Final Regulatory Analyses:

Including the:

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

Chapter 173-423 WAC - Clean Vehicles Program

Chapter 173-400 WAC - General Regulations for Air Pollution Sources

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For the

Air Quality Program

Washington State Department of Ecology

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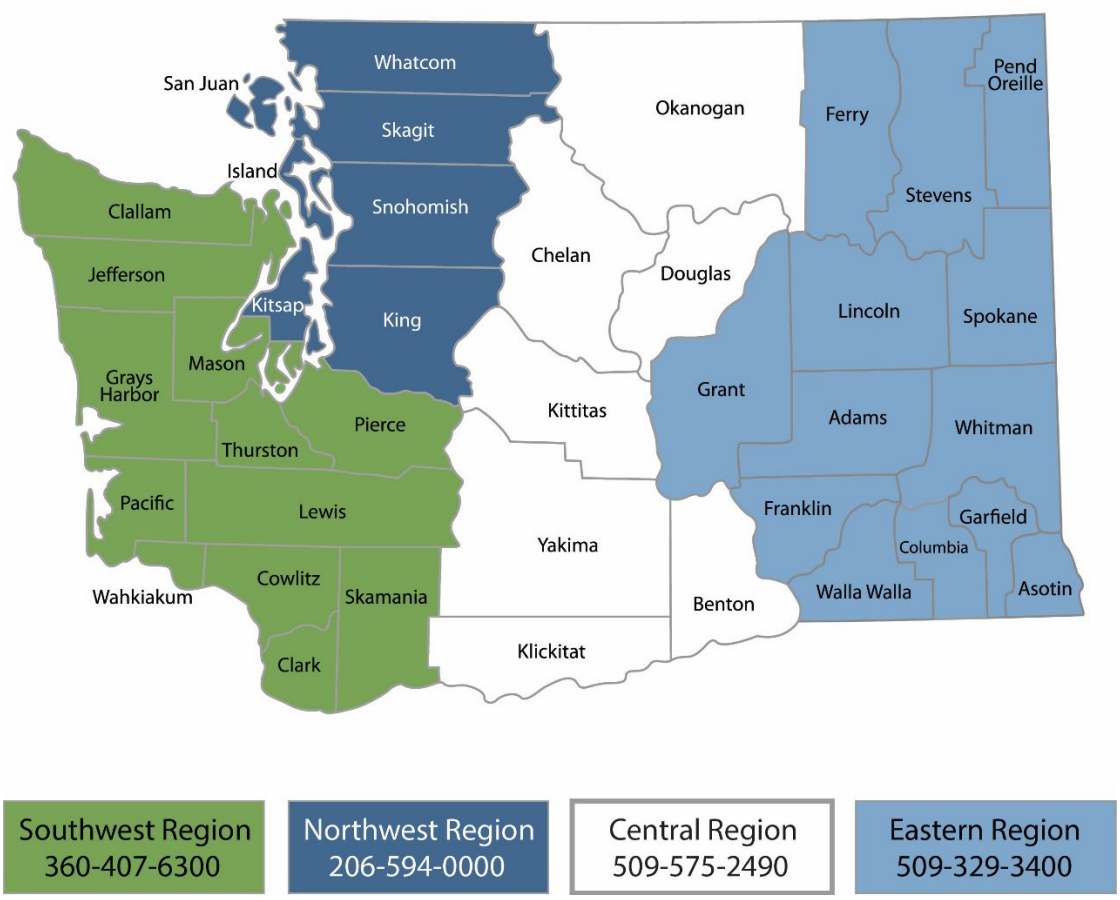

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Final Regulatory Analyses

Including the:

Final Cost-Benefit Analysis

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Olympia, WA

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DEPARTMENT OF
ECOLOGY
State of Washington

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Abbreviations

ACC I	Advanced Clean Cars I
ACC II	Advanced Clean Cars II
ACT	Advanced Clean Trucks
APA	Administrative Procedure Act
CARB	California Air Resources Board
CBA	Cost-Benefit Analysis
DOL	Washington State Department of Licensing
Ecology	Washington State Department of Ecology
EV	Electric vehicle
EPA	US Environmental Protection Agency
GHG	Greenhouse gas
GVWR	Gross vehicle weight rating
HD	Heavy duty
LBA	Least Burdensome Alternative Analysis
RCW	Revised Code of Washington
RFA	Regulatory Fairness Act
SCC	Social Cost of Carbon
WAC	Washington Administrative Code
ZEV	Zero emission vehicle

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 adopted amendments to the Clean Vehicles Program rule and General Regulations for Air Pollution Sources rule (Chapters 173-423 WAC and 173-400 WAC; the "rules"). This includes the:

- Final Cost-Benefit Analysis (CBA)
- Least-Burdensome Alternative Analysis (LBA)
- 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 adopted 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 of this document documents that analysis.

All determinations are based on the best available information at the time of publication.

RCW 70A.30.010 adopts California motor vehicle emission standards, including the zero emissions vehicle program, and directs Ecology to amend the regulations to maintain consistency with California standards.

The adopted rule makes the following changes:

- Adopts California's Heavy-Duty Engine and Vehicle Omnibus Regulation and associated amendments.
- Adopts California's Advanced Clean Cars II rule.
- Allows automakers to earn ZEV credits for sale of qualifying vehicles of model year 2023, 2024, and 2025 as set by Advanced Clean Cars I.
- Updates the adoption date of California's rules.

- Requires fleet owners and fleet operators to report information about vehicles in their fleets weighing over 8,500 pounds.
- Updates for organization and clarification without material impact.
- The final adopted rule also makes several changes intended to clarify the requirements, such as re-wording, updating references, and deleting irrelevant language.

Cost-Benefit Analysis: Costs

The cost of reporting in the California rule is about $200 per entity. Because California's reporting requirements and the mean hourly wage for transportation industry are similar to Washington, we conclude the cost of reporting, under the adopted rule, is also close to $200 per entity. To be conservative, we also include a high-end estimate of eight hours ($400) that an entity may need to report. This is a one-time requirement that will provide information to help Ecology and other organizations develop a strategy for reducing emissions from medium- and heavy-duty vehicles.

We identified 2,226 entities that will be required to report under the adopted rule. We recognize there is likely overlap between several categories and this is likely a conservative overestimate.

We estimate that the total cost range for all entities affected by the change is between $445,200 and $890,400.

We do not expect other costs associated with other sections of the adopted rule amendments, as compared to the baseline, because Ecology is required by statute to adopt California's vehicle emission standards and to amend the rule from time to time to maintain consistency with the California motor vehicle emission standards.

Cost-Benefit Analysis: Benefits

Offering early action credits will provide automakers an incentive to make the widest range of EV models available in Washington for the two years before the start of Washington's Clean Vehicles Program. Without the ability to generate credits during this period, some automakers may choose to send EVs to states that offer credits because they must meet their compliance obligation in those states. Washingtonians would potentially have to go to other states to purchase some of the most popular ZEVs.

Potentially, although not necessarily, the increase in EV sales will lead to earlier reduction in GHGs and, therefore, to avoiding costs caused by climate change. We estimate that one additional percent of EV sales in Washington will reduce GHG emissions by 6,507 MT CO_2e in 2023 and 2024, and, therefore, $327,603 in avoided Social Cost of Carbon.

We do not expect other benefits associated with other sections of the rule amendments, as compared to the baseline.

Cost-Benefit Analysis: Determination

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

Least-Burdensome Alternative Analysis

The authorizing statute for this rule is Chapter 70A.30.010 RCW, Motor Vehicle Emission Standards. Its goals and objectives are:

- To adopt rules to implement the motor vehicle emission standards of the state of California, including the zero emission vehicle program.
- To amend the rules from time to time, to maintain consistency with the California motor vehicle emission standards and 42 U.S.C. Sec. 7507 (section 177 of the federal Clean Air Act).

We considered the following alternative rule content, and did not include it in the adopted rule amendments because they either did not meet the goals and objectives of the statute, would have imposed additional burden on those required to comply with the rule, or both.

- Annual fleet reporting.
- Additional elements of fleet reporting.
- Alignment with the federal Clean Trucks plan instead of California's plan.
- Performance-based standard.
- Adopting the clean transit rule.
- Other credit reporting options.
- Higher threshold of fleet size subject to the fleet reporting requirement.

Regulatory Fairness Act Compliance

The average affected small business likely to be covered by the adopted rule employs approximately six people. The largest ten percent of affected businesses employ an average of 5,925 people. Based on total cost estimates, we estimated the following compliance costs per employee.

Table 1. Reporting costs per employee

Employment or Cost Category	Cost
Average small business employment	6
Average employment at largest ten percent of businesses	5,925
Small business cost per employee	$ 33.00
Largest business cost per employee	$0.03

We conclude that the adopted rule is likely to have disproportionate impacts on small businesses, and therefore Ecology must include elements in the adopted rule to mitigate this disproportion, as far as is legal and feasible.

Note that the basis for our estimated $200 per reporter is large fleets (50 vehicles or more) covered by the California fleet reporting rule, as the California rule only affects those entities. As the reporting requirements under the adopted Washington state rule will affect entities with fleets of five and more vehicles, we expect the cost for small businesses to be lower, because they generally have smaller fleets to report.

Businesses that will incur costs could experience reduced sales or revenues if the adopted rule significantly affects 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 will significantly affect marginal costs).
- Specific attributes of the markets in which they sell goods, including the degree of influence each firm has on market prices.
- The relative responsiveness of market demand to price changes.

We used the REMI E3+ model for Washington State to estimate the impact of the adopted rule on directly affected markets, accounting for dynamic adjustments throughout the economy. The model accounts for:

- Inter-industry impacts.
- Price, wage, and population changes.
- Dynamic adjustment of all economic variables over time.

Using the REMI E3+ model, we applied potential costs (averaging them to $670,000 and dividing them equally between years 2022 and 2023[2]) to the following industries:

- Truck transportation.
- Couriers and messengers.
- Transit and ground passenger transportation.
- Scenic and sightseeing transportation and support activities for transportation.
- Warehousing and storage.

Modeling results did not indicate significant impacts to industries. However, output was estimated to decrease by $251,213 in 2022 and $318,310 in 2023 over all industries in the state. Although results for affected industries did show some effect on output, and therefore, revenue of the industries, the relative indicators of industries demonstrate very little impact.

The adopted rule amendments will result in transfers of money within and between industries, as compared to the baseline. The modeled impacts on employment are the result of multiple

[2] The reporting must be complete until September 30, 2023.

small increases and decreases in employment, prices, and other economic variables across all industries in the state.

Table 2. Impact on jobs

Industry	Initial Jobs Impact (FTEs)	Jobs Impact in 20 years (FTEs)
Whole state	-1.800	-0.015
Truck transportation	-0.274	0.001
Couriers and messengers	-0.324	0
Transit and ground passenger transportation	-0.187	0
Scenic and sightseeing transportation and support activities for transportation	-0.171	0
Warehousing and storage	-0.129	0
Transportation and warehousing total	-1.089	0

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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 Clean Vehicles Program rule and General Regulations for Air Pollution Sources rule (Chapter 173-423 WAC and 173-400 WAC; the "rules"). This includes the:

- Final Cost-Benefit Analysis (CBA)
- Least-Burdensome Alternative Analysis (LBA)
- 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 adopted 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 of this document documents that analysis.

All determinations are based on the best available information at the time of publication.

1.1.1 Background for the Clean Vehicles Program rule

In 2020, the Legislature passed into law, SB 5811, Laws of 2020, Ch. 143 (amending RCW 70A.30.010), adopting California motor vehicle emission standards, including the zero emissions vehicle program, and directing Ecology to amend the regulations to maintain consistency with California standards.

In 2021, Washington expanded its Clean Vehicle Program (previously called Low Emission Vehicles) by adopting California's more protective vehicle emission standards for new vehicles – starting with model year 2025.

In January 2022, Ecology announced the start of the current rulemaking to adopt new vehicle emission standards. This rule will increase zero emission vehicle (ZEV) sales as a percentage of total new passenger cars, light-duty trucks, and medium-duty vehicles sold to 100 percent by 2035. It will also require cleaner, less polluting heavy-duty engines.

Transportation accounts for 45 percent of greenhouse gas emissions and is the largest source of nitrogen oxide emissions in Washington. We cannot make meaningful progress to address climate change without significantly reducing vehicle emissions. Along with cutting GHGs, switching to zero emission vehicles reduces toxic vehicle emissions, improves air quality, and protects public health, especially in communities living near transportation corridors and other areas of concentrated emissions. Data show a disproportionate impact by vehicle emissions to low-income communities and communities of color.[3] The new heavy-duty truck engine standards will reduce emissions of nitrogen oxide by 90 percent and particulate matter by 50 percent. Exposure to these pollutants is linked to serious health problems, including asthma, lung disease, and heart disease.

Section 177 of the federal Clean Air Act allows other states to adopt California's motor vehicle emission standards. A state that adopts California's standards must also provide two years' advance notice before the start of a model year. A vehicle's model year runs up to one year in advance of a calendar year and can start as early as January 1, although the exact cutoff date varies depending on automaker and vehicle model. For example, a new car sold and delivered in January 2023 could potentially be a model year 2024 vehicle if the automaker opts for that classification. Therefore, Washington's adoption of California's rules: Advanced Clean Cars II rule, Low NOx Omnibus Rules and Phase 2 Greenhouse Gas Rule will first apply to model year 2026 vehicles, as it has to follow the advance notice requirement.

Table 3. Advanced Clean Cars II Advance Notice Requirement Schedule

Action	Calendar year	Model year
Adopt rules in 2022	2022	2023
Advance notice - First calendar year	Jan 1, 2023	2024
Advance notice - Second calendar year	Jan 1, 2024	2025
Implementation date/applicable model year	Jan 1, 2025	2026

Advanced Clean Cars II

California adopted its Advanced Clean Cars II rule on August 25, 2022. The rule requires 35 percent of new passenger vehicles sold to be zero emissions starting in model year 2026. That

[3]Washington Tracking Network. Traffic Air Pollution. https://doh.wa.gov/data-statistical-reports/washington-tracking-network-wtn/traffic-air-pollution

percentage will increase by six to eight percent per year until model year 2035 when it will require 100 percent of new vehicles sold in California to be zero emissions.[4]

This rulemaking amended 18 sections in Title 13 (Motor Vehicles) of the California Code of Regulations and added six new sections to:

- Set stronger emissions standards for gasoline-powered cars and passenger trucks.
- Institute an updated ZEV credit system for automakers.

California's adopted rules also include amendments to existing rules to ensure internal consistency and maintain existing requirements. These primarily consist of updates to cross-references and definitions.

1.1.2 Background for the General Regulations for Air Pollution Sources rule

Chapter 173-400 WAC, General Regulations for Air Pollution Sources - establishes the regulatory framework to ensure that healthy air quality exists in Washington, including meeting federal air quality standards. This chapter adopts many federal rules by reference because it is our primary rule regulating air quality under the state and federal Clean Air Acts. In Washington, we incorporate applicable federal rules by either incorporating rule language into our state rules or adopting applicable federal rules by reference, as they exist at a specified adoption date.

1.2 Summary of the rule amendments

The adopted rule makes the following changes:

- Adopts California's Heavy-Duty Engine and Vehicle Omnibus Regulation and associated amendments.
- Adopts California's Advanced Clean Cars II rule.
- Allows automakers to earn ZEV credits for sale of qualifying vehicles of model year 2023, 2024, and 2025 as set by Advanced Clean Cars I.
- Updates the adoption date of California's rules.
- Requires fleet owners and fleet operators to report information about vehicles in their fleets weighing over 8,500 pounds.
- Updates for organization and clarification without material impact.

[4] Advanced Clean Cars II. California Air Resources Board. ww2.arb.ca.gov/our-work/programs/advanced-clean-cars-program/advanced-clean-cars-ii

- The final adopted rule also makes several changes intended to clarify the requirements, such as re-wording, updating references, and deleting irrelevant language.

1.3 Reasons for the rule amendments

1.3.1 Clean Vehicles Program

RCW 70A.30.010 adopts California's vehicle emission standards and directs Ecology to adopt rules implementing them, and to amend the rules to maintain consistency with the California motor vehicle emission standards and 42 U.S.C. Section 7507.

Adopting California's Heavy-Duty Engine and Vehicle Omnibus Regulation and associated amendments will lead to cleaner, less polluting heavy-duty engines.

Adopting California's Advanced Clean Cars II rule will require automakers to increase zero emission vehicle (ZEV) sales as a percentage of total new sales of passenger cars, light-duty trucks, and medium-duty vehicles to 100 percent by 2035.

This rule also updates the adoption date of California's rules to maintain consistency.

The rule also includes the following:

- Credit for early ZEV sales: Provides a manufacturer with credits for a ZEV sale before the Advanced Clean Cars I requirements take effect with model year 2025. This could provide automakers with an incentive to make a wide variety of vehicle models available for sale in Washington in model years 2023 and 2024.
- Fleet reporting: Institutes a one-time requirement for fleet owners and operators (fleet owners, businesses, government agencies, municipalities, brokers, transit agencies, etc.) of five or more vehicles to report information about vehicles in their fleets over 8,500 pounds. This requirement mirrors a similar requirement in California's Advanced Clean Trucks rule. Ecology has very little data on fleets, and the inventory of the existing heavy-duty fleet and information on where these vehicles operate will help provide us information to develop a statewide strategy to reduce their emissions.

1.3.2 General Air Quality Regulations for Air Pollution Sources

The rule will update the adoption date of federal rules in Chapter 173-400, General Air Quality Regulations for Air Pollution Sources. Ecology can only implement and enforce federal rules the state has adopted by reference. This rule amends the following sections:

- WAC 173-400-025 Adoption by reference.
- WAC 173-400-050 Emission standards for combustion and incineration units
- WAC 173-400-070 Emission standards for certain source categories
- WAC 173-400-115 Standards of performance for new sources
- WAC 173-400-720 Prevention of significant deterioration (PSD).

The rule retains the current definition of “project emissions accounting.”

1.4 Document organization

The remainder of this document is organized in the following chapters:

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

Chapter 2: Baseline and Adopted Rule Amendments

2.1 Introduction

We analyzed the impacts of the adopted 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 will face if the rule was not adopted. It is discussed in Section 2.2, below.

2.2 Baseline

The baseline for our analyses generally consists of existing rules and laws, and their requirements. 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:

- RCW 70A.30.010: Adopts California's vehicle emission standards and directs Ecology to adopt rules implementing them, and to amend the rules to maintain consistency with the California motor vehicle emission standards and 42 U.S.C. Section 7507.
- Section 177 of the Clean Air Act (42 U.S.C. §7507): Authorizes other states to choose to adopt California's standards instead of federal requirements.
- Chapter 70A.15 RCW, Washington Clean Air Act.
- The existing rules:
    - Chapter 173-423 WAC, Clean Vehicles Program.
    - Chapter 173-400 WAC, General Air Quality Regulations for Air Pollution Sources: Establishes the regulatory framework to ensure that healthy air quality exists in Washington, including meeting federal air quality standards.

2.3 Adopted rule amendments

The adopted rule makes the following changes:

- Adopts California's Heavy-Duty Engine and Vehicle Omnibus Regulation and associated amendments.
- Adopts California's Advanced Clean Cars II rule.
- Allows automakers to earn ZEV credits for sale of qualifying vehicles of model year 2023, 2024, and 2025 as set by Advanced Clean Cars I.
- Updates the adoption date of California's rules.
- Requires fleet owners and fleet operators to report information about vehicles in their fleets weighing over 8,500 pounds.

- Updates for organization and clarification without material impact.
- The final adopted rule also makes several changes intended to clarify the requirements, such as re-wording, updating references, and deleting irrelevant language.

2.3.1 Adopt California's Heavy-Duty Engine and Vehicle Omnibus Regulation and associated amendments

Baseline

RCW 70A.30.010 directs Ecology to adopt rules implementing California's vehicle emission standards and to amend the rule to maintain consistency with the California motor vehicle emission standards and 42 U.S.C. Section 7507.

Adopted

The amendments will adopt by reference sections of the California Code of Regulations, which require to drastically cutting smog-forming nitrogen oxides (NOx) from conventional heavy-duty engines. The Omnibus Regulation will significantly increase the stringency of NOx emissions standards and will lengthen the useful life and emissions warranty of heavy-duty diesel engines for use in vehicles with a gross vehicle weight rating (GVWR) greater than 10,000 pounds. The more stringent NOx emission standards begin with the 2024 model year engines and become more stringent with 2027 and subsequent model year engines.

Expected impact

Ecology is required by statute to adopt California's vehicle emission standards and to amend the rule from time to time to maintain consistency with the California motor vehicle emission standards; therefore, we do not expect any costs or benefits associated with this change as compared to the baseline.

California's rule includes a provisional exemption for transit buses. Washington does not have specific regulations for transit buses like California and will not adopt such regulations in this year's rulemaking. This gives Ecology time to review California's Innovative Clean Transit rule.[5]

2.3.2 Adopt California's Advanced Clean Cars II rule

Baseline

In 2020, the Legislature adopted the California rules as written, and directed Ecology to adopt rules implementing them (RCW 70A.30.010). In November 2021 Ecology amended Chapter 173-423 WAC – Clean Vehicles Program to incorporate the California Advanced Clean Cars I Program. This program combines the control of criteria pollutants, other pollutants, and greenhouse gas emissions into a coordinated regulatory package. The rule adopts California's motor vehicle emission standards that apply to:

[5] Some parts of California rules cannot apply inherently to Washington, two community-based clean mobility programs only apply in California and cannot be adopted in Washington, because such programs do not exist.

- Low emission vehicles – passenger cars, light-duty trucks, and medium-duty vehicles (trucks, SUVs, and vans)
- Zero emission vehicles – passenger cars, light-duty trucks, and medium-duty vehicles (trucks, SUVs, and vans)
- Zero emission trucks – vehicles greater than 8,500 pounds gross vehicle weight rating (delivery vans, work trucks, long-haul trucks, drayage trucks, transit buses, garbage trucks, and other commercial work vehicles). This is California's Advanced Clean Trucks rule.

Adopted

Ecology is adopting the Advanced Clean Cars II Program after California's adoption of the program on August 25, 2022. The newly adopted CARB amendments will set ZEV and LEV requirements for model year 2026 and subsequent model year vehicles, including new supporting ZEV and LEV test procedures. It will also establish ZEV assurance measures, which include new requirements for:

- Durability.
- Warranty.
- Serviceability.
- Data standardization.
- Battery labeling.

These rules are intended to ensure ZEVs are able to serve as true replacements to conventional internal combustion engine vehicles (ICEVs), thereby ensuring emissions reductions occur and providing consumer confidence needed to support the full entry of ZEVs into new and used vehicle markets.

Expected impact

Ecology is required by statute to adopt California's vehicle emission standards and to amend the rule from time to time to maintain consistency with the California motor vehicle emission standards, therefore we do not expect any costs or benefits associated with this change as compared to the baseline.

2.3.3 Allow automakers to earn credits for model years 2023 and 2024

Baseline

In November 2021, Ecology adopted the California ZEV requirement into Chapter 173-423 WAC to require automakers delivering new, light-duty vehicles for sale in Washington to make a certain percentage of those vehicles ZEVs. ZEVs can include:

- Battery electric vehicles (BEV),
- Plug-in hybrid electric vehicles (PHEV), or

- Hydrogen fuel cell electric vehicles (FCEV).

When Ecology adopted the rule, we opted to defer consideration of issuing proportional or early action credits (for selling ZEVs in the state before the rules take effect), due to existing robust sales of ZEVs in the state.

Adopted

The rule amendments will provide an option for automakers to earn early action credits for ZEV sales for model years 2023 and 2024.

An early action credit is an optional credit for a ZEV sale before the ZEV compliance period starts in model year 2025. For model year 2025, earned credits will be regulatory credits under ACC I. Both early action and regulatory credits will be allocated based on the performance of the ZEV being sold. For example, long-range BEVs are eligible for the maximum of four credits, whereas some PHEVs with limited range can receive as little as a fraction of one credit.

Starting in model year 2026, ZEVs will receive a maximum of one credit per sale. All credits banked under the previous rules will be converted to Historical Credits.

Ecology considered multiple options on how to assign credits and, seeking public input, presented the revised early credit options report[6] to the stakeholders.

Ecology considered the following options:

- Option 1. Full proportional credits: Washington credits are proportional to banked California credits.
- Option 2. Adjusted proportional credits: Washington credits are proportional to banked California credits but adjusted for robust Washington sales.
- Option 3. No credits.
- Option 4. Credits for model year 2023 and model year 2024.
- Option 5. Combination: a mix of proportional credits and early action credits.

After reviewing and considering input received during the informal comment period, Ecology concluded that the stakeholders recognize Option 4 - Credits for model year 2023 and model year 2024 - as the most beneficial. This option will provide early action - a credit for a ZEV sale before the ZEV compliance period starts with model year 2025.

Expected impact

The amended rule will provide benefits to EV automakers with sales in Washington, and to all Washingtonians. Offering early action credits provides a new incentive to automakers to make EV models available in Washington for the two years before the start of our Clean Vehicles program. Without the ability to generate credits during this period, some automakers may

[6] Revised ZEV Credit Options for Advanced Clean Cars II and Early Action Credits in Washington's Current Program. https://ecology.wa.gov/Asset-Collections/Doc-Assets/Rulemaking/AQ/WAC173-423_400-21-12/ZEV-Credit-Options-WAC-173-423-04-2022

choose to send EVs to states that offer credits to meet compliance obligations. Some automakers do not currently offer certain ZEV models for purchase in Washington due to the lack of ZEV credits, and will likely continue to keep those models off the Washington market until credits are available. Without early action credits, Washingtonians may continue to be unable to purchase some popular ZEV models in Washington.

2.3.4 Update the adoption date of California's rules

Baseline

The current rule incorporates California Code of Regulations as they existed on June 22, 2021 or the adoption by reference date: September 7, 2022, whichever is later.

Adopted

The amended rule will incorporate California Code of Regulations as they exist on September 7, 2022, or the adoption by reference date, whichever is later.

Expected impact

This change will allow Ecology to meet requirements in RCW 70A.30.010 and will not generate any costs or benefits as compared to the baseline.

2.3.5 Require fleet owners and operators to report

Baseline

Currently, no entities are required to report to Ecology information about vehicles over 8,500 pounds.

Adopted

The following entities will be required to report fleet information to Ecology:

- Any entity that has gross annual revenues greater than $50 million in the United States for the 2022 tax year, including revenues from all subsidiaries, subdivisions, or branches, and that operated a facility in Washington in 2022 that had one or more vehicles over 8,500 pounds as of gross vehicle weight rating (GVWR) operated in Washington in 2022.
- Any entity that owns or operates a facility in Washington and, in the 2022 calendar year, owned or operated five or more vehicles with a GVWR greater than 8,500 pounds.
- Any broker or entity that operated a facility in Washington and in the 2022 calendar year, dispatched five or more vehicles with a GVWR greater than 8,500 pounds into or throughout Washington.
- Any Washington government agency, including state and local government, that operated five or more vehicles over 8,500 pounds GVWR in Washington in 2022.
- Any federal government agency that operated five or more vehicles over 8,500 pounds GVWR in Washington in 2022.

Expected impact

We expect fleet reporting to impose costs on fleet owners and operators associated with the time necessary to report information about vehicles over 8,500 pounds. We also expect benefits from the requirement, as the inventory of the existing heavy-duty fleet and information on where these vehicles operate will provide information to help Ecology to develop a statewide strategy to reduce their emissions and assist with outreach for environmental justice advocates. Ecology currently has very little data on medium- and heavy-duty vehicle fleets. This data collection effort will help Ecology identify preliminary opportunities for efficiently reducing emissions and at the same time not to over-impose requirements that will create excess or unreasonable costs, and cause unexpected side-effects. This will also accelerate ZEV adoption and site ZEV infrastructure such as heavy-duty chargers.

2.3.6 Organization and clarification without material impact

Baseline

Over the course of implementation, Ecology determined that some parts of the rules were unclear or poorly organized.

Adopted

The rule amendments clarify and organize language and requirements to improve clarity and facilitate compliance. Other changes are necessary to make rules consistent across amended sections. The final adopted rule also makes additional changes compared to the proposed rule intended to clarify the requirements, such as re-wording, updating references, and deleting irrelevant language.

Expected impact

No behavioral impact is expected, although the clarification of, and ease of compliance with, the rule may reduce transitory costs (increased benefits) such as time spent determining whether or how to comply.

Chapter 3: Likely Costs of the Rule Amendments

3.1 Introduction

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

3.2 Cost analysis

The adopted rule makes the following changes:

- Adopts California's Heavy-Duty Engine and Vehicle Omnibus Regulation and associated amendments.
- Adopts California's Advanced Clean Cars II rule.
- Allows automakers to earn ZEV credits for sale of qualifying vehicles of model year 2023, 2024, and 2025 as set by Advanced Clean Cars I.
- Updates the adoption date of California's rules.
- Requires fleet owners and fleet operators to report information about vehicles in their fleets weighing over 8,500 pounds.
- Updates for organization and clarification without material impact.
- The final adopted rule also makes several changes intended to clarify the requirements, such as re-wording, updating references, and deleting irrelevant language.

3.2.1 Adopt California's Advanced Clean Cars II rule

The amended rule will provide an option for automakers to earn early action credits for ZEV sales for model years 2023 and 2024. An early action credit is a credit for a ZEV sale before the ZEV compliance period starts with model year 2025. This change is an option for ZEV manufacturers and sellers, not a requirement. We assume manufacturers will take this optional action only if they perceive a net benefit from doing so. Therefore, there are no costs associated with this change.

3.2.2 Require fleet owners and operators to report

The following entities will be required to submit reports, to Ecology:

- Any entity that has gross annual revenues greater than $50 million in the United States for the 2022 tax year, including revenues from all subsidiaries, subdivisions, or branches, and that operated a facility in Washington in 2022 that had one or more vehicles over 8,500 pounds GVWR operated in Washington in 2022.

- Any entity that owns or operates a facility in Washington and that, in the 2021 calendar year, owned or operated five or more vehicles with a GVWR greater than 8,500 pounds.
- Any broker or entity that operated a facility in Washington and that, in the 2022 calendar year, dispatched five or more vehicles with a GVWR greater than 8,500 pounds into or throughout Washington.
- Any Washington government agency, including state and local government, that operated five or more vehicles over 8,500 pounds GVWR in Washington in 2022.
- Any federal government agency that operated five or more vehicles over 8,500 pounds GVWR in Washington in 2022.

We identified 2,226 entities that will be required to report under the amended rule. We recognize there is likely overlap between several categories and this is likely a conservative overestimate. We made the following assumptions and then proceeded with the following data analyses:

- Any business within the identified business sector[7] with gross annual revenues greater than $50 million in the United States for the 2022 tax year, including revenues from all subsidiaries, subdivisions, or branches, and that operated in Washington in 2022, owns at least one or more vehicles over 8,500 pounds GVWR operated in Washington in 2022. We identified such businesses through Dun & Bradstreet's dataset for Washington businesses that Ecology uses for economic analyses.
- Any business in Washington that owns five or more vehicles with a GVWR greater than 8,500 pounds, owned or operated five or more vehicles with a GVWR greater than 8,500 pounds Washington, in the 2021 calendar year. We identified the number of business with such fleets through Washington State Department of Licensing's (DOL) information system DRIVES.[8]
- Since the data we used to identify businesses included in the bullets above was limited to businesses that are located in Washington, and the amended rule will cover all those that operated in the state regardless of base location, we scaled the potential number of businesses up to reflect all potentially covered entities. We adjusted the number of

[7] US Postal Service; Construction & mining companies with HD fleets; Logging companies; Electrical utility repair fleets; HVAC & plumbing contractors; Restaurant food distribution fleets (e.g. Sysco); Distribution fleets for retail products (e.g. Coca-Cola, Frito-Lay); Fuel distributors; Distribution fleets for retail companies (e.g. Walmart, Amazon, Safeway); Local freight transport companies; Long-haul freight transport companies; Specialized freight haulers (e.g. gravel, grain, seafood); Motor coach operators; School districts & pupil transporters; Drayage truck dispatchers; Transport logistics operators; Shipping & delivery companies (e.g. FedEx, UPS); Truck rental companies (e.g. Enterprise, Ryder, U-Haul); Other utility repair fleets; Hazardous materials transport companies; Motor vehicle transport companies.

[8] The data was pulled from DOL information system DRIVES on 6/21/22.

businesses that operated in Washington in 2021 based on the Large Entity Fleet Reporting by CARB[9].

- We assumed that any entity (public or private) that owned or operated five or more vehicles with a GVWR greater than 8,500 pounds in Washington in 2022, uses its own dispatching service. We identified dispatching services and freight brokers as those that dispatch fleets with less than five vehicles.
- We expect to receive the state fleet data from Department of Enterprise Services (DES) and Washington office of Superintendent of Public Instructions (OSPI).

Table 4. Summary of the number of entities we assume the requirement will impact.

Reporting category	Number of entities
Businesses with gross annual revenues greater than $50 million and that operated a facility in Washington in 2022 that had one or more vehicles over 8,500 pounds GVWR operated in Washington in 2022.	35
Washington businesses in 2021 that owned and operated five or more vehicles with a GVWR greater than 8,500 pounds.	1,347
Out-of-state businesses in 2021 that operated five or more vehicles with a GVWR greater than 8,500 pounds in Washington.	108
Businesses in the 2022 calendar year that dispatched five or more vehicles with a GVWR greater than 8,500 pounds into or throughout Washington.	395
Government agencies, excluding state agencies, which operate five or more vehicles over 8,500 pounds GVWR in Washington in 2022.	320
Any federal government agency that operated five or more vehicles over 8,500 pounds GVWR in Washington in 2022.	19
State fleet data reporting agencies	2
Total	2,226

Cost of reporting for one entity.

[9] Large Entity Fleet Reporting - Statewide Aggregated Data. https://ww2.arb.ca.gov/sites/default/files/2022-02/Large_Entity_Reporting_Aggregated_Data_ADA.pdf

In 2019, CARB published the Standardized Regulatory Impact Assessment (SRIA) for the Advanced Clean Trucks Regulation.[10] Under the Advanced Clean Trucks (ACT) Regulation, large fleet owners and large companies that contract out for transportation-related services are required to report the following information to CARB:

- A list of the vehicles they own.
- Location information for their companies in California.
- How they and their contractors move freight and perform other services.

Companies that do not own trucks need to report summary information about the:

- Types of product they move.
- Types of services they hire.

Most large companies that own trucks or buses have fleet software or other data management systems to pull information about their fleet and business quickly.

The rule will require all covered parties to report the following information:

(1) Fleet reporting requirement. An entity required to report under this section must report the information according to the requirements of each provision of this section. The reporting must include information for operations under common ownership or control.
  (a) General information.
    (i) Name (i.e., if a business, the registered business name) and all business names that the entity does business as (i.e., all "dba" or "doing business as" names);
    (ii) Mailing address including street name or P.O. box, city, state, and zip code;
    (iii) Name of the responsible official;
    (iv) Responsible official's email address;
    (v) Responsible official's phone number;
    (vi) Name of corporate parent or governing body, as applicable;
    (vii) Federal Taxpayer Identification Number of corporate parent or other entities with which the reporting person has vehicles under common or control;
    (viii) For a government agency, the jurisdiction (federal, state, or local); Federal Taxpayer Identification Number; Primary six-digit North American Industry Classification System code;
    (ix) For a non-governmental entity, the total annual revenue for the entity in the United States for 2022;

[10] Standardized Regulatory Impact Assessment (SRIA). Advanced Clean Trucks Regulation. 2019. https://dof.ca.gov/wp-content/uploads/Forecasting/Economics/Documents/SRIA-Advanced_Clean_Truck_080819_DOF.pdf

(x) Broker authority under the Federal Motor Carrier Safety Administration;

(xi) The operating authority numbers, including motor carrier identification number, United States Department of Transportation number, and International Registration Plan number;

(xii) The number of =entities with whom the reporting person had a contract to deliver items or to perform work in Washington using vehicles over 8,500 pounds GVWR in 2022;

(xiii) The estimated number of subhaulers, vehicles operated by subhaulers, and the number of vehicles operated by subhaulers that operated under the reporting entity's motor carrier authority; and

(xiv) The number of vehicles with a GVWR over 8,500 pounds the reporting entity owned and operated in Washington in 2022 that do not have a vehicle home base in Washington.

(b) Vehicle home base. An entity required to report under this section must report general information about the vehicle home base. Vehicles that accrue a majority of their annual miles in Washington but are not assigned to a particular location in Washington must be reported as part of the entity's headquarters or the location where the vehicles' operation is managed. The entity must report for each vehicle home base:

(i) Facility address including street name, city, state, and zip code;

(ii) Facility type category, using one of the following categories:

(A) Administrative/office building;

(B) Distribution center/warehouse;

(C) Hotel/motel/resort;

(D) Manufacturer/factory/plant;

(E) Medical/hospital/care;

(F) Multi-building campus/base;

(G) Restaurant;

(H) Service center;

(I) Store;

(J) Truck/equipment yard; and

(K) Any other facility type;

(iii) Name of responsible official;

(iv) Responsible official's email address;

(v) Whether the facility is owned or leased by the entity;

(vi) What type of fueling infrastructure is installed at the facility;

(vii) Whether the refueling infrastructure at the facility was initially installed on or after January 1, 2010; and

(viii) The types of trailers the reporting entity pulls, if it has tractors assigned or domiciled at this facility.

(c) For each vehicle home base, an entity may report the information grouped by vehicle body type, and weight class bins and fuel type. An entity may complete responses for each individual vehicle and include the vehicle's body type, weight class bin, and fuel type. If applicable, an entity must separately report vehicles dispatched under their brokerage authority. When responding, each vehicle must only be counted once for each response. An entity must report:

(i) Number of vehicles in each vehicle group;

(ii) Model year of the vehicle and engine for each reported vehicle;

(iii) The percent of the vehicles in each vehicle group with operating characteristics including, but not limited to: daily mileage, usage patterns, refueling, trailer towing, and other such characteristics as specified by Ecology. The term "usage pattern" shall include:

(A) Average number of trips per day;

(B) Typical destination points for vehicles within each group;

(C) Locations where trucks are parked for two hours or more per day, if different from the vehicle home base;

(iv) The average annual mileage for a typical vehicle in this vehicle group;

(v) The average length of time a typical vehicle in this vehicle group is retained by the reporting entity after acquisition;

(vi) Whether the reporting entity is the fleet owner for this group of vehicles, or if they are dispatched under the reporting entity's brokerage authority; and

(vii) The start and end date of the analysis period selected by the reporting entity as required under (d) of this subsection.

(d) An entity must choose a period of time, for example annual or quarterly data averaged for work days during the period selected to determine responses. For example, if an entity selects annual data to determine vehicle daily mileage, the entity must average the annual mileage accrued based on the number of workdays that year.

(i) A shorter analysis period may be used if the reporting entity deems it more representative of periods of high vehicle utilization when answering questions about typical daily operation. For example, if a reporting entity with seasonal workload fluctuations determines that a week or month during the busy season is representative, average the data records for that week or month when determining a response.

(ii) If an alternative analysis period is used, the reporting entity must be prepared to describe their reasoning at the request of Ecology.

(e) For information reported for a vehicle group at one location, a reporting entity may repeat that information for the same vehicle group at another vehicle home base if the reporting entity determines that the operation at the second location is substantially similar to that at the first location.

(f) A broker must provide information about vehicle usage that is dispatched under contract, such as if a broker hires a truck to move a load, only the miles driven under that contract are required for the response. If known, the broker may voluntarily report information about the miles driven outside the contract.

(2) Fleet reporting recordkeeping.

(a) An entity required to report must maintain all of the following records related to the reporting for five years after the reporting deadline:

(i) For owned on-road vehicles, mileage records and dates from records, such as maintenance logs, vehicle logs, or odometer readings, or other records with the information that the reporting entity used to prepare the information the person submitted;

(ii) For on-road vehicles not owned, but dispatched by the entity, dispatch records and dates, contracts, or other records with the information that the reporting entity used to prepare the information the entity submitted;

(iii) Vehicle registration for each owned vehicle operated in Washington; and

(iv) Contracts with entities, or contracts with subhaulers, or other records with the information that the reporting person used to prepare the information the person submitted.

(b) An entitysubject to this section must respond to requests for clarification of reported information within 14 days of receiving the request from Ecology.

The amended rule also requires businesses to keep their reporting records for five years after the reporting deadline.

Affected entities will need time to prepare and submit their report. CARB estimated it takes on average:

- Two hours to retrieve, review, and report company-specific information.
- Two hours to retrieve, review, and report vehicle information.

This means businesses will need four hours to prepare and submit their report to Ecology. This may be higher or lower from company to company. These averages assume that some large entities will not have information to report other than to respond that they do not contract directly for any transportation services. We assumed the hourly cost is $50 per hour for staffing and lost revenue from the employee assigned to do the reporting.

The cost of reporting in the California rule is about $200. Because California's reporting requirements and the mean hourly wage for transportation industry are similar to Washington, we conclude the cost of reporting, under the amended rule, is also close to $200. To be conservative, we also include high-end estimate of eight hours ($400) that an entity may need to report. This is a one-time requirement that will provide information to help Ecology and

other organizations develop a strategy for reducing emissions from medium- and heavy-duty vehicles.

We estimated the total cost range for all entities affected by the change is between $445,200 and $890,400.

3.2.3 Sections of Rule with No Impact

Ecology is required, by statute, to:

- Adopt California's vehicle emission standards.
- Amend the rule to maintain consistency with the California motor vehicle emission standards.

We do not expect any costs or benefits associated with the following changes as compared to the baseline.

- Adopt California's Heavy-Duty Engine and Vehicle Omnibus Regulation and associated amendments.
- Adopt California's Advanced Clean Cars II rule.
- Update the adoption date of California's rules.

3.2.4 Organization and clarification without material impact.

We do not expect any changes to behavior, although the clarification of, and ease of compliance with, the amended rule may reduce transitory costs such as time spent determining whether or how to comply.

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 rule amendments and the baseline are discussed in detail in Chapter 2 of this document.

4.2 Benefits analysis

The adopted rule makes the following changes:

- Adopts California's Heavy-Duty Engine and Vehicle Omnibus Regulation and associated amendments.
- Adopts California's Advanced Clean Cars II rule.
- Allows automakers to earn ZEV credits for sale of qualifying vehicles of model year 2023, 2024, and 2025 as set by Advanced Clean Cars I.
- Updates the adoption date of California's rules.
- Requires fleet owners and fleet operators to report information about vehicles in their fleets weighing over 8,500 pounds.
- Updates for organization and clarification without material impact.
- The final adopted rule also makes several changes intended to clarify the requirements, such as re-wording, updating references, and deleting irrelevant language.

4.2.1 Allow automakers to earn credits for model years 2023 and 2024

Per the report[11]: Offering early action credits will provide automakers an incentive to make the widest range of EV models available in Washington for the two years before the start of the Washington Clean Vehicles program. Without the ability to generate credits during this period, some automakers may choose to send EVs to states that offer credits because they must meet their ZEV compliance obligation in that state. Washingtonians will potentially have to go to other states to purchase some of the most popular ZEVs.

This option provides an incentive for an automaker to deliver a ZEV to Washington before model year 2025. Automakers sold a little more than 20,000 EVs (BEV & PHEV) in Washington in calendar year 2021, according to Department of Licensing data, and are expected to sell about 25,000 EVs in calendar year 2022.

[11] Revised ZEV Credit Options for Advanced Clean Cars II and Early Action Credits in Washington's Current Program. https://ecology.wa.gov/Asset-Collections/Doc-Assets/Rulemaking/AQ/WAC173-423_400-21-12/ZEV-Credit-Options-WAC-173-423-04-2022

We estimate sales of 34,125 EVs for model year 2023 and 46,581 EVs for model year 2024 that could generate early action credits.[12] Assuming the 2020 average of 3.2 credits per vehicle, according to CARB data, these EVs will generate approximately 258,200 early action credits that automakers could use to ease compliance with Washington's Clean Vehicles program starting with model year 2025.

As with other pre-2026 credits, these early action credits will be converted to Historical Credits in ACC II starting in model year 2026. The conversion will reduce these credits to approximately 122,952[13] historical credits that can be used in limited amounts each year for model year 2026 through model year 2030.

This option will provide the opportunity for automakers to generate more than 122,952 credits for use through model year 2030. Assuming a cap of 15%, the early action credits generated under this option will satisfy a portion of the 15% of automakers' ZEV sales obligations for model year 2025 through model year 2030.

4.2.1.1 Potential benefits of avoiding earlier GHG emissions reductions

Increases in EV sales create benefits by avoiding the climate damages created by carbon dioxide emissions. To illustrate the avoided Social Cost of Carbon (the damages created by one extra metric ton of CO_2e emissions, MT CO_2e) of cumulative emissions reductions in each year, we used an estimate of the sales in the previous section and assumed the early credit incentive will lead to 282,000 MT CO_2e emissions reduction for the years 2022-2025 (see Table 4).

As ZEVs reduce GHG emissions from transportation, society will benefit by avoiding various impacts of climate change. We estimate the value of reduced GHG emissions using an estimate of the social cost of carbon (SCC) developed and used by the federal government. The SCC is an estimate of the value of the negative impacts to society caused by GHG emissions. The estimate of the SCC rises each year, and we chose the model with the annual discount rate of 2.5 percent.[14] Current economic research and practice suggests the true discount rate for the SCC

[12] Revised ZEV Credit Options for Advanced Clean Cars II and Early Action Credits in Washington's Current Program. https://ecology.wa.gov/Asset-Collections/Doc-Assets/Rulemaking/AQ/WAC173-423_400-21-12/ZEV-Credit-Options-WAC-173-423-04-2022

[13] The original forecast estimated 80,700 historical credits. CARB's latest 15-Day changes adjust the conversion factor for Historical Credits to 2.1 for all pre-2026 credits (as opposed to 4.0 for BEV and 1.1 for PHEV). Therefore, the projected number of Historical Credits would be 122,952. Limits on usage in MY 2026-2030 remain unchanged.

[14] 2.5 percent is the nearest discount rate for which federal interim SCC values were estimated, and is the closest to the current long-run average risk-free rate of return (or social rate of time preference) based on historic real return rates on US Treasury I Bonds (cite).
Note that in November 2022, the US Environmental Protection Agency published new draft SCC values, reflecting updated methodology, climate science, and economic modeling. See https://www.epa.gov/system/files/documents/2022-11/epa_scghg_report_draft_0.pdf. The updated SCC values for a 2.5 percent discount rate begin at $125 per MTCO$_2$e emitted in 2023, rising to $167 by 2038. The report also presents SCC values for 2.0 percent and 1.5 percent, beginning at $204 and $351, respectively. For consistency,

should be lower or declining, so these benefits are likely underestimated. See Appendix B for the Basis for the use of the SCC.

Table 5. Cumulative avoided Social Cost of Carbon from Electric Vehicles

Year	Number of EVs	Additional GHG Emission Reductions (in MMT CO2e)	Avoided SC-CO2 (Million 2020$) 2.5% Discount Rate	Total, million dollars
2022	25,000	0.111	79.033	$8.75
2023	34,125	0.151	80.339	$12.15
2024	46,581	0.206	81.645	$16.85
2025	63,669	0.282	82.951	$23.40

It is hard to predict how many additional ZEVs will be sold as a result of early credit incentive compared to the baseline. Currently, supply for the EV market is significantly below its demand. For illustration, we provide the estimates for SCC avoided as a result of one percent annual increase in EVs sales.

Table 6. The avoided SCC of early one percent increase in EV sales

Year	Number of EVs	Additional MT GHG Emission Reductions	Avoided SC-CO2 (2020$) 2.5% Discount Rate	Total, dollars
2023	341	1,512	91	$137,332
2024	466	2,064	92	$190,271
Cumulative	807	3,576	N/A	$327,603

While the SCC includes values of economic activity and some health impacts, it is not all-inclusive. See Appendix C for description of excluded values of other impacts of climate change, which affect quality of life and equity, as well as economic activity.

and because these draft values are not yet final, we have maintained a 2.5 percent discount rate throughout this analysis. Of the final Interagency Working Group discount rates, this 2.5 percent rate is the closest to the current long-run, risk-free rate of return based on US Treasury I Bonds (currently a 0.89 percent historic average). If final values were available for a lower discount rate that more closely matched the long-run, risk-free rate of return, we would use those SCC values and employ that discount rate throughout this analysis.

4.2.3 Require fleet owners and operators to report

We anticipate that the data Ecology receives from the reporting requirement will be used to identify opportunities for medium- and heavy-duty ZEV adoption. Specifically, it will help inform decisions on what regulatory mechanisms are most appropriate to:

- Help fleet owners and operators buy ZEVs.
- Target the weight classes and use cases most appropriate for electrification.
- Identify where ZEV chargers and related infrastructure should be located.
- Ensure businesses use ZEVs in ways that are suitable to meet individual fleet needs.

Collecting this level of detailed information from fleet owners and operators will provide information about fleet types and businesses in Washington to support and focus future efforts that will require the use of ZEVs.

We also expect benefits from the adopted requirement, as the inventory of the existing heavy-duty fleet and information on where these vehicles operate will help provide Ecology information to develop a statewide strategy to reduce their emissions and assist with outreach for environmental justice advocates. This data collection effort will help identify preliminary opportunities for efficiently reducing emissions and at the same time not to over-impose requirements that will create excess or unreasonable costs, and cause unexpected side-effects. This will also accelerate ZEV adoption and site ZEV infrastructure such as heavy-duty chargers.

Ecology currently has very limited information about heavy-duty fleets, so this effort will fill an important information gap.

4.2.4 Sections of rule with no impact

The authorizing statute explicitly adopts California's vehicle emission standards.

- Ecology is required to amend the rule to maintain consistency with the California motor vehicle emission standards.

We do not expect any costs or benefits associated with the following changes as compared to the baseline.

- Adopt California's Heavy-Duty Engine and Vehicle Omnibus Regulation and associated amendments.
- Adopt California's Advanced Clean Cars II rule.
- Update the adoption date of California's rules.

4.2.5 Organization and clarification without material impact

No behavioral impact is expected, although the clarification of, and ease of compliance with, the amended rule may reduce transitory costs such as time spent determining whether or how to comply.

Chapter 5: Cost-Benefit Comparison and Conclusions

5.1 Summary of costs and benefits of the rule

We identified the costs for the following entities that must report fleet information to Ecology:

- Any person that owns or operates a business with gross annual revenues greater than $50 million in the United States for the 2022 tax year, including revenues from all subsidiaries, subdivisions, or branches, and that operated a facility in Washington in 2022 that had one or more vehicles over 8,500 pounds as of gross vehicle weight rating (GVWR) operated in Washington in 2022.
- Any person that owns or operates a facility in Washington and, in the 2021 calendar year, owned or operated five or more vehicles with a GVWR greater than 8,500 pounds.
- Any person that operated a facility in Washington and in the 2022 calendar year, dispatched five or more vehicles with a GVWR greater than 8,500 pounds into or throughout Washington.
- Any Washington government agency, including state and local government, that operated five or more vehicles over 8,500 pounds GVWR in Washington in 2022.
- Any federal government agency that operated five or more vehicles over 8,500 pounds GVWR in Washington in 2022.

Affected entities will need time to prepare and submit their report. CARB estimated it takes on average:

- Two hours to retrieve, review, and report company-specific information.
- Two hours to retrieve, review, and report vehicle information.

This means businesses will need four hours to prepare and submit their report to Ecology. This may be higher or lower from company to company. These averages assume that some large entities will not have information to report other than to respond that they do not contract directly for any transportation services. We assumed the hourly cost is $50 per hour for staffing and lost revenue from the employee assigned to do the reporting.

The cost of reporting in the California rule is about $200. Because California's reporting requirements and the mean hourly wage for transportation industry are similar to Washington, we conclude the cost of reporting, under the rule, is also close to $200. To be conservative, we also include high-end estimate of eight hours ($400) that an entity may need to report. This is a one-time requirement that will provide information to help Ecology and other organizations develop a strategy for reducing emissions from medium- and heavy-duty vehicles.

We identified 2,226 entities that will be required to report under the rule. Although we recognize there is likely overlap between several categories and we are conservative in our analyses.

We estimated the total cost range for all entities affected by the change is between $445,200 and $890,400.

We also expect benefits from the requirement, as the inventory of the existing heavy-duty fleet and information on where these vehicles operate will provide information to help Ecology to develop a statewide strategy to reduce their emissions and assist with outreach for environmental justice advocates. Ecology currently has very little data on medium- and heavy-duty vehicle fleets. This data collection effort will help Ecology identify preliminary opportunities for efficiently reducing emissions and at the same time not to over-impose requirements that will create excess or unreasonable costs, and cause unexpected side-effects. This will also accelerate ZEV adoption and site ZEV infrastructure such as heavy-duty chargers.

Offering early action credits will provide automakers an incentive to make the widest range of EV models available in Washington for the two years before the start of Washington's Clean Vehicles program. Without the ability to generate credits during this period, some automakers may choose to send EVs to states that offer credits because they must meet their compliance obligation. Washingtonians will potentially have to go to other states to purchase some of the most popular ZEVs.

Potentially, although not necessarily, the increase in EV sales will lead to earlier reduction in GHGs and, therefore, to avoiding the social cost of carbon. We estimate that one additional percent of EV sales in Washington will reduce GHG by 6,507 MT CO_2e MT in 2023 and 2024, and, therefore, to avoiding the social cost of carbon costing around $327,603.

5.2 Conclusion

We conclude, based on a reasonable understanding of the quantified and qualitative costs and benefits likely to arise from the rule, as compared to the baseline, that the benefits of the rule 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 are required to determine that the contents 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. For additional alternatives that were suggested during the public comment period, and Ecology's responses, see the associated Concise Explanatory Statement for this rulemaking.

6.2 Goals and objectives of the authorizing statute

The authorizing statute for this rule is Chapter 70A.30.010 RCW, Motor Vehicle Emission Standards. Its goals and objectives are:

- To adopt rules to implement the motor vehicle emission standards of the state of California, including the zero emission vehicle program,

- To amend the rules from time to time, to maintain consistency with the California motor vehicle emission standards and 42 U.S.C. Sec. 7507 (section 177 of the federal clean air act).

6.3 Alternatives considered and why they were excluded

We considered the following alternative rule content, and did not include it in the rule amendments for the reasons discussed in each subsection below.

- Annual fleet reporting.
- Additional elements of fleet reporting.
- Alignment with the federal Clean Trucks plan instead of California's rules.
- Performance-based standard.
- Adopting the clean transit rule
- Other credit reporting options.
- Higher threshold for the fleet reporting requirement.

6.3.1 Annual fleet reporting.

Ecology considered requiring annual fleet reporting instead of a one-time report. We are pursuing a one-time fleet reporting requirement at this time. These data will help give us a better understanding of fleets in Washington, and we consider one-time reporting sufficient for decision making at the current stage. The one-time requirement is also consistent with California's approach. Requiring annual reporting would be more burdensome for Washington businesses and does not provide clear additional benefits at this time. We may consider additional reporting at a later date.

6.3.2 Additional elements of fleet reporting.

Ecology received comments suggesting the fleet reporting requirement should include additional elements, such as model year of the vehicle and engine, travel through overburdened communities, and others. Ecology modified the rule language in response to comments to include some of the additional elements requested, including model year. Currently, there is no clear definition of overburdened communities as would be applicable and usable in the reporting requirement. It is also difficult and burdensome to construct a reporting system that reflects meaningful data on travel through overburdened communities on a fleet wide basis. Requiring additional elements would be more burdensome for Washington businesses and does not provide clear additional benefits at this time.

6.3.3 Alignment with federal Clean Trucks plan instead of CA

This alternative proposed to align Washington motor vehicle fuels rules with the federal Clean Trucks plan instead of California's rules. The legislature directed Ecology to adopt and maintain consistency with California's rules. Therefore, this alternative did not meet the goals and objectives of the authorizing statute.

6.3.4 Performance-based standard.

This alternative proposed a performance-based standard, which would be technologically neutral and require fleet operators to meet certain environmental and safety standards, rather than a mandate to increase ZEV adoption. The legislature directed Ecology to adopt and maintain consistency with California rules. Therefore, this alternative did not meet the goals and objectives of the authorizing statute.

6.3.5 Adopting the clean transit rule

This alternative would require public transit agencies to transition to ZEVs. This is outside the scope of the rulemaking. Ecology will consider adopting the Advanced Clean Transit rule in the future. Adopting the Innovative Clean Transit rule would be more burdensome for Washington transit agencies and does not provide clear additional benefits at this time.

6.3.6 Other credit options.

Ecology evaluated six ZEV credit options for Advanced Clean Cars II and Early Action Credits in Washington's Current Program.

- Option 1: Provide automakers the number of credits proportional to their credits in California's credit bank.
- Option 2: Provide automakers the number of credits proportional to their credits in California's credit bank, adjusted for more robust ZEV sales in Washington as compared to other ZEV states.
- Option 3: Adopt the Advanced Clean Cars II (ACC II) rule with its proposed flexibilities with no additional pre-established credit bank under ACC I.
- Option 4: Allow automakers to generate action credits for ZEV sales for model year 2023 and model year 2024, i.e., during the two years before the Clean Vehicles program begins in Washington.
- Option 5: Combination option of proportional credits and early action credits.
- Option 5a: Combine Option 4 and Option 1
- Option 5b: Combine Option 4 and Option 2

Ecology determined that option 4 will best meet the goals and objectives of the program. Early action credits will incentivize automakers to provide additional ZEVs to Washington before

regulatory requirements begin in MY 2025. This will benefit automakers by allowing them to bank credits from early ZEV sales for later use, which will ease future compliance costs. It will also ensure that Washington residents have a wider variety of ZEV models to purchase. In addition, stakeholders expressed concern that proportional credits (Options 1, 2, and 5) would enable double counting by granting automakers Washington credits for California ZEV sales.

6.3.7 Grant proportional credits to automakers

This alternative would grant automakers Washington ZEV credits proportional to their credits in California's credit bank. We identified multiple options, and presented and discussed these at stakeholder meetings held on February 28, 2022; April 19, 2022; and June 14, 2022. An analysis paper was made available before each meeting. We accepted informal comments February 21, 2022 through June 21, 2022. Options were revised based on stakeholder input. Projections show that the chosen option enables automakers to generate enough credits to meet compliance obligations though 2030. As evaluated, proportional credits did not meet the goals and objectives for offering credits, as the program could allow double counting and would not provide a credit incentive before model year 2025.

6.3.8 Lower threshold.

Oregon is much closer to Washington in size and population than California. Consequently, Washington, like Oregon, likely has fewer and smaller fleets than California. A high threshold would not provide sufficient data to meet our objectives. Instead, we followed Oregon's five-vehicle threshold.

6.4 Conclusion

After considering alternatives to the rule's contents, within the context of the goals and objectives of the authorizing statute, we determined that the rule represents the least-burdensome alternative of possible rule contents 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 adopted rule. 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 adopted rule, 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, based on the costs estimated in Chapter 3 of this document. In this section, we estimate compliance costs per employee.

The average affected small business likely to be covered[15] by the rule employs approximately six people. The largest ten percent of affected businesses employ an average of 5,925 people. Based on cost estimates in Chapter 3, we estimated the following compliance costs per employee.

[15] See section 7.6 for the full list of industries.

Table 7: Reporting costs per employee

Type of cost (or total cost)	Low	High
Average small business employment	6	6
Average employment at largest ten percent of businesses	5,925	5,925
Small business cost per employee	$33	$66
Largest business cost per employee	$0.03	$0.07

We conclude that the rule may have disproportionate impacts on small businesses, and therefore Ecology must include elements in the adopted rule to mitigate this disproportion, as far as is legal and feasible.

Note that for California's rule the $200 estimate is based on large fleets (50 vehicles or more), as the rule only affects those entities. As the reporting requirements will affect entities with fleet of five and more vehicles, we expect the base cost for small businesses to be lower, because they generally have smaller fleets to report.

7.3 Loss of sales or revenue

Businesses that will incur costs can experience reduced sales or revenues if the rule significantly affect the prices of the goods they sell. The degree to which this could happen is strongly related to:

- Each businesses production and pricing model (whether additional lump-sum costs will significantly affect marginal costs).
- Specific attributes of the markets in which they sell goods, including the degree of influence each firm has on market prices.
- The relative responsiveness of market demand to price changes.

We used the REMI E3+ model for Washington State to estimate the impact of the rule on directly affected markets, accounting for dynamic adjustments throughout the economy. The model accounts for:

- Inter-industry impacts.
- Price, wage, and population changes.
- Dynamic adjustment of all economic variables over time.

Using the REMI E3+ model, we applied potential costs (averaging them to $670,000 and dividing them equally between years 2022 and 2023[16]) to the following industries:

- Truck transportation
- Couriers and messengers
- Transit and ground passenger transportation

[16] The reporting must be complete until September 30, 2023.

- Scenic and sightseeing transportation and support activities for transportation
- Warehousing and storage

Modeling results did not indicate significant impacts to industries. However, output will decrease by $251,213 in year 2022 and $318,310 in 2023 over all industries in the state. Although the results for affected industries did show some effect on output - and therefore, revenue of the industries - the relative indicators of industries demonstrate very little impact. Please see Table 8.

Table 8. Effects of the reporting requirement costs on output

Industry	Output, $, 2022	Output, %, 2022	Output, $, 2023	Output, %, 2023
Truck transportation	-45,170	-0.001	-54,989	-0.001
Couriers and messengers	-14,936	-0.001	-17,958	-0.001
Transit and ground passenger transportation	-5,997	0	-8,056	-0.001
Scenic and sightseeing transportation and support activities for transportation	-34,379	-0.001	-42,360	-0.001
Warehousing and storage	-11,714	-0.001	-13,983	-0.001
Transportation and warehousing total	-113,712	0	-139,258	-0.001
State economy total	-251,213	0	-318,310	0

7.4 Action taken to reduce small business impacts

The RFA (19.85.030(2) RCW) 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 adopted 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, the goals and objectives of the authorizing statutes (see Chapter 6), and the scope of this rulemaking. We limited compliance cost-reduction methods to those that:

- Are legal and feasible.
- Meet the goals and objectives of the authorizing statute.
- Are within the scope of this rulemaking.

The scope of this rulemaking was limited to adopting California's ACC II program and establishing fleet reporting requirements, so we could not legally include options (a) and (c – f).

Finally, we included the following elements in the rule amendments to reduce costs to small businesses.

We simplified, reduced, and eliminated reporting requirements, including rejection of alternatives that would have been more burdensome:

- Annual fleet reporting requirement instead of one-time.

See Chapter 6 for more details.

7.5 Small business and government involvement

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

- Ecology held three webinars for stakeholders concerning the rule amendments in 2022 on February 28, April 19, and June 14.
- More than two hundred attendees registered for the webinars and public hearings. Among them: Snohomish PUD, City of Seattle, Puget Sound Clean Air Agency, Cowlitz PUD, and NW Seaport Alliance.
- Stakeholder meeting notices and materials and project updates were sent to the above groups and posted to the rulemaking website.

7.6 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/?58967?yearbck=2022

Table 9. Impacted industries with associated NAICS

Impacted Industries	NAICS code
Long-haul freight transport companies	484121
Local freight transport companies	484110

Impacted Industries	NAICS code
Shipping & delivery companies	492110
Drayage truck dispatchers	488510
Logging companies	113000
Hazardous materials transport companies	562112
Fuel distributors	424720
Specialized freight haulers	484220
Construction & mining companies with HD fleets	53241
Transport logistics operators	488510
HVAC & plumbing contractors	238220
Distribution fleets for retail companies	425120
Distribution fleets for retail products	424490
Restaurant food distribution fleets	423850
Motor vehicle transport companies	488490
Truck rental companies	532120
Motor coach operators	485113
Electrical utility repair fleets	237130
Other utility repair fleets	561990
Federal agencies with HD fleets in WA	999000
US Postal Service	491110
State agencies with HD fleets	999200
School districts & pupil transporters	485410
Local agencies with HD fleets	999300

7.7 Impact on jobs

We used the REMI E3+ model for Washington State to estimate the impact of the rule amendments on jobs in the state, accounting for dynamic adjustments throughout the economy.

The rule amendments will result in transfers of money within and between industries, as compared to the baseline. The modeled impacts on employment are the result of multiple small increases and decreases in employment, prices, and other economic variables across all industries in the state. Employment impacts are reported in terms of full-time employee (FTE) equivalents.

Table 10: Impacts on jobs

Industry	Initial Jobs Impact (FTEs)	Jobs Impact in 20 years (FTEs)
Whole state	-1.800	-0.015
Truck transportation	-0.274	0.001
Couriers and messengers	-0.324	0
Transit and ground passenger transportation	-0.187	0

Industry	Initial Jobs Impact (FTEs)	Jobs Impact in 20 years (FTEs)
Scenic and sightseeing transportation and support activities for transportation	-0.171	0
Warehousing and storage	-0.129	0
Transportation and warehousing total	-1.089	0

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Chapter 173-400 WAC, General Air Quality Regulations for Air Pollution Sources:

Chapter 173-423 WAC, Clean Vehicles Program.

Chapter 70A.15 RCW, Washington Clean Air Act.

Chapter 70A.30.010 RCW, Motor Vehicle Emission Standards.

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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.

In 2020, the Legislature passed into law Senate Bill 5811 (Chapter 143, laws of 2020) directing Ecology to adopt California motor vehicle emission standards, including the zero emissions vehicle program, and to amend the rule to maintain consistency with California standards. Since this is a requirement in state law Ecology did not consider alternatives to rulemaking.

Please 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 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.

Please 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.

Ecology evaluated state and federal law and determined that the rule does not require any entity to take an action that violates requirements in another federal or state law.

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.

Ecology evaluated the requirements and determined that the rule does not 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.

Yes

- If **yes**, the difference is justified because of the following:

  ☒ (i) A state statute explicitly allows Ecology to differ from federal standards. RCW 70A.30.010 "(1) Pursuant to the federal clean air act, the legislature adopts the California motor vehicle emission standards in Title 13 of the California Code of Regulations. The department of ecology shall adopt rules to implement the motor vehicle emission standards of the state of California, including the zero emission vehicle program, and shall amend the rules from time to time, to maintain consistency with the California motor vehicle emission standards and 42 U.S.C. Sec. 7507 (section 177 of the federal clean air act)."

  ☐ (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.

State law directs Ecology to adopt California motor vehicle emission standards for the state of Washington. EPA issued a notice of decision to reinstate California's Clean Air Act waiver for its Advanced Clean Car program on March 14, 2022. Local governments in Washington do not have authority to establish motor vehicle emission standards.

Appendix B: Basis for the use of the SCC

To estimate the benefits of avoiding a metric ton of GHG emissions, Ecology uses the Social Cost of Carbon (SCC). The SCC is an estimate of the global costs resulting from climate change associated with one additional metric ton of GHG emissions.

Many estimates of the social cost of carbon exist, each carrying its own assumptions regarding elements such as (but not limited to):

- The trajectory of worldwide emissions.
- Expected development and growth rates.
- The rate at which we discount the future.
- How much we value impacts that do not occur locally.

We (as well as the federal Interagency Working Group (IWG) that developed the SCC cited in this analysis) acknowledge the limitations of any quantitative estimate of the SCC. IWG states in its original analysis:

"As noted, any estimate of the SCC must be taken as provisional and subject to further refinement (and possibly significant change) in accordance with evolving scientific, economic, and ethical understandings. During the course of our modeling, it became apparent that there are several areas in particular need of additional exploration and research. These caveats, and additional observations in the following section, are necessary to consider when interpreting and applying the SCC estimates."

The workgroup follows up in the technical update:

"The 2010 interagency SCC TSD [technical support document] discusses a number of important limitations for which additional research is needed. In particular, the document highlights the need to improve the quantification of both non-catastrophic and catastrophic damages, the treatment of adaptation and technological change, and the way in which inter-regional and inter-sectoral linkages are modeled. While the new version of the models discussed above offer some improvements in these areas, further work remains warranted. The 2010 TSD also discusses the need to more carefully assess the implications of risk aversion for SCC estimation as well as the inability to perfectly substitute between climate and non-climate goods at higher temperature increases, both of which have implications for the discount rate used."

We note that these issues, among others, exist for all SCC estimates, and indicate neither specific overestimation nor specific underestimation in overall estimates when all of the variables and assumptions are considered. For example, estimates require development in valuing catastrophic endpoints, which might indicate underestimation, but estimates also require development in how they include adaptation, which might indicate overestimation.

Uncertainty is common in economic value estimates, and is tied to not only the certainty of the inputs and assumptions, but to the number of inputs dealt with. Understandably, models of climate change and their interrelationship with economic models and assumptions – with the sheer number of variables involved – carry greater uncertainty. We chose to use the SCC

developed by the federal Interagency Working Group on Social Cost of Carbon estimate because it attempts to broadly deal with some of these uncertainties, because it was developed by a wide range of federal experts, and because we wanted to use the estimate that uses the inputs most closely resembling those typically made in Ecology analyses in discounting social values.

In 2021, the federal government issued new interim values for the Social Cost of Carbon (SCC). These included median values estimated using three discount rates, as well as a set of values reflecting highly damaging scenarios.

Table 11. Social Cost of Carbon (2022$)

Year	Median SCC at 5% Discount Rate	Median SCC at 3% Discount Rate	Median SCC at 2.5%[17] Discount Rate	95th Percentile SCC at 3% Discount Rate
2021	$16.13	$56.93	$85.17	$168.96
2022	$16.68	$58.12	$86.63	$172.88
2023	$17.22	$59.31	$88.08	$176.79
2024	$17.77	$60.50	$89.54	$180.70
2025	$18.31	$61.69	$90.99	$184.61
2026	$18.86	$62.88	$92.45	$188.53
2027	$19.40	$64.07	$93.90	$192.44
2028	$19.95	$65.26	$95.36	$196.35
2029	$20.49	$66.45	$96.81	$200.26
2030	$21.03	$67.64	$98.27	$204.17
2031	$21.58	$68.83	$99.72	$208.09
2032	$22.23	$70.11	$101.24	$212.35
2033	$22.88	$71.38	$102.76	$216.61
2034	$23.53	$72.66	$104.28	$220.87
2035	$24.18	$73.93	$105.80	$225.13
2036	$24.83	$75.21	$107.32	$229.39
2037	$25.48	$76.48	$108.84	$233.66
2038	$26.13	$77.76	$110.36	$237.92
2039	$26.78	$79.03	$111.88	$242.18

[17] 2.5 percent is the nearest discount rate for which federal interim SCC values were estimated, and is the closest to the current long-run average risk-free rate of return (or social rate of time preference) based on historic real return rates on US Treasury I Bonds (cite).
Note that in November 2022, the US Environmental Protection Agency published new draft SCC values, reflecting updated methodology, climate science, and economic modeling. See https://www.epa.gov/system/files/documents/2022-11/epa_scghg_report_draft_0.pdf. The updated SCC values for a 2.5 percent discount rate begin at $125 per $MTCO_2e$ emitted in 2023, rising to $167 by 2038. The report also presents SCC values for 2.0 percent and 1.5 percent, beginning at $204 and $351, respectively. For consistency, and because these draft values are not yet final, we have maintained a 2.5 percent discount rate throughout this analysis. Of the final Interagency Working Group discount rates, this 2.5 percent rate is the closest to the current long-run, risk-free rate of return based on US Treasury I Bonds (currently a 0.89 percent historic average). If final values were available for a lower discount rate that more closely matched the long-run, risk-free rate of return, we would use those SCC values and employ that discount rate throughout this analysis.

Year	Median SCC at 5% Discount Rate	Median SCC at 3% Discount Rate	Median SCC at 2.5%[17] Discount Rate	95th Percentile SCC at 3% Discount Rate
2040	$27.43	$80.31	$113.40	$246.44
2041	$28.08	$81.58	$114.92	$250.70
2042	$28.80	$82.86	$116.41	$254.60
2043	$29.52	$84.14	$117.90	$258.50
2044	$30.24	$85.42	$119.38	$262.40
2045	$30.96	$86.69	$120.87	$266.30
2046	$31.68	$87.97	$122.36	$270.20
2047	$32.40	$89.25	$123.85	$274.10
2048	$33.12	$90.52	$125.34	$278.00
2049	$33.84	$91.80	$126.83	$281.90
2050	$34.56	$93.08	$128.32	$285.80

Global emissions context

Comments received on past rulemaking analyses involving the SCC expressed concern that global emissions contribution was not an appropriate measure of the benefits of a rule. We believe, however, that while it is not possible to specify the local benefits to climate change resulting from control of local emissions, it is appropriate to acknowledge that local emissions contribute to the global pool of GHGs that cause global impacts, including local impacts directly and indirectly through:

- International markets.
- Multinational businesses and supply chains.
- Trade.

These impacts affect local ecology, people, industry, agriculture, and infrastructure. Establishing a direct 100-percent relationship between local emissions and local impacts is inherently impossible. This is precisely why Ecology and other government agencies have chosen to represent the costs of GHG emissions and the benefits of reducing them on a global scale. This approach is consistent with our analytic practices and the requirements of the APA for cost and benefit analysis (RCW 34.05.328).

For typical costs and benefits, Ecology uses Washington State-only values, but GHG emissions are unique, and require a broader approach to valuation, especially as it applies to the co-externality impacts of carbon emissions. Ecology believes the use of a global SCC is the appropriate carbon cost to use in analyses, because of the unique nature of carbon and climate change. This has been reaffirmed at the federal level multiple times:

- The IWG addresses global SCC twofold in its interim 2021 Technical Support Document:

"First, the IWG found previously and is restating here that a global perspective is essential for SC-GHG estimates because climate impacts occurring outside U.S. borders can directly and indirectly affect the welfare of U.S. citizens and residents. Thus, U.S. interests are affected by the climate impacts that occur outside U.S. borders. Examples of affected interests include: direct effects on U.S. citizens and assets located abroad, international trade, tourism, and

spillover pathways such as economic and political destabilization and global migration. In addition, assessing the benefits of U.S. GHG mitigation activities requires consideration of how those actions may affect mitigation activities by other countries, as those international mitigation actions will provide a benefit to U.S. citizens and residents by mitigating climate impacts that affect U.S. citizens and residents.

Second, the IWG found previously and is restating here that the use of the social rate of return on capital to discount the future benefits of reducing GHG emissions inappropriately underestimates the impacts of climate change for the purposes of estimating the SC-GHG (see Section 3.1 [of the TSD]). Consistent with the findings of the National Academies (2017) and the economic literature, the IWG continues to conclude that the consumption rate of interest is the theoretically appropriate discount rate in an intergenerational context (IWG 2010, 2013, 2016). The IWG recommends that discount rate uncertainty and relevant aspects of intergenerational ethical considerations be accounted for in selecting future discount rates."

- The IWG previously addressed global SCC (as well as OMB guidance), and stated in its 2015 revised Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis:

"Under current OMB guidance contained in Circular A-4, analysis of economically significant proposed and final regulations from the domestic perspective is required, while analysis from the international perspective is optional. However, the climate change problem is highly unusual in at least two respects. First, it involves a global externality: emissions of most greenhouse gases contribute to damages around the world even when they are emitted in the United States. Consequently, to address the global nature of the problem, the SCC must incorporate the full (global) damages caused by GHG emissions. Second, climate change presents a problem that the United States alone cannot solve. Even if the United States were to reduce its greenhouse gas emissions to zero, that step would be far from enough to avoid substantial climate change. Other countries would also need to take action to reduce emissions if significant changes in the global climate are to be avoided. Emphasizing the need for a global solution to a global problem, the United States has been actively involved in seeking international agreements to reduce emissions and in encouraging other nations, including emerging major economies, to take significant steps to reduce emissions. When these considerations are taken as a whole, the interagency group concluded that a global measure of the benefits from reducing U.S. emissions is preferable."

- The 2015 Technical Support Document refers back to the 2010 Technical Support Document – Social Cost of Carbon for Regulatory Impact Analysis for further discussion, including the topic of whether it is permissible under law:

"As a matter of law, consideration of both global and domestic values is generally permissible; the relevant statutory provisions are usually ambiguous and allow selection of either measure.6 [Footnote 6: It is true that federal statutes are presumed not to have extraterritorial effect, in part to ensure that the laws of the United States respect the interests of foreign sovereigns. But use of a global measure for the SCC does not give extraterritorial effect to federal law and hence does not intrude on such interests.]"

- The 2010 TSD addresses scaling of global benefits of reducing global GHG emissions, and states, “It is recognized that [scaling to domestic (US) SCC is] approximate, provisional, and highly speculative. There is no a priori reason why domestic benefits should be a constant fraction of net global damages over time.” The same is true for any output-based scaling to state, region, county, or other geographic level.
- The IWG responded to comments in support of global SCC:

“A number of commenters supported the IWG's decision to base the SCC estimates on global damages. Commenters explained that climate change is a global commons problem because carbon pollution does not remain within one country's borders, and that the use of global damages in the SCC is consistent with the economic theory of the commons. One commenter further stated that if damage estimates are limited to only those within each country's borders, any actions based on those estimates would lead to a collective failure to optimally mitigate GHG emissions. Another commenter referred to the importance of this effect by stating that the consideration of global damages in domestic rulemaking can be based on an expectation of reciprocity from other countries. Several commenters stressed the importance of the use of global SCC estimates as a tool in international negotiations. Finally, some commenters offered other reasons for considering damages in regions outside of the United States, including liability, national security concerns, trade-related "spillover effects", and the principle in international environmental law of reducing cross-border harm.”

Response

“The IWG agrees that a focus on global SCC estimates in RIAs is appropriate. As discussed in the 2010 TSD, the IWG determined that a global measure of SCC is appropriate in this context because emissions of most greenhouse gases contribute to damages around the world and the world’s economies are now highly interconnected. To reflect the global nature of the problem, the SCC incorporates the full damages caused by CO2 emissions and we expect other governments to consider the global consequences of their greenhouse gas emissions when setting their own domestic policies.

The IWG also agrees that if all countries acted independently to set policies based only on the domestic costs and benefits of carbon emissions, it would lead to an economically inefficient level of emissions reductions which could be harmful to all countries, including the United States, because each country would be underestimating the full value of its own reductions. This is a classic public goods problem because each country’s reductions benefit everyone else and no country can be excluded from enjoying the benefits of other countries’ reductions, even if it provides no reductions itself. In this situation, the only way to achieve an economically efficient level of emissions reductions is for countries to cooperate in providing mutually beneficial reductions beyond the level that would be justified only by their own domestic benefits. By adopting a global estimate of the SCC, the U.S. government can signal its leadership in this effort. In reference to the public good nature of mitigation and its role in foreign relations, thirteen prominent academics noted that these “are compelling reasons to focus on a global SCC” in a recent article on the SCC (Pizer et al., 2014). In addition, as noted by commenters, there is no bright line between domestic and global damages. Adverse impacts on

other countries can have spillover effects on the United States, particularly in the areas of national security, international trade, public health and humanitarian concerns."

- In its response to public comments, the IWG also responded to concerns regarding domestic damages:

"A number of commenters suggested that the use of global damages creates a mismatch between estimates of costs and benefits in agency RIAs. Use of a global rather than domestic SCC may overstate the net benefits to the United States of reducing emissions, because global benefits are compared to domestic costs. A policy that appears cost-justified from a global perspective may not be from a purely domestic U.S. perspective. Therefore, these commenters suggest that a global SCC is only appropriate when the analysis considers global costs and benefits in the context of a global carbon mitigation program.

Other commenters indicated that the IWG should update and report domestic climate damages separately from global estimates for several reasons, including the public's right to know the domestic benefits of domestic regulatory actions. A few comments stated that the IWG should more clearly articulate that the SCC includes global damages, which they felt was particularly unclear in the 2013 TSD.

Finally, commenters also addressed the provisional range of domestic damages that was presented in the 2010 TSD. Several comments stated that the range discussed in the 2010 TSD for the domestic SCC was too high. Two commenters suggested a range for the domestic share of total global damages of 6 to 8.7 percent based on a paper by Nordhaus (2011). One commenter stated that the methods used to estimate the domestic damages as 7 to 23 percent of global damages is too speculative for quantification of the SCC.

Response

As stated in the prior section, GHG emissions in the United States will have impacts abroad, some of which may, in turn, affect the United States. For this reason, a purely domestic measure is likely to understate actual impacts to the United States. Also, as stated above, the IWG believes that accounting for global benefits can encourage reciprocal action by other nations, leading ultimately to international cooperation that increases both global and U.S. net benefits relative to what could be achieved if each nation considered only its own domestic costs and benefits when determining its climate policies.

Further, as explained in the 2010 TSD, from a technical perspective, the development of a domestic SCC was greatly complicated by the relatively few region-or country-specific estimates of the SCC in the literature, and impacts beyond our borders have spillover effects on the United States, particularly in the areas of national security, international trade, and public health. As a result, it was only possible to include an "approximate, provisional, and highly speculative" range of 7 to 23 percent for the share of domestic benefits in the 2010 TSD. This range was based on two strands of evidence: direct domestic estimates resulting from the FUND model, and an alternative approach under which the fraction of GDP lost due to climate change is assumed to be similar across countries. We note that the estimated U.S. share of global damages based on the Nordhaus (2011) study cited by several commenters largely falls within the provisional range offered in the 2010 TSD.

In conclusion, the IWG believes that the only way to achieve an efficient allocation of resources for emissions reduction on a global basis is for all countries to base their policies on global estimates of damages and will therefore continue to recommend the use of global SCC estimates in regulatory impact analyses. The IWG will also continue to review developments in the literature, including more robust methodologies for estimating SCC values based on purely domestic damages, and explore ways to better inform the public of the full range of carbon impacts, both global and domestic."

- On August 8th, 2016, the US Court of Appeals for the Seventh Circuit issued a ruling supporting not only the use of SCC, but the use of global SCC values:

"AHRI and Zero Zone next contend that DOE arbitrarily considered the global benefits to the environment but only considered the national costs. They emphasize that the EPCA only concerns "national energy and water conservation." 42 U.S.C. § 6295(o)(2)(B)(i)(VI). In the New Standards Rule, DOE did not let this submission go unanswered. It explained that climate change "involves a global externality," meaning that carbon released in the United States affects the climate of the entire world. 79 Fed. Reg. at 17,779. According to DOE, national energy conservation has global effects, and, therefore, those global effects are an appropriate consideration when looking at a national policy. Id. Further, AHRI and Zero Zone point to no global costs that should have been considered alongside these benefits. Therefore, DOE acted reasonably when it compared global benefits to national costs."

- On July 15, 2020, the US District Court in the Northern District of California ruled to reinstate a 2016 US Bureau of Land Management Waste Prevention Rule that had been rolled back in 2018 based on an "interim domestic social cost of methane" that resulted in significantly lower estimates of benefits than had been found during the 2016 rulemaking. The Court found the 2018 rescission to be arbitrary and capricious, stating:

"The analysis ignores impacts on 8 million United States citizens living abroad, including thousands of United States military personnel; billions of dollars of physical assets owned by United States companies abroad; United States companies impacted by their trading partners and suppliers abroad; and global migration and geopolitical security."

The discussion above concerning the application of the global SCC to valuation of domestic US GHG emissions reduction benefits applies equally to the application of the global SCC to the benefits of GHG emissions reductions in Washington. Washington's economy is tied to the world economy through trade, international supply chains, and local employment by international firms.

- Washington exported an estimated $69.9 billion in goods and $28.8 billion in services in 2018.
- International trade, including exports and imports, supported 940,800 Washington jobs in 2018.
- 140,600 people in Washington are directly employed by US affiliates of foreign multinational companies.

As with the US economy as a whole, Washington is impacted directly and indirectly by economic disruptions outside the state. , Therefore, we used the SCC in evaluating the benefits of the leakage avoided by this rule's accommodation of EITE facilities.

In 2017, authors at Carbon Brief addressed criticisms of the global SCC, noting:

- Scaling of global SCC to sub regions or populations:
    - Was rejected by the U.S. Seventh Circuit Court of Appeals.
    - Is not appropriate for global problems. For a global problem like climate change, consideration of local effects only is untenable, stating, "It's worth asking what would happen if the US were to ignore global effects. If other countries were to follow suit, then a large proportion of global climate impacts would be ignored, falling between the cracks."

  Contradicts ethical arguments in favor of considering irreversible impacts of climate change like species extinction in other regions.

- While arguments have been made to use higher discount rates for the SCC, such as a 7 percent rate consistent with past federal government practice and internal corporate rates of return, there are valid arguments in favor of much lower or zero discount rates:
- Accounting for the various uncertainties surrounding estimates of the SCC would increase the SCC value by 70 percent to 420 percent over current estimates.
- The federal SCC was ruled "reasonable and the best available measure to determine the environmental cost of CO2" in 2016.

In 2021, a group of prominent economists published arguments in favor of the global SCC, particularly as compared to a cost-based or cost-effectiveness approach to policy analysis that does not reflect the benefits of reduced or avoided climate change. The authors argue that in contrast to more limited scope approaches, "the SCC inherently builds in the notion of reciprocity among countries because it reflects the global damages of emissions. A future in which all countries seek to guide domestic policy by using the SCC can lead to progress on addressing climate change in a globally efficient and least-cost way."

That same year, using an empirical approach involving risk-free real rates of return on assets – consistent with Ecology's approach to discount rates – economists at University of California Santa Barbara and University of Chicago argued for a maximum discount rate of 2 percent based on current trajectories. The authors also noted the discount rate appears to have entered a phase of decline over time (following a downward trend since about 1985), which could support arguments for using a diminishing discount rate.

We note that the federal SCC was called into question by a federal district court in 2022. This decision was subsequently stayed by the Fifth Circuit Court of Appeals. The Fifth Circuit stated, "We conclude the standing inquiry shows the Government Defendants' likelihood of success on the merits in this appeal, and the other factors, including the public interest, favor granting a stay of the injunction." This ruling indicates that the Louisiana District Court's injunction was unwarranted and issued in error. The U.S. District Court for the Eastern District of Missouri

denied a similar challenge to the SCC. Also, the claims brought in these legal challenges focused in part on statutory and regulatory structures for federal rulemaking that do not apply to Ecology's rulemaking processes.

Appendix C: Values of other than SCC impacts of climate change affecting quality of life and economic activity.

While the SCC includes values of economic activity and some health impacts, it is not all-inclusive. Estimates exclude the values of other impacts of climate change, which affect quality of life as well as economic activity. Values not included in SCC estimates include:

Health:

- Respiratory illness
- Lyme disease
- Death, injuries, and illnesses from omitted natural disaster and migration
- Water, food, sanitation, shelter

Agriculture:

- Weeds, pests, pathogens
- Food price spikes
- Heat and precipitation extremes

Oceans:

- Acidification, temperature, and extreme weather impacts on fisheries, extinction, reefs
- Storm surge interaction with sea level rise

Forests:

- Pest infestations
- Pathogens
- Species invasion and migration
- Flooding and soil erosion

Wildfire:

- Burned acreage
- Public health
- Property losses
- Fire management costs

Ecosystems:

- Biodiversity
- Habitat
- Species extinction
- Outdoor recreation and tourism
- Ecosystem services
- Rising value of ecosystems due to increased scarcity
- Accelerated decline due to mass migration

Productivity and economic growth:

- Labor productivity and supply, public health
- Infrastructure impacts from sever events
- Diversion of resources to climate adaptation

Water:

- Availability and competing needs
- Flooding

Transportation:

- Changes to land and ocean transportation

Energy:

- Energy supply disruptions

Catastrophic impacts and tipping points:

- Rapid sea level rise
- Methane releases from permafrost
- Damages at very high temperatures
- Unknown catastrophic events

Inter- and intra-regional conflict:

- National security
- Increased violent conflicts

Wildfires

Climate change and land-use change are projected to make wildfires more frequent and intense, with a global increase of extreme fires of up to 14 percent by 2030, 30 percent by the end of 2050 and 50 percent by the end of the century, according to a recent report by the UN Environment Programme. The report notes, "the true cost of wildfires – financial, social, and environmental – extends for days, weeks, and even years after the flames subside." It also recommends developing an understanding of full wildfire costs, noting that, "One assessment estimated the annualized economic burden from wildfire for the United States to be between $71.1 billion to $347.8 billion." That corresponds to $216 to $1,056 per every person in the country each year, on average. Based on the 7.615 million population of Washington , this would be between $1.6 billion and $8.0 billion every year, on average, but this range is likely higher in the western states, since we experience a larger proportion of wildfires than the country in general.

Washington is particularly vulnerable to wildfire losses, not only from direct fire impacts to valuable natural spaces (as we saw in the over 600 thousand acres of Washington burned by just the large and highly significant wildfires in 2021) and human landscapes (as we saw in 2020's devastation of 85 percent of Malden and Pine City), but also from secondary impacts to forestlands, wildlife and habitat, soil erosion, and stream and river quality and temperature. Wildfires are also a risk to businesses, both private and governmental, as illustrated by our state's working forests.

In 2018, researchers found that commercial timber forests can burn 30 percent more severely than managed federal forestlands. A study of the impact of the 2020 Labor Day wildfires in Oregon found that nearly a million acres of burned managed forest lands would have generated end products worth $30 billion, but could generate only $2.6 billion in salvage harvests. That reflects a 91.3 percent value loss of managed timber lands. The same study found that private forest owners would represent 64 percent of that salvage value.

In 2020, the Washington Department of Natural Resources spent an estimated $20 million on aviation readiness and support for large fires. That same year they incurred direct costs of over $12.5 million responding to wildfire incidents in 2020, and estimated additional damages of:

- $20 million to utilities.
- $15 million to state agency infrastructure.
- $10 million to other government infrastructure.

Wildfires also cause hazardous air quality in broad regions, impacting rural as well as densely populated areas.

Heat impacts

Lessons learned from the extreme northwest heat wave of 2021 include assessment that climate change may result in more heat-related deaths than previously estimated. The 2021 heat dome that brought record-breaking temperatures to the Pacific Northwest and British Columbia, resulted in 138 heat-related deaths in Washington, making it the deadliest weather event in state history. Using the risk-based value of avoiding 100 percent risk of death (called "mortality risk valuation" or the "value of statistical life (VSL)", though it is not the value of any individual's life, and is statistically extrapolated from individuals' willingness to accept fatality risks for a premium) as used by the US EPA, each of these deaths resulted in losses to society of $10.5 million in current dollars, and the heat dome resulted in at least $1.45 billion in lost lives during just one event. Extreme heat events are forecast to happen more frequently and be more severe due to climate change.

In addition to fatal events, the US CDC assessed heat-related visits to emergency departments during the heat dome event. They found a nearly 70-fold increase in people seeking emergency care at the peak of the heat event. Particularly in times of overburdened or overwhelmed medical resources (as we have seen during the COVID-19 pandemic), this size of increased demand for urgent medical care could result in catastrophic delays and increased illness or death. The average cost of a single healthcare visit related to a high heat event is $12,544.

Ongoing drought and the 2021 heat dome also affected harvests:

- At least 30 percent impact to raspberries: The aggregate Whatcom County raspberry harvest fell 30 to 40 percent, with individual growers experiencing losses between 15 and 75 percent.
- At least ten percent impact to cherries: The overall cherry harvest, largely in the Yakima Valley, fell at least 10 percent.

- $85 million impact to blueberries: The Washington Blueberry Commission estimated $85 million in yield loss and quality impacts.

Wheat harvests:

- A 34-fold increase in the share of "poor" or "very poor" condition spring wheat.
- A 6-fold increase in the share of "poor" or "very poor" condition winter wheat.

Shellfish harvests:

- 40 percent losses of seeded oysters.
- A 56 percent increase in vibriosis cases. Vibriosis is an illness in humans caused by shellfish contaminated with Vibrio bacteria, which are naturally occurring but present in high concentrations in warmer temperatures.
- 5 – 30 percent oyster mortality in the Salish Sea.
- Higher losses among shellfish species in smaller, sheltered waters, and those that live nearer the surface, such as cockles.

Flood damages

A recent study by the Center for Western Weather and Water Extremes, at the University of California San Diego, modeled the impacts of various climate change scenarios on atmospheric rivers (long, flowing regions of the atmosphere that carry water vapor) impacting western states.[18] Using flood insurance data, the study estimated county-level increases in annual costs of flood damage, through 2090, due to the contribution of climate change to frequency, duration, and magnitude of atmospheric rivers.

- Flood damage due to climate change-induced impacts to atmospheric rivers in western Washington (per county):
    - **$10 million to $100 million per year** increases in most Puget Sound-adjacent counties.
    - Over **$100 million per year increases** in Snohomish, King, and Lewis counties.
    - This is at least a doubling of annual flood damage costs in Western Washington, compared to costs in the 1990s.
- Flood damage due to climate-change-induced impacts to atmospheric rivers in eastern Washington (per county):
    - **$1 million per year increases in most eastern Washington counties,** with some counties incurring up to $10 million more per year.
    - This is up to a doubling of annual costs for most eastern Washington counties.

[18] Corringham, TW, J McCarchy, T Shulgina, A Gershunov, DR Cayan, and FM Ralph, 2022. Climate change contributions to future atmospheric river flood damages in the western United States. Nature Scientific Reports 12:13747. https://doi.org/10.1038/s41598-022-15474-2

- For Pend Oreille, Spokane, Whitman, Columbia, and Asotin counties, this is between two and four times the size of flood damage costs in the 1990s.

Environmental justice improvements

Wildfires and air quality

Wildfires accounted for 25 – 50 percent of fine particulate matter in the US in recent years, with **higher levels in the western states**,[19] and are expected to increase in frequency and severity. Even when wildfire smoke is ubiquitous, it impacts overburdened communities more severely, as they may not have good access to air filtration or non-emergency healthcare, and may need to spend more time outside during high heat events that often coincide, since they may have limited access to air conditioning and other cooling options. They are also more likely to reside in areas that absorb more heat and retain it longer, due to reduced greenspace and tree canopy, proximity to industrial activity, and more paved area.[20]

Heat-related mortality

The **heat-related death risk also disproportionately affects overburdened communities.** A study in British Columbia found that heat deaths in the greater Vancouver area were **strongly tied to individuals' "material and social deprivation" as well as age, sex, and neighborhood greenness**,[21] meaning that deaths were more likely to occur in populations that:

- Had lower incomes.
- Had less shade and more impervious or paved surfaces.
- Were unsheltered or had inadequate housing.
- Had less education.
- Lived alone.
- Were elderly.
- Lacked transportation.
- Lacked recreational spaces.
- Experienced more job or income insecurity.

[19] Burke, M, A Driscoll, S Heft-Neal, J Xue, J Burney, and M Wara, 2020. The changing risk and burden of wildfire in the United States. PNAS 118(2). https://doi.org/10.1073/pnas.2011048118

[20] King County, 2021. Results of heat mapping project show inequitable impact of hotter summers. https://kingcounty.gov/elected/executive/constantine/news/release/2021/June/23-heat-mapping-results.aspx. Results: https://www.arcgis.com/apps/webappviewer/index.html?id=84709c65c08a40bbb47d0723ef1c797a&extent=-13604644.7965%2C6019787.1095%2C-13561266.7829%2C6046616.5065%2C102100

[21] Henderson, SB, KE McLean, MJ Lee, and T Kosatsky, 2022. Analysis of community deaths during the catastrophic 2021 heat dome. Environmental Epidemiology (2022) 6:e189. DOI: 10.1097/EE9.0000000000000189.

In short, heat deaths are more likely to occur among overburdened communities whose historically lower resource access puts them more at risk of being in one or more of the categories above. And particularly during a time of high numbers of people living unsheltered or without consistent shelter, climate change is poised to harm or kill the most vulnerable among us.

Other pollutants

Overburdened communities tend to be located in areas that expose them to higher historic or current pollutants. Whether in their homes, outdoors, at school, or at work, overburdened populations are more likely to interact with air emissions from vehicles, contaminated nonpotable and even potable waters, or soils and shorelines contaminated by historical activities or land uses. This means if covered parties reduce or offset GHG emissions in ways that also reduce other emissions (note that this is part of the regulatory baseline and adopted rule's definition of providing direct benefits to the state), the rule will provide additional benefits to those populations.

Changes in transportation fuels and infrastructure will also particularly benefit overburdened populations. The Washington State Department of Transportation notes:[22]

- In Washington about 1 in 7 (900,000) people live within 1/4 mile of heavy traffic roadways. These people breathe more air pollution from diesel and gasoline exhaust.
- People with an underlying health condition like asthma or heart disease, may be especially sensitive to traffic-related air pollution, as are children and adults age 65 and older.
- Traffic air pollution is linked to adverse birth outcomes such as low birth weight and premature births.

Environmental health disparities mapping

The Washington State Department of Health Environmental Health Disparities map[23] evaluates environmental health risk factors in communities, using a model adapted from CalEnviroScreen — a cumulative environmental impacts assessment mapping tool developed by CalEPA and used in California. The model estimates a cumulative environmental health impact score for each census tract reflecting pollutant exposures and factors that affect people's vulnerability to environmental pollution. The model is based on a conceptual formula of risk being the product of threat and vulnerability, where threat and vulnerability are based on several indicators.

Threat is represented by indicators that account for pollution burden, which is a combination of environmental effects and environmental exposures in communities. Environmental effects include indicators that account for adverse environmental quality generally, even when

[22] WA Department of Health, 2022. Traffic Air Pollution Data. https://doh.wa.gov/data-statistical-reports/washington-tracking-network-wtn/traffic-air-pollution

[23] WA Department of Health, 2022a. Washington Tracking Network, Environmental Health Disparities Map. https://fortress.wa.gov/doh/wtnibl/WTNIBL/

population contact with an environmental hazard is unknown or uncertain. Environmental exposures include the levels of certain pollutants that populations come into contact with.

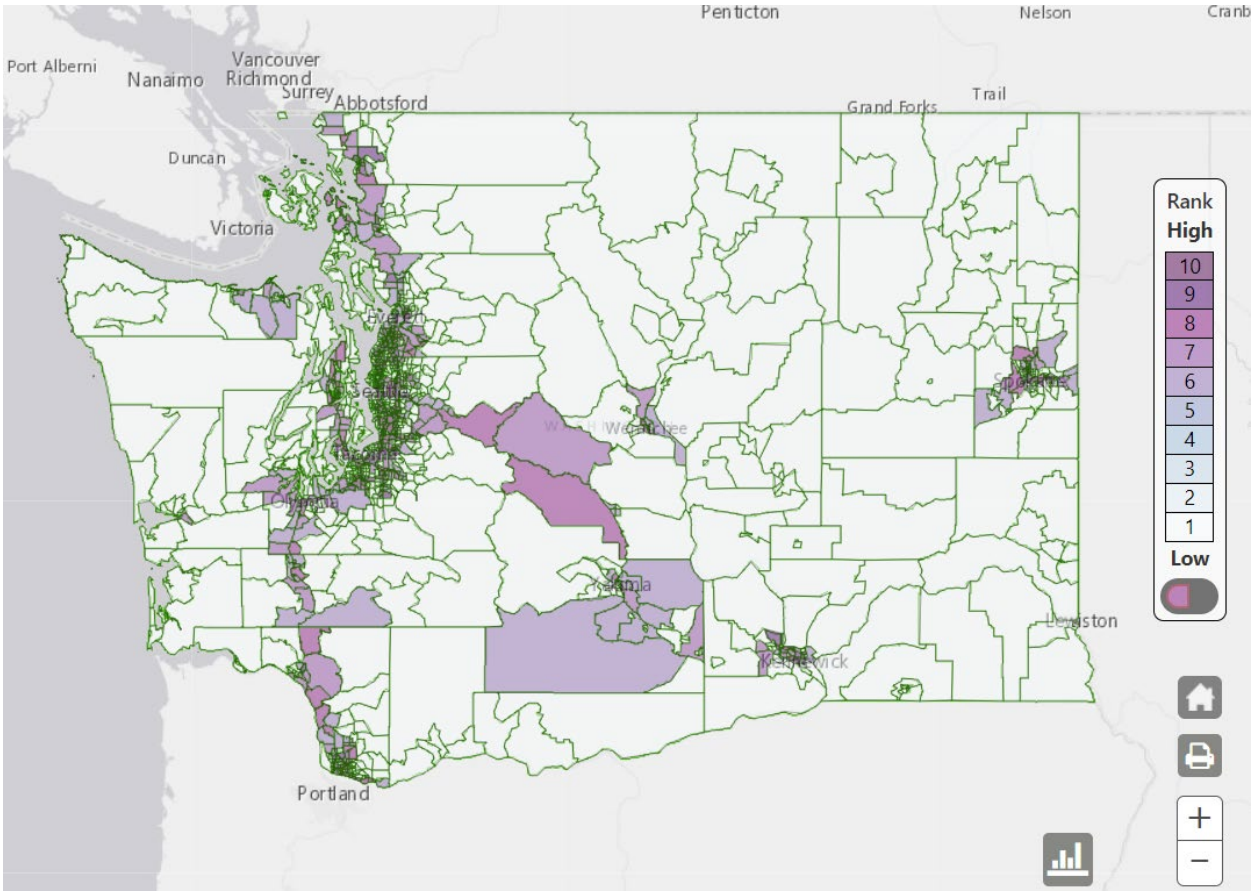
Vulnerability is represented by indicators of socioeconomic factors and sensitive populations for which there is clear evidence that they may affect susceptibility or vulnerability to an increased pollution burden. Indicators in socioeconomic factors measure population characteristics that modify the pollution burden itself. Sensitive populations refer to those who are at greater risk due to intrinsic biological vulnerability to environmental stressors.

The rankings help to compare health and social factors that may contribute to disparities in a community. Rankings should not be interpreted as absolute values. Instead, the relationships within and between map layers help to identify where the adopted rule will generate benefits with greater focus on overburdened communities. A higher rank generally reflects a higher combined threat and vulnerability to the depicted variable.

Populations living near high-traffic roadways

The Health Disparities map identifies areas across the state that live near highways. Many of them are in urban areas around Puget Sound, but others are along interstate or state highways to the south and east.

Figure 1: Health disparity rankings of populations living near high-traffic roadways.[24]

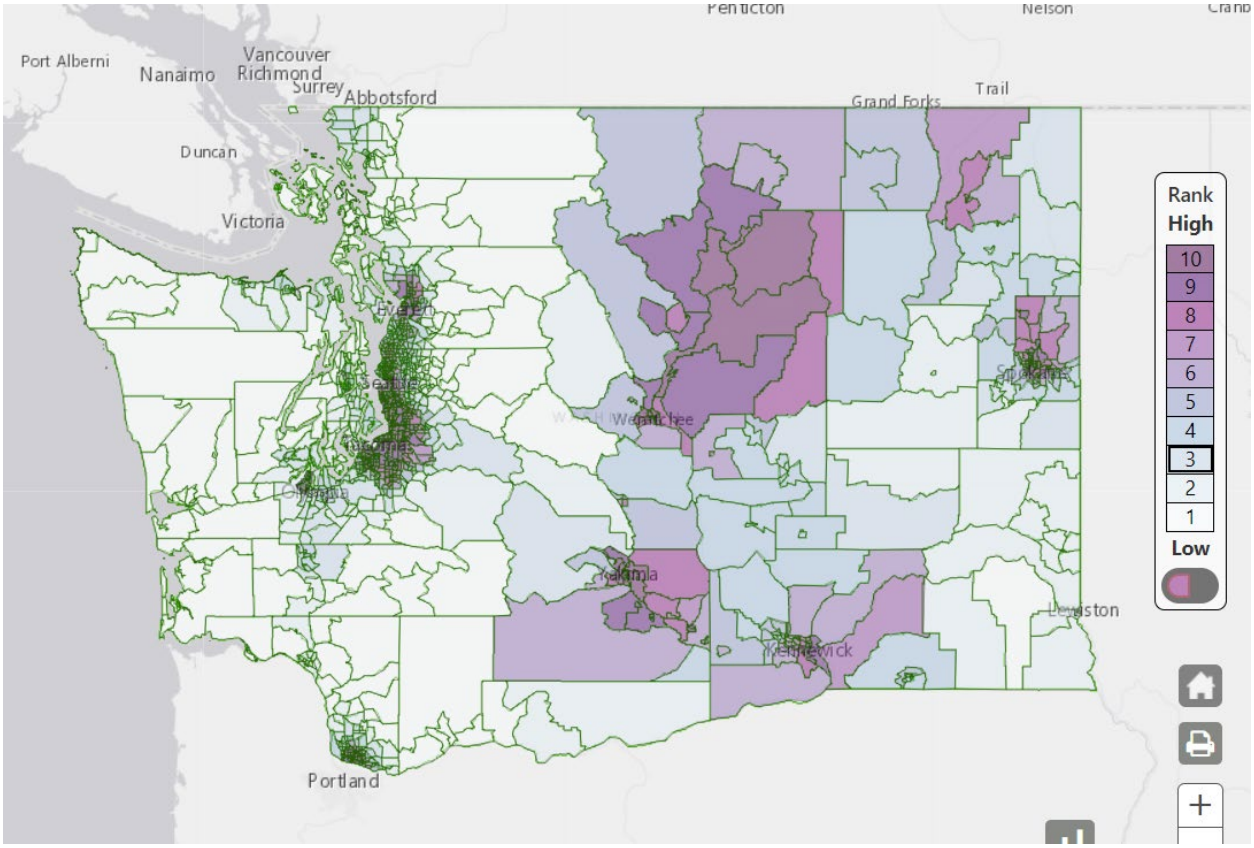


These populations overlap in many ways with areas that experience high levels of fine particulate matter. This is particularly true for areas along the Interstate 5 corridor near Puget Sound, and Interstate 82 through Yakima. Other areas that see high particulate matter are

[24] From University of Washington Department of Environmental & Occupational Health Sciences, 2019. Washington Environmental Health Disparities Map: technical report. Seattle; 2019: "This indicator uses 2017 census block population estimates from the Washington State Office of Financial Management and 2017 roadway traffic density data from the Washington State Department of Transportation in the form of estimated annual average daily traffic volumes (AADT). This indicator displays the percentage of population exposed to busy roadways within each census tract. The AADT is adjusted by the road segment length and the total road length includes roads within 150 meters of a census tract boundary. The exposure zone used in this indicator is defined as the area within 600 meters of a roadway (i.e., 300 meters on either side of the roadway). The population exposed per census block within a tract was summed in order to get the exposed population within each census tract."

those frequently impacted by wildfires, particularly in the northeast portion of Washington and around Yakima and Kennewick.

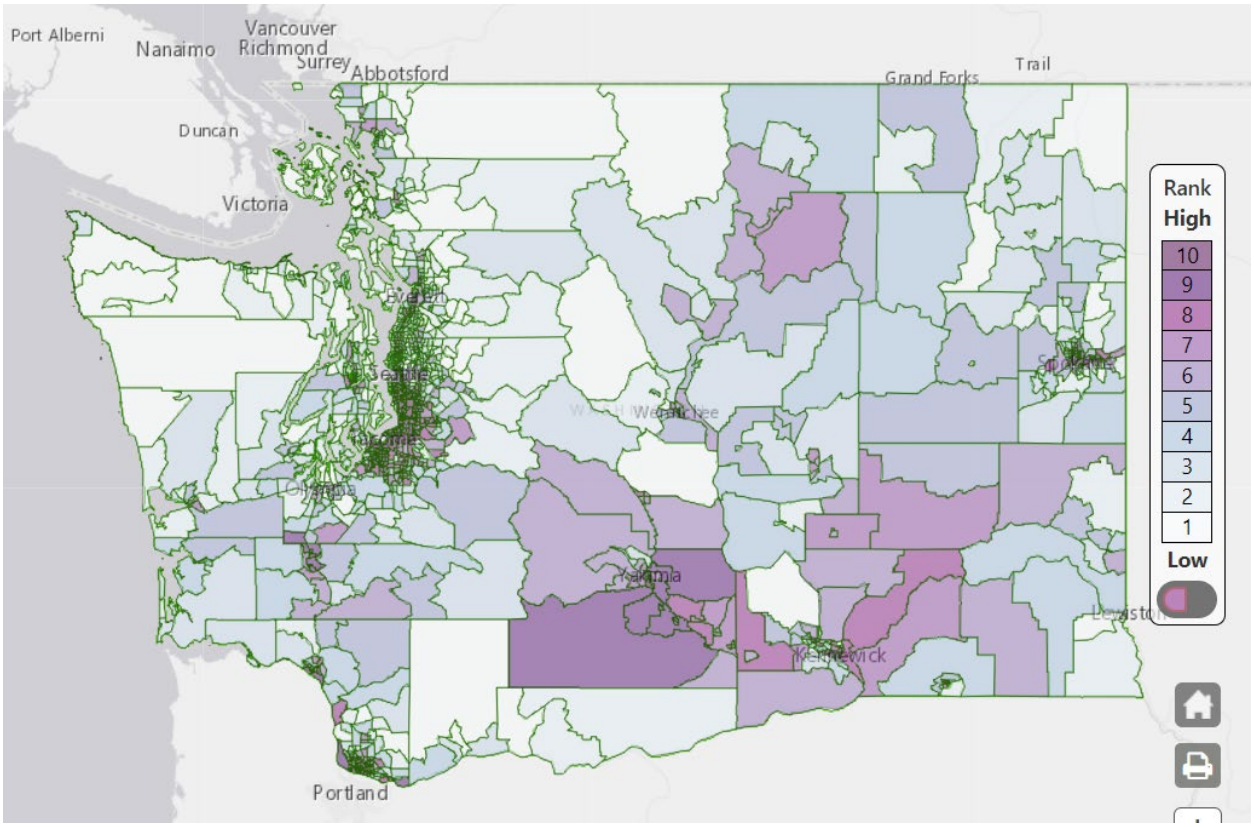
Figure 2: Populations with high risk associated with fine particulate matter.[25]



[25] From University of Washington Department of Environmental & Occupational Health Sciences, 2019. Washington Environmental Health Disparities Map: technical report. Seattle; 2019: "This indicator uses the three-year mean concentration of daily maximum 8-hour rolling averaged ozone for 2009-2011 from AIRPACT. AIRPACT provides data that averages daily max ozone level for three years within 12km x 12km grid cells. Daily maximum ozone concentrations were calculated by using inverse distance weighting from the center of each 12km x 12km grid cell to model the average ozone concentration at the census block level. The block-level ozone concentrations were then averaged for all blocks within a census tract."

There are many measures of environmental health disparities, and the Health Disparities Map combines them into an overall ranking for each census tract in the state. We note that Health Disparities rankings overlap significantly with areas near roadways and/or with high fine particulate matter.

Figure 3: Environmental Health Disparities rankings[26]



[26] From University of Washington Department of Environmental & Occupational Health Sciences, 2019. Washington Environmental Health Disparities Map: technical report. Seattle; 2019: "The ranking provides a common scale to compare various issues at the community level and to assess the cumulative impact of the indicators across communities. The use of rankings also allows health information to be displayed for each community, while protecting confidentiality in communities with small numbers. The IBL tool does not show the actual numeric difference between each rank. The ranks only show that there is a difference, not how much. Because the final composite scores are ranked by deciles, the resulting rankings shown on the map range from 1 (least impacted) to 10 (most impacted)."