysis is available. At adoption (CR-103 filing) under RCW 34.05.360, Ecology provides notice of the availability of the final cost-benefit analysis.

D. **RCW 34.05.328(1)(d): Determine that probable benefits of this rule are greater than its probable costs, taking into account both the qualitative and quantitative benefits and costs and the specific directives of the statute being implemented.**

See Chapters 1 – 5.

E. **RCW 34.05.328(1)(e): Determine, after considering alternative versions of the analysis required under RCW 34.05.328 (b), (c) and (d) that the rule being adopted is the least burdensome alternative for those required to comply with it that will achieve the general goals and specific objectives stated in Chapter 6.**

See Chapter 6.

F. **RCW 34.05.328(1)(f): Determine that the rule does not require those to whom it applies to take an action that violates requirements of another federal or state law.**

[135] https://app.leg.wa.gov/RCW/default.aspx?cite=70A.350
[136] https://app.leg.wa.gov/RCW/default.aspx?cite=70A.350.090

To the best of our knowledge, the rule doesn't require those to whom it applies to take an action that violates requirements of another federal or state regulation. We examined applicable federal and state regulations related to the regulation of toxic chemicals in consumer products.

G. **RCW 34.05.328(1)(g): Determine that the rule does not impose more stringent performance requirements on private entities than on public entities unless required to do so by federal or state law.**

To the best of our knowledge, the rule doesn't impose more stringent performance requirements on private entities than on public entities.

H. **RCW 34.05.328(1)(h): Determine if the rule differs from any federal regulation or statute applicable to the same activity or subject matter.**

In 2023, EPA finalized a rule under the Toxic Substances Control Act to require manufacturers (including importers) of PFAS and PFAS-containing articles to report information related to chemical identity, uses, volumes made and processed, byproducts, environmental and health effects, worker exposure, and disposal to EPA.

The rule is similar because it requires manufacturers report the intentional use of PFAS in specific product categories.

In Washington State, the following table shows the laws and rules that regulate PFAS in products.

Product category	Regulatory action	Effective date	Law or rule
Aftermarket stain- and water-resistance treatments	Restriction	Jan. 1, 2025	Chapter 173-337 WAC
Carpets and rugs	Restriction	Jan. 1, 2025	Chapter 173-337 WAC
Class B firefighting foam	Restriction	Jul. 1, 2020	Chapter 70A.400 RCW
Cosmetic products	Restriction	Jan. 1, 2025	Chapter 70A.560 RCW
Firefighting PPE	Reporting	Jul. 1, 2018	Chapter 70A.400 RCW
Food packaging	Restriction	Jan. 1, 2022	Chapter 70A.222 RCW
Leather and textile furniture and furnishings intended for indoor use	Restriction	Jan. 1, 2025	Chapter 173-337 WAC
Leather and textile furniture and furnishings intended for outdoor use	Reporting	Jan. 1, 2024 (report due Jan. 31, 2025)	Chapter 173-337 WAC

If **yes**, the difference is justified because of the following.

☐(i) A state statute explicitly allows Ecology to differ from federal standards.

☐(ii) Substantial evidence that the difference is necessary to achieve the general goals and specific objectives stated in Chapter 6.

I. **RCW 34.05.328(1)(i): Coordinate the rule, to the maximum extent practicable, with other federal, state, and local laws applicable to the same subject matter.**

Ecology examined applicable federal and state regulations related to the regulation of toxic chemicals in consumer products. Where possible, the requirements in the rule match similar requirements of other authorities including other US states and other nations.