Draft Preliminary Cost-Benefit Analysis and Least-Burdensome Alternative Analysis

Chapter 173-201A WAC
Water Quality Standards for Surface Waters of the State of Washington

DRAFT

The analysis in this document is based on the draft rule language posted on 30th September, 2014.

Note that while this analysis refers to the "proposed rule language", the draft language released is not being proposed at this time.

Prepared by Kasia Patora
with research assistant
Kim Morley

for

Water Quality Program
Washington State Department of Ecology
Olympia, Washington

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Executive Summary

The Washington Administrative Procedure Act (APA; RCW 34.05.328) 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."

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.

The proposed rule establishes human health criteria that must be met to comply with Washington's water quality standards:

- Updates scientific values for:
  - Toxicity factors - reflecting current research
  - Body weight - representative of current population mean – 80kg
- Changes the level of protectiveness:
  - Fish consumption rate – 175 g/day, up from 6.5 g/day
  - Excess cancer risk rate – 1×10^{-5} (one in one hundred thousand), down from 1×10^{-6} (one in one million)
- Does not reduce protectiveness from current levels
- Sets the arsenic criteria to the drinking water concentrations

The proposed rule also updates implementation tools that can be used to meet all Washington water quality standards:

- Removes time limit on compliance schedules
- Allows intake credits where there is no net addition of pollutants
- Establishes a public, technical, and timed process for variances

<u>Using existing data and sampling techniques, analysis of the human health criteria expects:</u>

- No impact to existing facilities
- One likely future impact to a groundwater cleanup facility
- **Costs (expected present values):**
  - **$600 thousand to $3 million in costs for groundwater cleanup**
- Benefits (expected present values):
  - **Cancer risk reductions valued at $6 million to $90 million** in equivalent mortality risk avoided across affected populations for groundwater cleanup
  - **Avoided cancer treatment costs of $400 thousand to $2 million**
  - Reduced non-cancer health impacts in affected populations fishing in groundwater cleanup area
  - Reduced losses to income, debt, and non-pecuniary quality of life measures

Analysis of the implementation tool changes expects:

- Adjustment to both costs and benefits, in terms of delayed timing affecting the present values of compliance with all water quality requirements, including HHC as well as standards for values such as temperature and dissolved oxygen.
- Predictability and cost-smoothing for compliance with water quality regulations.

If, in future, there are improvements in sampling coverage and sensitivity, this analysis expects:

- Costs:
  - Ecology was unable to quantify costs to facilities and locations without existing data. Costs likely include:
    - Equipment capital costs
    - Operation and maintenance costs
    - Monitoring costs
    - Timing costs of interim limitations on chemicals discharged
- Benefits:
  - Ecology was unable to quantify benefits to the public and environment due to the degree of uncertainty without additional data. Benefits likely include:
    - Reduced cancer incidence and associated expenditures
    - Reduced cancer mortality and associated costs
    - Reduced exposure to non-carcinogenic toxic chemicals
    - Reduced losses to income, debt, and non-pecuniary quality of life measures
    - Preservation of tribal values for cultural, treaty, and maintenance or improvement of tribal lifeways
    - Preservation of general non-use values
    - Prospective co-benefits to nutrition and the environment

Conclusion

After evaluating the likely costs and benefits of the proposed rule amendments, Ecology believes that the likely qualitative and quantitative benefits of the rule exceed its likely costs. We also conclude that the content of the proposed rule amendments is the least-burdensome alternative that achieves the goals and objectives of the authorizing statutes.

Chapter 1: Introduction and Background

1.1 Introduction

This report describes two of the economic analyses performed by the Washington State Department of Ecology ("Ecology") to estimate the costs and benefits, and alternatives considered, of the proposed Water Quality Standards for Surface Waters of the State of Washington (chapter 173-201A WAC). These analyses – the Cost-Benefit Analysis (CBA) and Least-Burdensome Alternative Analysis (LBA) – are based on the best available information at the time of publication. This is a preliminary draft and the formal draft of the Cost-Benefit Analysis and Least Burdensome Alternative Analysis will be submitted when the formal draft rule is filed with the Code Reviser's Office. If there is feedback and information that could improve the accuracy and precision of the analysis in this document, we would welcome that information.

The Washington Administrative Procedure Act (APA; RCW 34.05.328) 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 through 8 of this document describe that determination, for a 20-year timeframe of impacts.

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 9 of this document describes that determination.

1.2 Description of the proposed rule amendments

The proposed rule updates the levels at which toxic pollutants can be present in water and still protect human health. These levels, known as the human health criteria, are determined using the following EPA HHC equations:

- For Carcinogens:
  - Freshwater criterion = (RL x BW)/(CSF x [DWI + (FCR x BCF)])
  - Marine criterion = (RL x BW)/(CSF x FCR x BCF)
- For Non-Carcinogens:
  - Freshwater criterion = (RfD x RSC x BW)/[DWI + (FCR x BCF)]
  - Marine criterion = (RfD x RSC x BW)/(FCR x BCF)

Where:

- RL: excess cancer risk level. The maximum allowable level of excess cancer.
- BW: body weight. The representative adult body weight for the population, as based on population attributes.
- CSF: cancer slope factor. A toxic-specific number representing the risk of cancer associated with exposure to a carcinogenic or potentially carcinogenic substance. A slope factor is an

upper bound, approximating a 95% confidence limit, on the increased cancer risk from a lifetime exposure to an agent by ingestion.

- DWI: drinking water intake. Typical drinking water intake, based on the existing National Toxics Rule (EPA, 1992).
- FCR: fish consumption rate.
- BCF: bioconcentration factor. A chemical-specific number representing contaminant uptake.
- RfD: reference dose. A toxic-specific number representing a daily oral exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime.
- RSC: relative source contribution. The RSC identifies or estimates the portion of a person's total exposure attributed to water and fish consumption and thereby accounts for potential exposure from other sources such as skin absorption, inhalation, other foods, and occupational exposures.

The proposed rule makes changes to the human health criteria for water quality:

- Updates scientific values for:
  - Toxicity factors - reflecting current research for each chemical
  - Body weight - representative of current population mean – 80kg
- Changes the level of protectiveness:
  - Fish consumption rate – 175 g/day, up from 6.5 g/day
  - Excess cancer risk rate – 1×10^{-5} (one in one hundred thousand), down from 1×10^{-6} (one in one million)
- Does not reduce protectiveness from current levels
- Allows for natural background concentrations of arsenic

The proposed rule updates implementation tools that can be used to meet all Washington water quality standards:

- Removes time limit on compliance schedules
- Allows intake credits where there is no net addition of pollutants
- Establishes a public, technical, and timed process for variances

Each of these changes is described in more detail, and its impacts discussed, in subsequent chapters of this analysis.

It is important to note that the proposed rule changes real cancer risk differently for different people, depending on their real fish consumption. Much as the proposed rule amendments do not assume *everyone* consumes 175 g/day of fish and shellfish, the proposed rule also does not make everyone's excess cancer risk one in one hundred thousand. Actual likely impacts depend on actual fish consumption behavior, as discussed further in Chapter 6.

1.3 Reasons for the rule amendments

The Federal Clean Water Act (CWA) directs states, with oversight by the Environmental Protection Agency (EPA), to adopt water quality standards (WQS) to protect the public health and welfare, enhance the quality of water, and serve the purposes of the CWA. Under section 303, states' water quality standards must include at a minimum:

1. Designated uses for all water bodies within their jurisdictions.
2. Water quality criteria sufficient to protect the most sensitive of the uses.
3. An antidegradation policy consistent with the regulations at 40 CFR 131.12.

States are also required to hold public hearings once every three years for the purpose of reviewing applicable WQS and, as appropriate, modifying and adopting standards. The results of this triennial review must be submitted to EPA, and EPA must approve or disapprove any new or revised standards. Section 303(c) also directs the EPA Administrator to promulgate WQS to supersede state standards that have been disapproved, or in cases where the Administrator determines that a new or revised standard is needed to meet CWA requirements.

As part of the triennial review, Ecology identified a need to adopt new human health criteria, based on more accurate numbers used in the EPA HHC equations for determining numeric chemical criteria. In this rulemaking, Ecology is proposing the inputs and resultant criteria necessary to protect public health, safety, and welfare. Until new human health criteria are adopted, Washington State will continue using federal standards that do not reflect current science on protection from toxic chemicals, as well as existing standards for levels of protectiveness of the population.

Ecology also identified a need to update sections of the WQS that direct the implementation of the HHC and other water quality standards. The goal of revising these implementation tools is to provide clear and predictable regulatory requirements to help entities subject to National Pollutant Discharge Elimination System (NPDES) permits comply with the newly proposed standards. The proposed implementation tools also address legislation (RCW 90.48.605) obligating Ecology to amend water quality standards to allow compliance schedules in excess of ten years under certain circumstances for permitted dischargers.

1.4 Document organization

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

- Baseline (Chapter 2): Description of the baseline for comparison in this analysis (what would occur in the absence of the proposed rule).
- Proposed rule amendments (Chapter 3): Discussion of the proposed rule amendments, and how they are analyzed later in the document.
- Who is prospectively impacted (Chapter 4): Description of the methodology and results of determining the entities impacted (positively or negatively) by the proposed rule amendments.
- Likely costs of the proposed rule amendments (Chapter 5): Analysis of the types and size of costs we expect impacted entities to incur as a result of the proposed rule amendments. Qualitative and quantitative.

- Likely benefits of the proposed rule amendments (Chapter 6): Analysis of the types and size of benefits we expect impacted entities to receive as a result of the proposed rule amendments. Qualitative and quantitative.
- Costs and Benefits under Improved Sampling (Chapter 7): Discussion of costs and benefits that are likely to occur as a result of the proposed rule amendments, allowing for long-run improvements in sampling and sample sensitivity.
- Cost-benefit comparison and conclusions (Chapter 8): Discussion of the complete implications of the proposed rule amendments, results of cost and benefit analyses, and comments on the results.
- Least-burdensome alternative analysis (Chapter 9): Analysis of considered alternatives to the contents of the proposed rule.

Chapter 2: Baseline

2.1 Introduction

In this chapter, we describe the baseline to which the proposed rule amendments are compared. The baseline is the regulatory context in the absence of the proposed rule amendments being adopted. Alternately, one can think of the baseline as what the world looks like if Ecology doesn't adopt the proposed rule amendments.

This analysis does not consider possible federal action as part of the baseline at this time. Due to uncertainty about its components, we did not compare the proposed rule amendments to any rule the EPA would likely adopt in response to Ecology's lack of action, in the absence of this rulemaking.

2.2 What is the baseline?

The baseline generally consists of a collection of existing rules and laws, and their underlying assumptions. For economic analyses, the baseline necessarily also includes the implementation of those regulations, including the guidelines and policies that result in behavior and real impacts. This is what allows us to make a consistent comparison between the state of the world with or without the proposed rule amendments. For this rulemaking, we discuss the baseline below, grouped into existing:

- Rules and laws
- National Toxics Rule (NTR) criteria assumptions[1]
- Permitting guidelines
- 303(d) listing policy
- Compliance behavior
- Growth trajectories
- Allowance for compliance schedules
- Intake Credits
- Allowance for variances

This section contains descriptions of baseline attributes. Where the baseline is describable quantitatively, we discuss relevant baseline quantities and trends directly in the analysis in chapters 4 – 6.

[1] The Federal Register (FR) citation for the human health criteria are from two sources. 57FR60848 is the National Toxics Rule (NTR) which was issued by EPA in 1992. 64FR61182 is a revision to the NTR that changed the PCB criteria from individual aroclors to total PCBs. The NTR can be found at 40CFR131.36.

2.2.1 Existing rules and laws

The underlying elements of the baseline are existing state and federal laws and rules. Relevant local regulations are included when applicable.

2.2.1.1 Federal requirement

Clean Water Act 303(c)(2)(A) states:

> …Such standards shall be such as to protect the public health or welfare, enhance the quality of the water and serve the purposes of this Chapter. Such standards shall be established taking into consideration their use and value for public water supplies, propagation of fish and wildlife, recreational purposes and agricultural, industrial and other purposes and also taking into consideration their use and value for navigation.

2.2.1.2 State requirements

In addition to the federal requirements the Department of Ecology is required under State Statute to "retain and secure high quality waters".

Water Pollution Control Act – RCW 90.48.010 Policy enunciated.

> It is declared to be the public policy of the state of Washington to maintain the highest possible standards to insure the purity of all waters of the state consistent with public health and public enjoyment thereof, the propagation and protection of wild life, birds, game, fish and other aquatic life, and the industrial development of the state, and to that end require the use of all known available and reasonable methods by industries and others to prevent and control the pollution of the waters of the state of Washington. Consistent with this policy, the state of Washington will exercise its powers, as fully and as effectively as possible, to retain and secure high quality for all waters of the state. The state of Washington in recognition of the federal government's interest in the quality of the navigable waters of the United States, of which certain portions thereof are within the jurisdictional limits of this state, proclaims a public policy of working cooperatively with the federal government in a joint effort to extinguish the sources of water quality degradation, while at the same time preserving and vigorously exercising state powers to insure that present and future standards of water quality within the state shall be determined by the citizenry, through and by the efforts of state government, of the state of Washington.

Water Pollution Control Act – RCW 90.48.035 Rule-making authority.

> The department shall have the authority to, and shall promulgate, amend, or rescind such rules and regulations as it shall deem necessary to carry out the provisions of this chapter, including but not limited to rules and regulations relating to standards of quality for waters of the state and for substances discharged therein in order to maintain the highest possible standards of all waters of the state in accordance with the public policy as declared in RCW 90.48.010.

Water Pollution Control Act – RCW 90.48.260 Federal Clean Water Act – Department designated as state agency, authority – Delegation of authority - Powers, duties and functions.

> The Department of Ecology is hereby designated as the State Water Pollution Control Agency for all purposes of the federal clean water act as it exists on February 4, 1987, and is herby authorized to participate fully in the programs of the act.

Water Resources Act of 1971 – RCW 90.54.020 General declaration of fundamentals for utilization and management of waters of the state.

> (b) Waters of the state shall be of high quality. Regardless of the quality of the waters of the state, all wastes and other materials and substances proposed for entry into said waters shall be provided with all known, available, and reasonable methods of treatment prior to entry. Notwithstanding that standards of quality established for the waters of the state would not be violated, wastes and other materials and substances shall not be allowed to enter such waters which will reduce the existing quality thereof, except in those situations where it is clear that overriding considerations of the public interest will be served.

2.2.2 Existing human health criteria: the National Toxics Rule criteria assumptions

The existing values for inputs into the equation for National Toxics Rule (NTR; 40CFR131.36) criteria are listed below. These are inputs into the EPA HHC equations that calculate the human health criteria levels for surface waters. This chapter discusses only the changes to criteria inputs.

- Excess cancer risk level = 10^{-6} (one in one million; RL in EPA HHC equations below)
- Relative source contribution = 1.0 (RSC in EPA HHC equations below)
- Hazard quotient = 1.0 (an underlying factor of RfD below)
- Body weight = 70 kg (BW in EPA HHC equations below)
- Drinking water intake = 2 L/day (DWI in EPA HHC equations below)
- Fish consumption rate = 6.5 g/day for chemicals excluding mercury (FCR in EPA HHC equations below)
- Fish consumption rate for mercury = 18.7 g/day

The EPA HHC equations using these inputs are:

- For Carcinogens:
  - Freshwater criterion = (RL x BW)/(CSF x [DWI + (FCR x BCF)])
  - Marine criterion = (RL x BW)/(CSF x FCR x BCF)
- For Non-Carcinogens:
  - Freshwater criterion = (RfD x RSC x BW)/[DWI + (FCR x BCF)]
  - Marine criterion = (RfD x RSC x BW)/(FCR x BCF)

These EPA HHC equations are discussed in more depth in section 5.2 of this document.

2.2.3 Existing permitting guidelines

Permitting guidelines help permit writers translate the requirement to meet water quality criteria for protection of human health to permittee-specific requirements. While not a legal requirement, guidance informs how human health criteria impact permittees who discharge effluent to water bodies. Therefore, in describing the baseline for this analysis of the proposed rule amendments, it is necessary to consider the permitting guidelines in the baseline and proposed scenarios, as they will contribute to the cost and benefit estimates and discussion of impacts.

Ecology uses the Water Quality Program Permit Writer's Manual (Ecology, 2011) for technical guidance when developing wastewater discharge permits. A general overview of the permitting process for all dischargers includes:

- Ecology receiving the permit application
- Review of the application for completeness and accuracy
- Derivation of applicable technology-based effluent limits
- Determination of whether effluent will cause, or have reasonable potential to cause or contribute to, violation of water quality standards
- If yes, derivation of human health-based effluent limits necessary to meet water quality standards
- Derivation of monitoring requirements and other special conditions
- Review process for the draft or proposed permit
- Issuance of the final permit decision

For example, within the complex process of National Permit Discharge Elimination System (NPDES) permit-writing (see Ecology, 2011, Figure II-2), a step includes determination of whether toxic pollutants are present in the effluent. Next, the permit writer must determine the best methods of controlling the levels of those toxic chemicals. Using existing technology-based guidelines, or developing them using best professional judgment, a reasonable potential determination is made based on modeling as to whether technology-based controls are sufficient to meet water quality standards. If not, water quality-based limits are developed.

The basic requirements and process for developing permits will not change under the proposed rule amendments. Extensive discussion of all of the considerations made during the permitting process can be found in Ecology (2011).

2.2.4 Existing 303(d) listing policy

The federal Clean Water Act's section 303(d) established a process to identify and clean up polluted waters. Every two years, all states are required to perform a water quality assessment of the quality of surface waters in the state, including all the rivers, lakes, and marine waters where data are available. Ecology compiles its own water quality data and Federal data, and invites other groups to submit water quality data they have collected. All data submitted must be collected using appropriate scientific methods. The assessed waters are placed in categories that describe the status of water quality. Once the assessment is complete, the public is given a chance to review it and give comments. The final assessment is formally submitted to the EPA for approval.

Waters whose beneficial uses – such as for drinking, recreation, aquatic habitat, and industrial use – are impaired by pollutants are placed in the polluted water category in the water quality assessment (303(d) list). These water bodies fall short of state surface water quality standards and are not expected to improve within the next two years. The 303(d) list, so called because the processes for developing the list and addressing the polluted waters on the list are described in section 303(d) of the federal Clean Water Act, comprises waters in the polluted water category.

Ecology's assessment of which waters to place on the 303(d) list is guided by federal laws, state water quality standards, and the Policy on the Washington State Water Quality Assessment (WQP Policy 1-11; revised July 2012). This policy describes how the standards are applied, requirements for the data used, and how to prioritize Total Maximum Daily Loads (TMDL), among other issues.[2] In addition, even before a TMDL is completed, the inclusion of a water body on the 303(d) list can reduce the amount of pollutants allowed to be released under permits issued by Ecology.

Waters placed on the 303(d) list require the preparation of a water cleanup plan (TMDL) or other approved water quality improvement project. The improvement plan identifies how much pollution needs to be reduced or eliminated to achieve clean water, and allocates that amount of pollution reduction required among the existing sources.

Ecology periodically revises the Water Quality Assessment Policy based on new information and updates to EPA guidance. Each revision includes a public review process. Ecology is not scheduled to revise the policy for listing water bodies as 303(d) impaired waters within the time frame of this rulemaking. The most recent Water Quality Assessment and 303(d) list was approved by the EPA in December 2012.

2.2.5 Existing compliance behavior

The baseline includes existing compliance behavior. This includes behavior undertaken in response to federal and state laws, rules, permits, guidance, and policies. This also includes business decisions in response to regulatory, economic, or environmental changes. Such behavior might include, but is not limited to, existing treatment technologies, production processes, and effluent volumes.

2.2.6 Existing growth trajectories

The proposed rules apply to existing and future dischargers, on existing and future impaired water bodies, and water bodies with TMDLs and without TMDLs, so the baseline must also account for:

- Attributes and behaviors of future dischargers
- Future TMDLs

[2] A TMDL is the sum of the Load Allocations and Wasteload Allocations, plus reserves for future growth and a margin of safety, which are equal to the Loading Capacity of the water body. This is a requirement of Section 303(d) of the federal Clean Water Act and is defined in 40 CFR 130.2(i). The term "TMDL" is often also applied to the process to determine a TMDL ("Ecology is doing a TMDL") and to the final documentation of the TMDL ("Ecology has submitted a TMDL").

The regulatory environment that current and future dischargers would encounter under the baseline would include the elements of the baseline described above, as well as any change in TMDLs.

2.2.6.1 Growth in TMDLs

The baseline forecast of future growth in the number of TMDLs is based on past growth in that number. We allow for variance in the locations of TMDLs, as geographic location is not necessarily predictable based on past locations.

2.2.6.2 Growth in dischargers

The baseline forecast of future dischargers is based on attributes of existing dischargers. The forecast accounts for the number and type of discharger, as well as discharge expansions.

2.2.7 Existing allowance for compliance schedules

The baseline includes existing compliance schedules. A compliance schedule is an enforceable tool used as part of a permit, order, or directive to achieve compliance with applicable effluent standards and limitations, water quality standards, or other legally applicable requirements. Compliance schedules include a sequence of interim requirements such as actions, operations, or milestone events to achieve the stated goals. Compliance schedules are a broadly used tool for achieving compliance with state and federal regulations; compliance schedules under the Clean Water Act are defined federally at CWA 502(17) and 40 CFR Section 122.2. Under the baseline, compliance schedules may last for up to ten years.

2.2.8 Existing intake credits

An intake credit is a procedure that allows permitting authorities to conclude that a permittee does not cause, have the reasonable potential to cause, or contribute to an excursion above water quality standards when he or she returns an unaltered intake water pollutant to the body of water it was taken from under identified circumstances. Washington's current water quality standards do not allow intake credits.

2.2.9 Existing allowance for variances

A variance is a temporary change to the water quality standards for an individual discharger, multiple dischargers, or stretches of waters. Variances establish a time-limited set of temporary requirements that apply instead of the otherwise applicable water quality designated uses and related water quality criteria. Variances may be used where attaining the designated use and criteria are not feasible immediately, but might be, or will be, feasible in the longer term.

The EPA has approved state-adopted variances in the past and has indicated that it will continue to do so if:

- Each variance is included as part of the water quality standard.
- The state demonstrates that meeting the standard is unattainable based on one or more of the grounds outlined in 40 CFR 13 1.10(g) for removing a designated use.

- The justification submitted by the state includes documentation that treatment more advanced than that required by sections 301(b) and 306 has been carefully considered, and that alternative effluent control strategies have been evaluated.
- The more stringent state criterion is maintained and is binding upon all other dischargers on the stream or stream segment.
- The discharger who is given a variance for one particular constituent is required to meet the applicable criteria for other constituents.
- The variance is granted for a specific period of time and must be re-justified upon expiration.
- The discharger either must meet the standard upon the expiration of this time period or must make a new demonstration of "unattainability".
- Reasonable progress is being made toward meeting the standards.
- The variance was subjected to public notice, opportunity for comment, and public hearing. The public notice should contain a clear description of the impact of the variance upon achieving water quality standards in the affected stretch of waters.

Chapter 3: Proposed Rule Amendments

3.1 Introduction

In this chapter, we describe the proposed rule amendments, and identify which changes will likely result in costs or benefits (or both). Here, we also address complexities in the scope of analysis, and indicate how costs and benefits are analyzed in chapters 5 and 6 of this document.

3.2 Analyzed changes

In this analysis, we evaluated the elements of the proposed rule amendments discussed in the following subsections. Note that elements of the human health criteria values that do not change (e.g., drinking water intake, relative source contributions) are not discussed in this analysis, as the current values of these variables in the criteria calculations are not changing in the proposed rule.

3.2.1 Excess cancer risk level

The human health criteria in the proposed rule are based on an allowable excess cancer risk level of 1×10^{-5} as an input into the NTR EPA HHC equations. This level is equivalent to a probability of one additional cancer in one hundred thousand people, in excess of background levels of cancer in the population.[3] In and of itself, this proposed excess cancer risk would increase (make less protective) criteria values as compared to the baseline, which includes an allowable excess cancer risk level of 1×10^{-6}. All of the changes to the NTR-criteria equation inputs, however, work in combination to affect criteria. The rule provides that the proposed criteria will not change if the change would make the criteria less protective than the current levels set by the NTR.

Ecology is proposing this excess cancer risk level based on a policy decision, incorporating both risk assessment and risk management. This policy decision is consistent with how criteria have been developed in the past, as the process has not separated assessment and management into individual tasks, but has rather combined the information that would go into them (scientific information, economic information, technological viability, environmental context, etc.). It is important to note, also, that the allowable excess cancer risk level is one of many variables in the EPA HHC equations, and the implicit protectiveness in the chosen risk level combines with policy choices in protectiveness made for other inputs, as discussed below.

3.2.2 Body weight

The human health criteria in the proposed rule are based on an assumed body weight of 80 kg (approximately 176 lbs) as a revised input into the criteria equation. This body weight is higher than the baseline weight of 70 kg, and is a more accurate representation of the general adult population nationally, as well as for two tribal populations near Puget Sound. While all of the changes to the

[3] The background level of cancer risk in the population is the population-wide cancer risk absent exposure to the toxics addressed by this rule. It can be thought of as the risk of developing a cancer from typical behaviors and population-wide exposures. Note that this is the risk of developing a cancer, and does not speak to the severity or type of cancers developed.

equation inputs in the proposed rule work in combination to affect criteria, in and of itself, this proposed body weight increases (makes less protective) criteria values as compared to the baseline.

Ecology determined 80 kg was the appropriate body weight to propose based on its survey of guidance and studies of body weight, including local data and federal guidance.

3.2.3 Fish consumption rate

The human health criteria in the proposed rule are based on an assumed fish consumption rate of 175 g/day. This fish consumption rate is higher than the baseline rate (a national general population average of 6.5 g/day), and reflects average values of highly-exposed populations that consume fish and shellfish in Washington. While all of the changes to the criteria equation inputs in the proposed rule work in combination to affect criteria, in and of itself, this fish consumption rate decreases criteria values as compared to the baseline.

Ecology is proposing to use a FCR of 175 g/day for calculating the HHC, based on a state-specific risk management decision. The new fish consumption value is representative of average FCRs ("all fish and shellfish" including all salmon, restaurant, locally caught, imported, and from other sources) for highly exposed populations that consume both fish and shellfish from Puget Sound waters. 175 g/day is also considered an "endorsed" value. This numeric value was used by the Oregon Department of Environmental Quality to calculate HHC in a 2011 rulemaking. Groups endorsing the use of this numeric value include the EPA and several tribes. Average FCR values for various highly exposed groups that harvest both fish and shellfish from Puget Sound waters are found in Ecology, 2013.

3.2.4 Compliance schedules

The proposed rule includes changes to compliance schedules, including definition of "Compliance Schedule" or "Schedule of Compliance". It deletes the specific period of time for the compliance schedule (ten years under the baseline), and adds language to describe circumstances when a compliance schedule can go beyond the term of a permit. The proposed rule seeks to ensure compliance is achieved as soon as possible.[4] It also includes language to authorize compliance schedules for longer periods of time in accordance with RCW 90.48.605 (which allows longer compliance schedules for compliance with TMDLs), as well as language addressing circumstances when more time is needed and a TMDL does not exist.

Ecology based this proposed change on 2009 legislation that recognized there are circumstances where extending a compliance schedule would be appropriate, but the legislation did not specify those circumstances.

Compliance schedules must still meet requirements in state NPDES regulations, which include specific timeframes within the schedule of compliance and enforceable provisions. RCW 90.48.605 focuses on instances when a TMDL exists on the receiving water, and describes a four-part test that must be met:

[4] The portion of the proposed rule that discusses compliance schedules for TMDLs has changed from using "practicable" to "possible", to match legislation. For the purposes of this analysis, the two words are treated as synonymous.

1. The permittee is meeting its requirements under the TMDL as soon as possible.
2. The actions proposed in the compliance schedule are sufficient to achieve water quality standards as soon as possible.
3. A compliance schedule is appropriate.
4. The permittee is not able to meet its waste load allocation solely by controlling and treating its own effluent.

3.2.5 Intake credits

The proposed rule amendments add a new section to the water quality standards rule at WAC 173-201A that addresses intake credits allowed when facilities bring in high levels of background pollutants in intake water and discharge those same pollutants back into receiving waters. The proposed language is intended to clarify conditions where intake credits would be allowed for determining reasonable potential and water quality-based effluent limits (WQBEL) that account for pollutants already present in the intake water, and would only be allowed when the mass and concentration of pollutant in the effluent is the same or less than that of the intake water, and there is "no net addition" of the pollutant.

An intake credit is a tool that is intended to be used in the National Pollutant Discharge Elimination System (NPDES) Permit Program, in specific circumstances where the discharger is not contributing any additional mass of the identified intake pollutant in its wastewater, thereby having a "no net addition" of the pollutant. Examples of pollutants already found in the intake water include naturally-occurring or legacy pollutants that are outside the control of the facility. This implementation tool would not impact Washington's water quality and public health because it would not be granted unless the facility met the requirements for "no net additions" of the pollutant.

The following conditions typically must be met for an intake credit to apply:

- The intake pollutant must not cause, or have the reasonable potential to cause, or contribute to levels above an applicable water quality standard.
- Intake water must come from the same body of water to which the facility effluent is discharged.
- The facility must not contribute any additional mass of the identified intake pollutant to its wastewater.
- The facility must not alter the identified intake pollutant chemically or physically in a manner that would cause adverse water quality impacts to occur that would not occur if the pollutants were left in-stream.
- The facility must not increase the identified intake pollutant concentration at the point of discharge, as compared to the pollutant concentration in the intake water.
- The timing and location of the discharge must not cause adverse water quality impacts to occur that would not occur if the identified intake pollutant were left in-stream.

3.2.6 Variances

The proposed rule amendments include changes to the use of variances, including the definition of "Variance". They revise language that establishes minimum qualifications for granting variances for individual dischargers, stretches of waters, or application to multiple dischargers. The proposed process for considering a variance includes:

- A public process, including tribal notification, rule-making, and EPA approval.
- The time period for when a variance would be in effect, generally not to exceed the term of the permit, but longer under certain circumstances, as long as the time is as short as possible.
- Requirements for interim numeric and narrative requirements that reflect the highest achievable water quality, as soon as possible, during the term of the variance.
- Requirements for a pollutant minimization plan, intended to show that progress is being made to work towards meeting the original criteria.
- Requirements for a mandatory five-year review if the variance extends beyond the term of a permit.
- Requirements for a watershed assessment or TMDL to identify responsible sources, for variances that apply to more than individual sources.
- Conditions under which a variance would be shortened or terminated, and when renewal would be considered.

Ecology chose to propose changes to the variance provisions based on the intent to provide a means authorizing sources to work toward achieving compliance as soon as possible rather than having facilities in long-term or indefinite noncompliance. Ecology recognizes that the proposed amendments to the human health criteria result in decreased (more protective) limits for some pollutants, and those decreased limits may be difficult to meet in situations where:

- Technology is not yet available or feasible to remove the pollutant, or
- A persistent pollutant resides and is cycling within the aquatic ecosystem of the water body and cannot be removed without degrading the system, or
- The main sources of the pollutant are not within the scope of the state's jurisdiction to control through water quality protection.

The EPA has advised states that a variance should be used instead of removal of a designated use where the state believes the standard can ultimately be attained. By maintaining the designated use rather than changing it, the state will ensure that further progress is made to improve water quality and attain the standard. With a variance, NPDES permits may be written to include discharger requirements based on interim criteria such that the discharge remains in compliance with the Clean Water Act and the discharger maintains reasonable progress toward attaining the applicable water quality standards.

With these factors in mind, Ecology is proposing rule amendments that use variances with the goals of:

- Providing accountability

- Extending timeframes where necessary
- Using resources efficiently

3.2.7 Toxicity factors

The proposed rule includes updated toxicity factors for various chemicals, reflecting current research on toxic chemicals and their impacts. The updated toxicity factors are largely from EPA's Integrated Risk Information System (IRIS), and depending on the chemical, these values included in the chemical-specific criteria calculations may be higher (less protective) or lower (more protective) than under the baseline.

3.2.8 No less-protective standards

The draft criteria were calculated using the factors and EPA HHC equations described in this document, and were secondarily modified by a risk-management decision that, except for the special case of arsenic *no new human health criterion would become less protective than the current NTR criterion concentration*. This decision results in some draft criteria that are at a lower concentration than those calculated based on the equation variable decisions described in 3.2.1 – 3, above. Ecology included this risk management decision in the proposed rule amendments. Ecology's application of this choice, in a direct form, is to not allow (with the exception of arsenic, discussed in the next section) criteria concentration values to increase (become less protective) under the proposed rule amendments. This means that if all other changes in the proposed rule amendments regarding criteria equation inputs would have made a criterion concentration value increase (become less protective), Ecology reverted to the existing NTR criterion value that is part of the baseline.

3.2.9 Special case for arsenic

The exception to the proposed human health criteria in the proposed rule amendments is arsenic. Arsenic is ubiquitous in the state environment, due to natural sources and widespread historic contamination. Because of the pervasive nature of arsenic in Washington State, Ecology is proposing to set the human health criterion for arsenic at the safe drinking water Maximum Contaminant Level (MCL) regulatory concentration for total arsenic. The current NTR criteria are based on inorganic arsenic. Ecology's decision is consistent with other states' management of this issue.[5] This arsenic requirement is coupled with the existing requirement to determine and eliminate non-natural sources of arsenic in facility effluent (see WAC 173-201A-240).

Ecology is proposing the following two specific rule changes for arsenic:

- Setting the human health criteria for total arsenic at the Safe Drinking Water Act (SDWA) MCL of 10 µg/L, based on a consideration of the continuing uncertainty around the long-term reassessment of the EPA IRIS cancer potency factor for arsenic, EPA's CWA-approval of the of the SDWA MCL for arsenic for other states, and the presence of naturally occurring arsenic in Washington.
- Adding a requirement to minimize anthropogenic inputs of arsenic in discharges to surface waters.

[5] See Ecology decision paper for treatment of arsenic in this rulemaking.

Ecology has determined that use of the EPA cancer potency factor to develop human health criteria for arsenic would introduce a significant amount of uncertainty:

- The inorganic arsenic cancer potency factor has been under reassessment for many years, and a date for finalization is not available.
- EPA did not use the 1998 IRIS cancer potency factor in their development of the new SDWA MCL of 10 ppb promulgated in 2001, nor did they depend on this value in their promulgation of the HHC for the state of California in 2000. In the 2000 California Toxics Rule, EPA expressed their finding of uncertainty around the effects of arsenic, and did not use the newer 1998 cancer potency factor. EPA used an older cancer potency factor ((1.75 per (mg/kg)/day) derived from the drinking water unit risk (5×10^{-5} per (ug/L)) that was used to calculate the NTR arsenic criteria in its 1998 and 2002 national recommended guidance criteria calculations, but not as the basis of new regulations in either the 2000 CTR or the new 2001 MCL for arsenic.
- Using either of these older cancer potency factors ((1) the cancer potency factor (1.75 per (mg/kg)/day) derived from the drinking water unit risk (5×10^{-5} per (ug/L) that was used to calculate the NTR arsenic criteria, or, (2) the 1998 cancer potency factor (1.5 per (mg/kg)/day)) injects a high degree of uncertainty into the criteria calculation for a regulatory level, especially given that EPA has not depended on either of these values as the basis of more recent regulations.

After review of other states' methods to set human health criteria for arsenic, with subsequent approval by EPA, and consideration of naturally high concentrations of arsenic in Washington, Ecology has determined that use of the SDWA MCL for arsenic is appropriate for Washington on the following basis:

- Use of the MCL has been approved by EPA widely across the nation. In particular, several other western states that have high levels of natural arsenic in the environment have adopted the SDWA MCL and are successfully applying it for protection of human health.

Adopting new arsenic criteria that reflect both a change in the chemical form (from inorganic arsenic to total arsenic) and a higher concentration has prompted Ecology to address implementation to ensure that unforeseen industrial discharges of arsenic are controlled and reduced. The following draft language was developed to address discharges of arsenic from industrial sources to waters with the designated use of "domestic water supply." [6]

WAC 173-201A-240 Toxic substances.

When the Department determines that an indirect or direct industrial discharge to surface waters designated for domestic water supply may be adding arsenic to its wastewater, the Department will require the discharger to develop and implement a pollution prevention plan to reduce arsenic through the use of AKART. Indirect discharges are industries that discharge wastewater to a privately or publicly owned wastewater treatment facility.

[6] Washington state waters designated for domestic water supply include all freshwater lakes, river, and streams, except those brackish waters in river estuaries and a few stretches of waters noted in Table 173-201A-602.

Ecology is therefore proposing an arsenic standard matching the drinking water standard of 10 ug/L.

Chapter 4: Who is Prospectively Impacted

4.1 Introduction

In response to the complexities of this rule, its application, and the entities that prospectively incur costs and/or receive benefits, we describe in this chapter the methodology for determining and describing the entities identified as likely impacted by the proposed rule amendments.

4.2 Impacted entities

As a general description, entities prospectively impacted by this rulemaking are listed as follows, in the categories discussed further in sections 4.2.1 – 4.2.3. Analysis of costs and benefits to these entities follows in chapters 5 and 6. Possibly impacted general groups are as follows.

- The public and Tribes:
  - Fish and water consumers.
  - Water users who value water quality as an attribute of direct interaction with water.
  - Non-users holding existence and cultural values for water quality itself.
- Dischargers:
  - Existing dischargers of chemicals for which water quality criteria change as a result of the proposed rule amendments.
  - Future dischargers of chemicals for which water quality criteria change as a result of the proposed rule amendments.
- The environment:
  - Animals exposed to waters of the state.
  - Plants exposed to waters of the state.

4.2.1 The public and Tribes

The members of the public and Tribes that are likely to be impacted by the proposed rule amendments may fall into one or more of three categories: fish/shellfish and water consumers, water users, and non-users. We discuss the attributes of these categories below, as well as how we estimated their populations.

4.2.1.1 Fish/shellfish and water consumers

We estimated the population of impacted members of the public and Tribes in the state based on existing surveys of fish and shellfish consumption. Changing water quality criteria potentially impact all fish and shellfish consumers to some degree, depending on their consumption rates. Tribe populations, Asian and Pacific Islanders, and subsistence fishermen that have been shown to have higher than average consumption rates are included in this whole-population distribution. To attempt to better reflect tribal values, we incorporated language from tribe members regarding the value of safe fisheries and clean waters in Chapter 6 of this document.

Stakeholders suggested that there could be impacts to local fisheries, due to changes in demand caused by perceptions of the quality and safety of the fish supply. As a standard practice, however, the Cost-Benefit Analysis considers only first-round impacts, and does not include secondary impacts such as these. Therefore, this analysis includes costs and benefits arising from the proposed rule amendments, but does not look at costs and benefits resulting from changes in supply and demand (movements along supply curves and demand curves resulting from spending changes, or shifts in those curves resulting from changes in perception, context, or technology).

4.2.1.2 Water users

People that use the state's waters for purposes other than drinking or as a fish/shellfish source are also prospectively impacted by the proposed rule. Surface waters are used for on-water and near-water recreation, for example, and individuals hold a value for those uses. As the proposed rule affects a number of different water quality criteria levels, and because it is difficult to quantify people's value for water quality itself for activities like sport fishing for catch-and-release, swimming, boating, or riparian recreation, we did not quantify the impacts to this group. In Chapter 6 we include a qualitative description of benefits to this group.

4.2.1.3 Non-users

Individuals and communities hold various values for clean or high-quality waters, even without using them. These values include cultural values, existence values, and bequest values for water quality (for clean water) itself. We did not quantify these values, as they are difficult or impossible to quantify with any degree of certainty. This is because of the myriad implicit attributes that any given individual or community might value water quality for, even within the three categories of cultural, existence, and bequest. Additionally, where a particular value is held by a relatively small population or has no proxy, related behavior, or even hypothetical behavior that includes quantifiable values, survey or revealed-preference mechanisms fail to accurately (or at all) derive non-use values for non-users in the case of water quality.

While we could not quantify impacts to non-users, we did, however, generally identify the types of individuals and groups that would hold these values. While all three values, cultural, existence, and bequest values, can be held by any person in the state, we note that cultural values in particular (overlapping with bequest values) are held by the populations of tribes in the state. There are 29 federally-recognized tribes in Washington, as well as tribes that are not federally-recognized but include members who also hold cultural values. In Washington State, 1.9 percent of individuals in 2013 identified themselves as American Indian or Alaska Native alone (we could not identify from the data the percentage of those identifying as two or more races that included American Indian or Alaska Native)(US Census, 2013). This translates to at least 132,457 individuals who may hold tribal cultural values for cleaner water in the environment.

4.2.2 Dischargers

4.2.2.1 Existing dischargers

The proposed rule amendments are likely to impact current and future dischargers in various ways. We used existing permit data on effluent to determine existing permittees that might be impacted,

based on whether they currently discharge chemicals that have changing or new human health criteria limits under the proposed rule amendments. We began with effluent data for 1,420 matched combinations of facilities and chemicals, representing 415 individual facilities (some of which have existing permit restrictions, while others do not). This was the universe of prospectively impacted facilities considered in this analysis. Within this group, we identified likely impacted entities, as well as those entities which were likely not impacted, using the process described in Section 5.2. The overall universe of prospectively impacted existing entities spanned 115 specific facility types, of diverse sizes and in 55 diverse private and public industries, including treatment works (at the 4-digit North American Industry Classification System level; US Census, 2012).

4.2.2.2 Future dischargers

In addition, where we identified likely impacted industries (see section 4.2.2.1, above), we estimated future growth (during the 20-year timeframe of this analysis) in dischargers (new and expanded) for a given industry where, the chemicals typically found in the industry's effluent, would encounter changed or new criteria restrictions when the dischargers (or expansions) come to exist. We included various sets of assumptions about where new dischargers (or expanded discharges) would occur in the future.

We also considered possible expansions of POTWs due to population growth, and discussed with permit managers the effects of the proposed rule amendments (changes to criteria values and/or new 303(d) listings), and the findings for existing POTWs in the analysis. See sections 5.2.6 and 5.4.1 of this document, for discussion of criteria-change impacts to POTW expansions, and listing-change impacts to POTWs, respectively.

4.2.3 The environment

4.2.3.1 Animals

Just as the proposed rule amendments are likely to impact human health, they may have impacts on animal health. The rules may impact animals living in water, and animals drinking water. Since animal health impacts vary across animals, and we have little or no information concerning these impacts, we could not quantify these impacts. Additionally, due to the broad array of animals living in or drinking surface waters of the state, we do not list them here, but instead discuss the affected population qualitatively and categorically. Affected animals may include at least fish (the means by which they affect human health), orca whales, seals and sea lions, amphibians, and water birds.

4.2.3.2 Plants

Where the proposed rule amendments change criteria for chemicals that may also impact plant health, we find it likely that the proposed rule will impact plant health in or near water bodies. Similarly to determining impacts to animal health, it is difficult to determine which or how plants might be impacted. As a result, we discuss this impacted population descriptively as well.

Chapter 5: Likely Costs of the Proposed Rule Amendments

5.1 Introduction

We estimated the likely costs associated with the proposed rule amendments, as compared to the baseline described in Chapter 2 of this document, and with changes discussed in Chapter 3. These costs are incurred by dischargers discussed in Chapter 4.

In this chapter, we discuss the following steps to the analysis:

- Impacts of the change in criteria: How many facilities are prospectively impacted, and for what chemicals in their effluent.
  - Permit and effluent review
  - Existing permit limits
  - Reasonable potential analysis
  - Facility data and site-manager review
  - Conclusions – changes in criteria
  - Criteria changes, future facilities, and expansions
- Impacts of a change in waterbody listing status.
  - Change in listing status
  - Likely impacted existing facilities
  - Likely costs to existing facilities
  - Future TMDLs for existing facilities
- Future growth, 303(d) listings, and TMDLs.
  - New or expanded dischargers on waterbodies with new 303(d) listings
  - Future TMDLs completed on waterbodies that become 303(d) listed
  - Future 303(d) listings resulting from new samples or sample sensitivity

5.2 Impacts of change in criteria

We determined likely existing impacted entities, as well as forecasts of entities likely affected in the next 20 years. For costs, the proposed rule amendments are likely to affect dischargers that are discharging a specific toxic chemical where a criterion would become more restrictive for that chemical, and result in compliance behaviors that are more costly than current compliance behaviors.

We began by reviewing existing discharger effluent data, including dischargers that have permit restrictions and those that do not (PARIS, 2014; permit factsheets). For the criteria levels resulting from the proposed rule amendments, we determined which of these entities were likely to be affected by changing criteria based on their existing reasonable potential determination, which is a calculation and comparison that determines whether a discharger has a reasonable potential to cause an exceedance of the criterion for a given chemical.

A reasonable potential determination compares the concentration of a chemical at the edge of the appropriate site-specific mixing zone, to the human health criteria value for that chemical. It

determines whether a facility's effluent has a reasonable potential to cause an exceedance of human health criteria. We surveyed existing effluent data from facilities and sites with NPDES permits, to perform a Reasonable Potential analysis to determine if effluent limits would likely be required as a result of human health criteria in the proposed rule amendments.[7] We eliminated from consideration those facilities whose priority pollutant scan information would not exceed the human health criteria as well as those facilities whose exceedances would fall below the detection limits for the affected chemicals.

5.2.1 Permit and effluent review

During late-March through early-April 2014, we reviewed all of the fact sheets available for permits listed in Ecology's Permitting and Reporting Information System (PARIS) database. **The review was limited to active industrial and municipal NPDES individual permits. General permits do not currently include numeric effluent limits based on human health criteria, and were therefore not included in this analysis.** Fact Sheets for the permits were downloaded and reviewed from the PARIS database. The most recent Fact Sheets were used in lieu of previous versions. In the few cases where Fact Sheets were unavailable, Fact Sheet Addenda, Public Notices, Compliance and Enforcement Reports, and/or Permits were reviewed to obtain needed information.

We attempted to collect the following information for each permit.

- Facility/Permit Name
- Permit Number
- Permit Type
- Permit Status
- Document Reviewed (via hyperlink)
- Ecology Contact
- Date Received
- Administrative Region
- Type of Facility/Operation
- Human Health Criteria (HHC) chemicals detected in final effluent
- Maximum Concentrations at the Edge of Chronic Mixing Zones (MCECMZs)
- Results of Reasonable Potential Analyses (RPAs)
- Technology-Based Effluent Limits (TBELs)
- Water Quality-Based Effluent Limits (WQBELs)
- Receiving Water Types (fresh or marine)
- Additional notes to assist with interpretation of the information

[7] This process was also followed for the special case of arsenic, using the drinking-water criteria in the proposed rule amendments.

In some cases, information from the Fact Sheets was incomplete or unclear. For example, there were a number of instances where maximum concentrations at the edge of the mixing zone (MCECMZs) were apparently truncated and reported as 0.0 or 0.00 µg/l. In other instances, it was unclear whether permit limits were technology-based effluent limits (TBELs) or water quality-based effluent limits (WQBELs). In addition, there were concerns that impending permit issuances were not being included.

To address these uncertainties and concerns, water quality permit writers from Ecology's regional offices and Industrial Section were consulted. Their responses to questions about specific permits and information on permit updates were incorporated into the set of information collected from the Fact Sheets.

Specifically, all of the available human health MCECMZs were compiled and compared to human health criteria resulting from the proposed rule amendments, as well as the current human health criteria. Where the MCECMZ exceeded the existing human health criteria, the Reasonable Potential Analysis result was "YES" (there is a reasonable potential to exceed water quality standards). Where the MCECMZ was at or below the human health criteria, the Reasonable Potential Analysis result was "NO".

Information was collected for all chemicals in which there are current or proposed human health criteria. However, data on certain metals (nickel, selenium, zinc, copper) and cyanide were left off since it became clear that the aquatic life criteria currently in rule are much more stringent than HHC for these chemicals. This means permit limits for these metals were lower than the proposed HHC, and the metals content of effluent was not likely to be impacted by the proposed rule amendments. The special case of a 10 ug/L criteria value for arsenic was also accounted for.

Table 1: Number of Permits Reviewed by Type

Number of Permits	
Industrial	183
Municipal	232
TOTAL	415

HHC chemicals were detected in 146 of the permitted facilities. One-half of the facilities with detected HHCs were waste water treatment plants (WWTPs), which treat domestic wastewater. The most common types of industrial facilities with detected HHCs were pulp and paper mills, bulk storage terminals, and oil refineries.

Table 2: Summary of Facility Types with Detected HHC Chemicals and Commonly Detected HHC Chemicals

Permit Type	Facility Type	Number of Facilities with Detected HHC Chemicals	Total Instances of HHC Chemical Detections	Ten Most Detected HHC Chemicals (in order of prevalence)
Municipal	WWTPs	74	673	zinc, nickel, mercury, bis(2-ethylhexyl) phthalate, arsenic, chloroform, antimony, toluene, selenium, phenol
Industrial	Pulp and paper mills	9	380	zinc, nickel, arsenic, mercury, antimony, benzene, phenol, chloroform, selenium, toluene
	Ship yards	8		
	Bulk petroleum storage terminals and related activities	7		
	Oil refineries	5		
	Ground water remediation sites	5		
	Wood preservers	4		
	Other industrial	34		
TOTAL	--	146	1,053	zinc, nickel, mercury, arsenic, bis(2-ethylhexyl) phthalate, chloroform, antimony, toluene, selenium, phenol

Six of the ten most commonly detected HHCs at both municipal and industrial facilities were metals. Three of the four most commonly detected organic chemicals – phenol, chloroform, and toluene – were among the top ten detected chemicals for both industrial and municipal permits. In all, 95 different HHC chemicals were detected in effluent. This list of chemicals includes 83 in the current NTR for which criteria would change, and 12 additional chemicals in Ecology's proposed HHC that do not have existing human health criteria.

5.2.2 Existing permit limits

Effluent limits for human health criteria chemicals are included in 54 permits – seven municipal and 47 industrial permits. All of the limits at WWTPs are WQBELs, and most of these are for DDT compounds and PCBs related to waste load allocations for the Okanogan River TMDL.

Approximately 30% (42 of 138) of the industrial permit limits are WQBELs. Several of these are zinc limits based on the benchmark level in the Industrial Stormwater General Permit (117 µg/l) and appear to be limits for stormwater. Some of the TBELs are set at levels equivalent to human health or aquatic life criterion levels, and do not incorporate mixing zones (e.g. benzene and PAHs set at human health criteria, pentachlorophenol set at aquatic life criteria). WQBELS for PCB limits are generally set at the analytical quantitation or method detection limits, as the analytical test method for PCBs cannot identify concentrations lower than those levels. The objective is still to meet the water quality criteria.

Of the 96 TBELs for human health criteria chemicals, many are for volatile chemicals at groundwater remediation sites and petroleum storage facilities. For instance, a number of bulk storage facilities

have a BTEX (sum of benzene, toluene, ethylbenzene, and xylene) limit of 100 µg/l. TBELs for phenol have been set for several woodwaste landfills.

TBELs exist for 2,3,7,8-TCDD (dioxin) at four pulp and paper mills. These appear to be based on production levels, and the effluent limits are load-based, expressed as mg/day. One facility contains production-based limits (in lbs/day) for 54 chemicals; not all of these chemicals are identified in Table 3.

Table 3: Summary of Facility Types with Effluent Limits for HHC Chemicals, and HHC Chemicals with Limits. Limits are based on technology or on human health criteria.

Permit Type	Facility Type	Number of Facilities with Final Effluent Limits for HHC Chemicals	Total HHC Chemical Limits	HHC Chemicals with Limits (in order of prevalence)
Municipal	WWTPs	7	18	4,4'-DDE, 4,4'-DDD, 4,4'-DDT, PCBs, zinc, mercury, arsenic, benzo(b)fluoranthene, bis(2-ethylhexyl) phthalate
Industrial	Bulk petroleum storage terminals and related activities	7	138	zinc, benzene, ethylbenzene, PCBs, 2,3,7,8-TCDD, toluene, pentachlorophenol, phenol, benzo(a)pyrene, trichloroethylene, 1,1-dichloroethylene, tetrachloroethylene, vinyl chloride, mercury, arsenic, 1,1,2,2,-tetrachloroethane, 1,1,2-trichloroethane, acenaphthene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, carbon tetrachloride, chloroform, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, methylene chloride, nickel
	Ground water remediation sites	6		
	Pulp and paper mills	5		
	Ship yards	5		
	Electric power generation	4		
	Wood preservers	3		
	Woodwaste landfills	3		
	Other industrial	14		
TOTAL	--	54	156	--

5.2.3 Reasonable potential analysis

Using the reasonable potential analysis as an initial screening tool, we found that 4 existing dischargers had a reasonable potential to exceed criteria resulting from the proposed rule amendments, but did not have a reasonable potential to exceed under the baseline, or required further investigation and verification of input data. We also found that 6 existing dischargers could face more restrictive limits under the proposed rule amendments, for chemicals for which they currently have permit restrictions, requiring further investigation and verification of permit data. Both of these groups included some facilities that had existing permit limits that required further investigation and verification.

The identified facilities included:

- Publicly Owned Treatment Works (POTW) (1)
- Pulp and paper manufacturing (1)
- Metals manufacturing (1)
- Wastewater treatment (1)
- Leaking underground storage tank (LUST) remediation (1)
- Groundwater cleanup (2)
- Petroleum storage and distribution (1)
- Wood preserving (2)

5.2.4 Facility data and site-manager review

We then discussed the 10 individual facilities identified as possibly having reasonable potential to exceed the proposed water quality criteria, with their relevant Ecology permit managers to determine what, if any, impact would be expected under the proposed rule amendments. These evaluations looked at facility attributes, performance, discharge locations, and other contextual information. In discussing the proposed rule amendment and the changes to criteria values with facility site managers, we encountered the following results:

- **Publicly Owned Treatment Works (POTW):** The one affected POTW facility discharges to a waterbody with an existing TMDL. Ecology will not be revising existing TMDLs as a result of this rulemaking, and load allocations will not change.
- **Pulp and paper manufacturing:** The data from the pulp and paper manufacturing facility did not reflect the MCECMZ correctly, due to an initial data-transfer or calculation error that occurred as part of this analysis. True concentration as reflected in the permit and data does not trigger reasonable potential.
- **Metals manufacturing:** The metals manufacturing facility has existing technology-based permit limits that result in a MCECMZ that does not trigger reasonable potential.
- **Wastewater treatment:** The wastewater treatment facility MCECMZ is based on one anomalous sample that detected benzo(b)fluoranthene, while five others were non-detects. Under both the baseline and proposed rule amendments, additional monitoring will be necessary during the next permit cycle to determine whether, and in what concentration, the chemical is present.

  However, even if further sampling indicates the chemical is present and the MCECMZ exceeds criteria resulting from the proposed rule amendments, numeric limits would not be established, because the facility is a combined sewer overflow (CSO) facility – discharging only during heavy rain events. In such a case, it is infeasible to derive appropriate numeric effluent limits for human health criteria. Ecology would instead follow permitting guidelines and 40 CFR 122.44(k)(3) and require the use of best management practices (BMPs).

BMPs may include source controls such as collection system monitoring, collection system cleaning, stricter pretreatment limits, and increased industrial user inspections. Such controls would only be required, however, if Ecology determined the chemical was present in a consistent set of samples, and the sample were controlled for quality.

- **LUST remediation:** The LUST remediation site data used in the initial screening was not correct, due to an initial data-transfer error that occurred as part of this analysis. The correct existing permit limit is well below the criteria resulting from the proposed rule amendments, and so MCECMZ does not trigger reasonable potential.

- **Groundwater cleanup:**

  One of the two identified groundwater cleanup sites has more recent data than initially reviewed indicating zero discharge of relevant chemicals, and so does not trigger Reasonable Potential.

  The other groundwater cleanup site discharges processed groundwater to a mixing box, where it mixes with stormwater and non-contact process water. This mix is then discharged to a mixing area. The facility's permit maintains a chronic dilution factor of 15 for human-health toxic chemicals, and so does not exceed the criteria resulting from the proposed rule amendments at the edge of the mixing zone. In the past, the permit has sometimes employed a mixing zone, and sometimes set limits to the human health criteria at the end of the pipe discharging into the mixing box.

  This site is, however, a cleanup site for sediments that is part of an EPA Superfund cleanup. In discussion with the facility site manager and communication from others working on the clean up, we determined the criteria changes resulting from the proposed rule amendments were likely to result in additional necessary treatment at the facility, as compared to the existing treatment. However, as part of the baseline, in approximately 4 years, a full plant redesign is already planned, largely to address higher volumes and concentrations of contaminants in groundwater. This planned plant includes an additional air stripper, and with this baseline technology, the facility could meet the lower (more protective) criteria set under the proposed rule amendments.[8]

- **Petroleum storage and distribution:** The effluent from the petroleum storage and distribution facility with pollutant concentrations high enough to be covered in this analysis is stormwater. Because most human health-based criteria are based on lifetime exposures, direct comparisons of receiving water criteria with pollutant concentrations in intermittent stormwater discharges are not appropriate. This and the high variation in stormwater pollutant concentrations and discharge volumes, both between storms and during a single storm, make the application of human health criteria to stormwater particularly problematic.

  Based on the authority of 40 CFR 122.44(k)(3), Ecology is requiring the implementation of best management practices (BMPs) to control or abate pollutants in stormwater discharges because it is infeasible to derive appropriate numeric effluent limits for the human health

[8] The chemicals that initially flagged this facility as potentially impacted include vinyl chloride – a member of the group of chemicals targeted by the facility rebuild and upgrade.

criteria. The facility has met all requirements in the past, and performance indicates that it could comply with BMPs and new criteria as well, without additional costs over the baseline.

- **Wood treatment:**

  Based on current data and technology-based permit limits, one of the two identified wood treatment facilities already meets the criteria resulting from the proposed rule amendments.

  The other facility discharges stormwater. Because most human health-based criteria are based on lifetime exposures, direct comparisons of receiving water criteria with pollutant concentrations in intermittent stormwater discharges are not appropriate. This and the high variation in stormwater pollutant concentrations and discharge volumes, both between storms and during a single storm, make the application of human health criteria to stormwater particularly problematic.

  Based on the authority of 40 CFR 122.44(k)(3), Ecology is requiring the implementation of BMPs to control or abate pollutants in stormwater discharges because it is infeasible to derive appropriate numeric effluent limits for the human health criteria. Ecology would not be likely to set new requirements for the facility under the proposed rule amendments, and the facility would not likely incur additional best management practices costs over the baseline.

5.2.5 Conclusion – changes to criteria

After reviewing, filtering, and assessing real cases of existing effluent data for dischargers using existing analytical methods and permitting practices, we conclude that while it is theoretically possible for existing facilities to be impacted by a change in criteria values, based on the reasonable potential determination and resulting from the proposed rule amendments, no such existing facility will be impacted, based on the analysis we conducted. To be impacted, a facility must have the following attributes:

- Discharge a chemical for which criteria values would change as a result of the proposed rule amendments.
- Discharge that chemical in quantities greater than the detection limits for that chemical using required test methods. If a facility uses the required sufficiently sensitive test method, a non-detect in an effluent sample generally means the discharge has no reasonable potential to violate standards.
- Currently, or under the baseline, discharge that chemical in quantities such that the concentration at the edge of the chronic mixing zone exceed the relevant proposed criteria value.
- Not be in an existing TMDL, as Ecology will not be revising TMDLs as a result of this rulemaking.
- Have samples that consistently indicate the presence of the chemical.
- Have a continuous discharge (i.e., *not* be an intermittent discharge, such as stormwater or CSO).

and potentially:

- Discharge to sediments of concern for the chemicals of concern in the discharge, at rates in excess of sediment concentrations, as this may violate nondegradation requirements.

No existing facilities meet the above criteria, based on the analysis we conducted, so we estimate zero incremental cost to existing facilities under the proposed rule amendments.

Note that this section describes the general result, including current 303(d) listings and TMDLs. Discussion of the impacts of changes in listing status is in section 5.3, below. Discussion of the impacts of various trajectories for future industry growth, 303(d) listings, and TMDLs is in section 5.4. General permits do not currently include numeric effluent limits based on human health criteria, and were therefore not included in this analysis.

5.2.6 Human health criteria changes, future facilities, and expansions

For typical production-based industries, if an existing facility was impacted by the proposed changes in human health criteria, and was expected to incur compliance costs as a result, we would forecast that industry's growth and include costs for future facilities in this analysis. The lack of any existing facilities impacted by the proposed rule's resulting changes to human health criteria values indicates that future facilities in these industries are not generally likely to be impacted by these criteria changes either. Ecology has no reason to assume that future facilities in any given industry would discharge chemicals in quantities exceeding those currently discharged (whether with or without permit limits). Similarly, any permit limits set for future dischargers are likely to be similar to those set for current dischargers in the same industry, and thus will impose no costs resulting from the proposed rule amendments.

Using the same reasoning, we determined that facility expansions would not be impacted by the proposed amendments to human health criteria values, because the concentrations of pollutants discharged by the expansions would likely be similar to the concentrations of pollutants discharged by existing facilities, and would have similar baseline attributes such as mixing zones, control technology, and permit limits. We, therefore, do not expect future facility expansions to be impacted by proposed changes to the human health criteria. This reasoning applies to necessary growth in POTWs due to population growth.

However, a groundwater remediation facility discharging to sediments of concern would likely have been impacted by the proposed rule amendments, if a treatment plant redesign had not already been planned under the baseline. This indicates that similar groundwater remediation scenarios in the future may be impacted by the proposed rule amendments, as compared to the context they would face under the baseline. We chose to estimate the costs for such a facility, since the circumstances for the existing facility are particularly unique and complex. In particular, we assumed that some future groundwater treatment facilities discharging volatile organic compounds (VOCs) to contaminated sediments were likely to be impacted by this proposed rule. It is difficult to forecast future remediation sites, as their attributes and locations depend on not just the behavior of liable parties, but availability of sampling data, location, contaminated media, and the types and concentrations of chemicals that are dangerous to human health.

We assumed that sites with VOC contamination and discharges near contaminated sediments, that are likely impacted by the proposed rule amendments, were as likely to exist in the future as they are now, based on existing knowledge. This is likely an overestimate, if we consider the goal of getting more cleanups done over time, and reducing new contamination, and so is a conservatively high cost estimate.

The existing groundwater remediation site analyzed above is one of five groundwater remediation sites identified in our effluent-review data since the year 2000. It contains five chemicals in its effluent that would trigger reasonable potential if a plant rebuild were not in progress:

- 1,1,2,2-tetracholoroethane
- Carbon tetrachloride
- Tetrachloroethylene
- Trichloroethylene
- Vinyl chloride

Based on having identified one such site in the most recent 14 years of data, we expect approximately one site to be impacted in the next 20 years. To account for uncertainty in the timing of that site, we chose to use an expected value in this analysis. An expected cost for that new site takes the odds of that outcome, and the cost of that outcome, and multiplies them together to get a cost-equivalent likely to happen given the odds. In this case, if one groundwater remediation site is likely to be impacted in the next 20 years, the likely cost in any given year the cleanup might happen is 0.05 (one in 20) multiplied by the cost of additional controls in that year. The cost of controls in that year is the present value of an up-front capital cost followed by operations and maintenance costs in the subsequent years. To calculate expected present value costs across all five years, we summed all 20 years of present value costs multiplied by 0.05.

The permit manager and on-site managers identified the likely technology required to meet proposed human health criteria for the five chemicals listed above as an additional air stripper. Based on facility design plans, past facility research, recent installation of a new air stripper, and review of the available literature for the technology, we estimated that the proposed rule amendments would likely require this facility to incur an additional $150,000 of capital cost (EPA, 2004; in 2003 dollars), as well as $52,560 – $357,408 of operations and maintenance (O&M) costs each year (FRTR, 2006; in 2006 dollars), depending on flow rate and volume. These O&M costs assume the air stripper necessitates 100 percent of the typical O&M costs, as though it was the only one. As this air stripper would be an additional unit, however, we assume these costs are conservatively high (overestimated), because many of the O&M tasks likely have efficiencies and economies of scale for each additional air stripper.

We do not know, however, whether such a site would come to exist and/or begin remediation, say, next year, or in 15 years, or in 20 years. We therefore calculated the range of present value costs for a groundwater remediation facility needing to include an additional air stripper, in each of the next

20 years. **This gave us an expected present value cost of $600 thousand to $3 million in the next 20 years.**[9]

Note that this section describes the general result for existing facilities and a likely future facility, including current 303(d) listings and TMDLs. Discussion of the impacts of changes in listing status is in section 5.3, below. Discussion of the impacts of various trajectories for future sample sensitivity, 303(d) listings, and TMDLs is in section 5.4.

Table 4: Sources of Uncertainty in Quantitative Costs

Sources of Uncertainty in Quantitative Costs			
Source	**Effect on Analysis**	**Impact on Estimate**	**Why it Was Used**
Comprehensiveness of effluent data	The analysis was based on existing effluent data. We assumed that discharger effluent was representative of all existing and future effluent types by industry.	Indeterminate	We used the most comprehensive dataset comprised of existing data.
Detection limits	The analysis assumes that dischargers comply with the HHC, and did not limit the degree of compliance to detection limits that were above the HHC.	Costs overestimated for compliance with HHCs that are below detection limits.	In light of uncertainty, Ecology chooses to overestimate costs where possible.
Number of impacted future facilities	The analysis assumes that future sites are predicted by existing facilities.	Indeterminate	Absent data indicating that future dischargers would be significantly dissimilar to existing facilities was not available.
Technology type	The analysis uses site-specific attributes of an existing facility, professional judgment, and existing compliance plans to predict the type of technology used by a future facility to comply with the proposed rule amendments.	Indeterminate or costs overestimated, as technologies may become more efficient over time.	Based on the assumption (above) that existing facilities sufficiently predict future facility attributes, and best professional judgment of permit and site managers, Ecology chose to potentially overestimate costs.
Unit cost estimates	The analysis uses site-specific attributes and technology plans to estimate capital and O&M costs for the assumed compliance technology (above).	Indeterminate or costs overestimated, as existing technologies may become less expensive to install or operate over time.	Based on the technology chosen (above), we used current costs and assumed they would be stable in the future.

[9] Present values are calculated using the average 1.32 risk-free, inflation-adjusted rate of return on I Bonds (US Treasury, 2014). All dollar values are updated to 2014-dollars using the Consumer Price Index (US Bureau of Labor Statistics, 2014).

5.3 Impacts of change in waterbody listing status

The proposed rule amendments are likely to result in a change in the listing status of some waterbodies. Ecology is not changing the policy and methods by which waterbody segments are listed as 303(d) (impaired), as part of this rulemaking. Therefore, in this section, we address the issues of:

- Which waterbodies are likely to change from being unlisted to listed
- For what chemicals listings are likely to change
- The number and types of facilities on those waterbodies
- The likely behaviors and costs resulting from the change in listing status

5.3.1 Change in listing status

Using existing 303(d) listings and policy, the data used to develop those listings, and the changes to criteria resulting from the proposed rule amendments, we determined which waterbody segments were likely to change status from being unimpaired to being 303(d) listed. Each 303(d) listing represents an impairment due to a particular chemical for a particular segment of a waterbody. Some waterbody segments can have multiple listings for the number of chemical that do not meet water quality standards.

Our statewide analysis identified 55 listings that would be likely to change from unimpaired to impaired.[10] That is, there would be 55 new 303(d) listings comprised of a segment and chemical pairing. The majority (50 out of 55) of these additional listings would be in waterbody segments on which there are no NPDES discharges present, so there would be no impact on any NPDES permits or their permitted facilities on those waterbodies. However, we did find five changes in 303(d) listings that could potentially impact the permits of three facilities. These five changed 303(d) listings would occur on four adjacent segments of one waterbody (the Duwamish Waterway) and the chemicals for which the impairments are based were:

- Antimony (1 listing)
- Dibenzo[a,h]anthracene (2 listings)
- Benzo(a)anthracene (2 listings)

5.3.2 TMDL process for dischargers

The degree of impact a facility experiences from finding itself on a listed waterbody depends on where the waterbody is in the process of moving toward an improvement plan, which might be a TMDL or other Water Quality Improvement project such as a Straight to Improvement plan. The basic notion of what happens on a 303(d) listed waterbody without a TMDL is covered by Ecology guidance for permit writing (Ecology, 2011).

For developing a permit for a facility discharging chemicals to a waterbody listed for those chemicals, but not yet with a TMDL or other plan, the following sequence of questions is asked:

[10] This analysis and review included the proposed criteria for arsenic of the drinking water standard.

1. Can the effluent be treated or can the effluent or pollutant(s) be removed seasonally at a cost which is economically achievable or reasonable?
    a. If unsure: Permit has interim limit (no additional loading) and requires engineering report on options and cost.
    b. If yes: Final limits as the water quality criteria or lower, a compliance schedule is necessary, and interim limits based on current discharge.
    c. If no: Go to question 2.
2. Are there options for effluent trading or mitigation by treating uncontrolled sources?
    a. If yes: Permit contains final effluent limits as the water quality criteria, a compliance schedule to accommodate trading and meeting final limits, and interim effluent limits based on current discharge.
    b. If no: Permit contains interim and final limits to prevent an increase in loading. A TMDL is completed.

Effectively, the guiding principle is, "There can be no additional loading or higher concentration allowed for the listed pollutants at times of impairment until the TMDL is completed and it shows dilution available at full implementation of the TMDL."

5.3.3 Likely impacted existing facilities

When a waterbody segment is likely to change from being unimpaired to listed as impaired for certain chemicals, the dischargers likely to be impacted are those discharging any of those chemicals to the waterbody in question. As noted above, we found three facilities discharging directly to the four segments of the Duwamish Waterway that would likely change from unimpaired to impaired as a result of the proposed changes in human health criteria. These facilities are:

- Cement manufacturing
- Scrap metal processing and recycling
- Wastewater treatment

Of these facilities, we identified that neither the cement manufacturing nor the scrap metal processing and recycling facility currently discharge any of the chemicals for which listing status would change on the segment to which they discharge. The wastewater treatment plant, however, is identified in fact sheets as discharging benzo(a)anthracene and dibenzo[a,h]anthracene to a waterbody that would likely change listing status to 303(d) for those chemicals, under the proposed rule amendments.[11]

Note also that none of the above facilities discharge in quantities that would require them to make changes to comply with the human health criteria changes themselves (see section 5.2, above), so we only analyze the costs of the incremental change of prospectively discharging to a listed versus currently unlisted waterbody for the relevant chemicals.

Ecology reviewed data for a wastewater treatment plant (WWTP) discharging affected chemicals to a likely newly listed segment of the Duwamish. Listings data indicated that the WWTP and its

[11] Note that while one listing would change for antimony, none of the identified dischargers have antimony in their effluent.

associated combined sewer overflow (CSO) plants discharge to the Duwamish. Review of the permit for the WWTP indicated that the only facility in that permit discharging to the Duwamish is a CSO. A review of current effluent data showed that this CSO does not currently discharge either of the chemicals in question. Effluent data also indicated the chemicals in question were only discharged by the main plant in the permit, which does not discharge to the Duwamish.

We therefore concluded that no existing facility, with current production/flow levels, would likely be impacted by any changes to 303(d)-listed waterbodies that would occur as a result of the proposed rule amendments.

5.3.4 Future TMDLs for existing facilities

For the waterbody segments, for which three additional chemical listings (based on fish tissue) are likely, there are no existing impacted facilities. There are three facilities with outflows directly to the affected segments, but none of these discharges the chemicals in question. Therefore, we conclude that future TMDLs due to the proposed rule amendments are not likely to impact these existing facilities.

5.4 Future growth, 303(d) listings, and TMDLs

The proposed rule amendments are likely to result in a change in regulatory circumstances for future additional businesses, based on resulting changes in criteria. We discuss the following sets of likely impacts qualitatively, as they are multivariate in chemical, business, discharge, location, and TMDL context, and many of those variables are unknown at this time, such that we are not able to forecast them quantitatively with a great enough degree of confidence. Overall, we consider these categories to reflect the likely impacts of future protectiveness resulting from the proposed rule amendments.

- New or expanded dischargers on waterbodies with new 303(d) listings as a result of the proposed rule amendments.
- Future TMDLs completed on waterbodies that become 303(d) listed because of the proposed rule amendments.
- Future 303(d) listings resulting from the proposed rule amendments, as new samples are taken, or sample sensitivity improves.

5.4.1 New or expanded dischargers on waterbodies with new 303(d) listings

As we discuss above in section 5.3, the proposed rule is likely to change the listing status of segments of the Duwamish, for three chemicals, based on existing tissue samples. To be impacted by the proposed rule, a new or expanded discharger facility would need to discharge to an impacted segment, and discharge one of the three chemicals in question.

Currently, we are not aware of a facility that discharges these chemicals to the impacted segments. We do not consider it likely, therefore, that a facility would locate or expand a discharge to the impacted segments, containing the chemicals for which new listings are likely under the proposed rule amendments. If there were such a facility, however, it would likely incur the costs of complying with permit limits for antimony, benzo(a)anthracene, and dibenzo[a,h]anthracene. We do not

estimate the costs of the proposed rule for this category, as we cannot quantify this with sufficient certainty, as we have no basis for assuming which industry, the type of facility, which chemical(s), and what concentrations in effluent might be involved. Based on existing facilities discharging to the segments in question, however, we do not consider it likely that new or expanded dischargers that incur costs will exist on these segments.

The above conclusion includes POTWs with expansions necessary due to population growth. No existing POTW discharges the chemicals for which listings (and therefore TMDLs) are likely to change due to the proposed rule amendments, and taking the existing chemical mixture in effluent as an indicator of future discharge chemical mixtures (for current or expanded discharge volumes), we determined it is not likely that the future listings or TMDLs that are due to the proposed rule amendments will impact expanded facilities with larger discharge volumes.

5.4.2 Future TMDLs completed on waterbodies that become 303(d) listed

As we discuss above in section 5.4.1, the proposed rule is unlikely to impact new and expanded facilities locating on the segments of the Duwamish that are likely to become 303(d)-listed as a result of the proposed rule amendments. As a result, we do not consider any future TMDL on these segments, applying to the chemicals for which the additional listings occur, likely to impact new or expanded dischargers discharging effluent to the segments.

5.4.3 Future 303(d) listings as new samples are taken or sample sensitivity improves

This chapter focuses on costs in the context of known data and required sample methods. See Chapter 7 for discussion of costs and benefits of the proposed rule amendments in the context of improved future sampling sensitivity and coverage.

5.5 Implementation tools

The proposed rule includes proposed changes to compliance tools that can be used to comply with the human health criteria and other water quality standards. We have not included the use of compliance tools in our cost or benefit assumptions elsewhere in this analysis. That is, the previous analysis of costs assumes full compliance with the human health criteria. Here, we discuss the costs and benefits of the compliance tools, with context for how they would affect estimates. Functionally, any of these compliance tools affects the timing of real water-quality impacts of effluent controls.

5.5.1 Compliance schedules

The proposed rule removes the 10-year limit on compliance schedules that exists in the current rule. This change was made to comply with the legislature's 2009 directive to Ecology to authorize compliance schedules in excess of ten years under certain circumstances (RCW 90.48.605). In the context of economic analysis, compliance schedules affect the timing of costs and benefits. Where they allow gradual movement toward compliance, they delay or reduce costs, but also delay the onset of benefits. In this analysis, delaying both costs and benefits by any period of time, increases the degree to which both are discounted, and that degree is equal for both. In this sense, the ratio of costs and benefits for any given facility in the future remains the same, regardless of whether compliance is delayed by up to ten years, or by longer.

Compliance schedules also provide a benefit to discharges by reducing the costs of noncompliance and providing the ability to incur compliance costs over an extended period of time. At the same time, compliance schedules also add costs to the public associated with the time period for which the public is exposed to water not meeting water quality standards.

5.5.2 Intake credits

The proposed rule adds intake credits as a new tool for compliance with water quality standards. Intake credits allow facilities to account for chemicals in their intake when determining the limits and actions required to achieve compliance with the rule. This means intake credits prospectively reduce compliance costs because they allow dischargers to avoid managing chemicals in effluent that were already present in the intake water. As the degree to which costs might be reduced would vary widely depending on facility attributes, intake attributes, and the amounts and concentrations of chemicals in the water body segments involved, we could not quantify this cost-reduction benefit with a high degree of confidence. The benefits are likewise not quantifiable.

However, qualitative analysis indicates that intake credits would provide benefits to dischargers by reducing their costs of compliance. Intake credits likewise provide costs to the public by not requiring that all discharges meet water quality standards.

5.5.3 Variances

The proposed rule refines and elaborates on the existing rule provisions authorizing variances in compliance with water quality standards. Ecology has not issued a variance in the past, and we consider in this analysis that is the issuance of variances will likely remain a rare occurrence. However, by allowing the facility more time to comply with the rule (at least for a period of time), a variance would potentially reduce both costs and benefits. This would happen through a reduction in compliance costs (though likely traded for other monitoring and behavioral costs), with a delay in the removal of chemicals toxic to human health and the environment from discharges.

Variances also provide a benefit to discharges by reducing the costs of noncompliance and providing the ability to incur compliance costs over an extended period of time. At the same time, variances also add costs to the public associated with the time period for which the public is exposed to water not meeting water quality standards.

Chapter 6: Likely Benefits of the Proposed Rule Amendments

6.1 Introduction

We estimated the likely benefits associated with the proposed rule amendments, as compared to the baseline described in Chapter 2 of this document, and with changes discussed in Chapter 3. These likely benefits are received by entities as discussed in Chapter 4.

6.2 Affected entities

As a general description, entities potentially benefitting from this rulemaking are listed as follows, in the categories discussed further in sections 6.2.1 – 6.2.2.

- The public and tribes:
  - Fish and water consumers.
  - Water users who value water quality as an attribute of direct interaction with water.
  - Non-users holding existence and cultural values for water quality.
- The environment:
  - Animals exposed to waters of the state.
  - Plants exposed to waters of the state.

6.2.1 The public and Tribes

The members of the public and tribes that are likely to benefit from the proposed rule amendments may fall into one or more of three categories:

1. Fish and water consumers,
2. Water users, and
3. Non-users.

We discuss the attributes of these categories below, as well as how we estimated their populations.

6.2.1.1 Fish consumers

We estimated the population of impacted adult members of the public and tribes in the state based on existing surveys of fish consumption. Changing water quality criteria potentially impact all fish consumers to some degree, depending on their consumption rates. Tribe populations, Asian and Pacific Islanders, and subsistence fishermen that have been shown to have higher than average consumption rates are included in this whole-population distribution.

We used the EPA's 2014 results from the National Health and Nutrition Examination Survey (NHANES; EPA, 2014) as a basis for associating fish consumption rates and their related proportions of the population. While there is ongoing discussion and remaining questions about the NHANES report, we use it in this analysis because it provides more recent and regionally appropriate

information.[12] This basis does not have Washington-specific values, but does have values specific to states bordering the Pacific coast. A summary of that distribution follows. For each segment of fish consumption rate, we estimated the impacts of the proposed rule amendments based on the difference in the real health impacts (e.g., cancer risk levels) based on baseline water quality criteria versus the water quality criteria resulting from the proposed rule amendments. More detail is provided in chapter 3 on how these calculations were performed using the EPA HHC equations that determine water quality criteria based on inputs like fish consumption rate, toxicity/exposure variables, body weight, etc.

Table 5: Distribution of Fish Consumption Rates

Fish Consumption Rate for All Finfish and Shellfish, Western States						
adults 21+; g/day raw weight, edible portion; with 95% confidence interval (CI)						
	50th percentile	**75th percentile**	**90th percentile**	**95th percentile**	**97th percentile**	**99th percentile**
FCR	20.0	35.6	55.7	71.1	82.6	108.4
95% CI low	17.1	30.7	47.7	60.3	69.5	89.8
95% CI high	23.4	41.2	65.0	83.9	98.2	130.9

Note: The FCRs listed in this table are exactly *at* the percentiles listed. While we conservatively use these FCRs to represent the consumption rates of the entire segment of the distribution up to the next percentile point listed, actual FCRs *within* the segments of the distribution are in between the FCRs in the table. For example, while the FCR listed at the 99th percentile is 108.4 g/day, this means that one percent of the population consumes fish at a rate that is *at least* 108.4g/day, some consuming significantly above that rate.

6.2.1.2 Water users

People that use the state's waters for purposes other than drinking or as a fish source are also prospectively impacted by the proposed rule. Surface waters are used for on-water and near-water recreation, for example, and individuals hold a value for those uses. As the proposed rule affects various water quality criteria levels, and because it is difficult to quantify people's value for water quality itself for activities like sport fishing (catch-and-release), swimming, boating, or riparian recreation, we did not quantify the impacts to this group.

6.2.1.3 Non-users

Individuals and communities hold various values for clean or high-quality waters, even without using them. These values include cultural values, existence values, and bequest values. We did not quantify these values, as they are difficult or impossible to quantify with any degree of certainty. This is because of the myriad implicit attributes that any given individual or community might value water quality for, even within the three categories of cultural, existence, and bequest. Additionally, where a particular value is held by a relatively small population or has no proxy, related behavior, or even hypothetical behavior that includes quantifiable values, survey or revealed-preference

[12] Ecology commented on the NHANES report, and indicated that data was missing for the lower half (below 50th percentile) of the distribution. Even without the bottom half of the distribution, we can estimate benefits based on the upper half of the distribution, and populations with fish consumption in the lower half of the distribution (while not quantifiable) still benefit and are additionally protected under the proposed rule.

mechanisms fail to accurately (or at all) derive non-use values for non-users in the case of water quality.

While we could not quantify impacts to non-users, we did, however, generally identify the types of individuals and groups that would hold these values. While all three of cultural, existence, and bequest values can be held by any person in the state, we note that cultural values in particular (overlapping with bequest values) are held by the populations of tribes in the state. There are 29 federally-recognized tribes in Washington state, as well as tribes that are not federally-recognized but include members who also hold cultural values. In Washington State, 1.9 percent of individuals in 2013 identified themselves as American Indian or Alaska Native alone (we could not identify from the data the percentage of those identifying as two or more races that included American Indian or Alaska Native) (Census Bureau, 2013). This translates to at least 132,457 individuals who may hold tribal cultural values for the waters.

6.2.2 The environment

Just as the proposed rule amendments are likely to impact human health, they may have impacts on animal health. Animals may be affected by living in water, as well as by consuming it. Since animal health impacts vary across animals, and we have little or no information concerning these impacts, we could not quantify these impacts. Additionally, due to the broad array of animals living in or drinking surface waters of the state, we do not list them here, but instead discuss the affected population qualitatively and categorically. Affected animals may include fish (the means by which they affect human health), orca whales, seals and sea lions, amphibians, and water birds, as well as animals drinking the water.

Where the proposed rule amendments change criteria for chemicals that may also impact plant health, we find it likely that the proposed rule will impact plant health in or near water bodies. Similarly to determining impacts to animal health, it is difficult to determine which or how plants might be impacted. As a result, we discuss this impacted population descriptively as well.

6.3 Benefits of reduced cancer risk

Of the benefits that the proposed rule amendments are likely to have on human health over the next 20 years, the likely impacts to cancer are the only impacts that are quantifiable. This is because of how cancer risk is identified in the EPA HHC equations (as specific excess risk levels), versus how noncancer risk is identified (being above or below a level at which there is no appreciable risk of adverse effect; not in degrees of severity or risk of noncancer health endpoints). In this section, we discuss the methodology and results for quantifying changes in cancer risk that are likely to result from the proposed rule amendments. We then qualitatively discuss the likely impacts of the proposed rule amendments on noncancer health endpoints in section 6.4.

It is important to note that the proposed rule changes real cancer risk differently for different people, depending on their real fish consumption. Much as the proposed rule amendments do not assume *everyone* consumes 175 g/day of fish and shellfish, the proposed rule also does not make everyone's excess cancer risk one in one hundred thousand.

To quantify changes in cancer risk to the overall population, we used the distribution of adult fish consumption rates in western (Pacific-adjacent) states in the USA, as summarized in Table 5.[13] For each segment of percentiles, we conservatively assumed that the entire segment consumed fish and shellfish at the rate identified for the bottom of the percentile segment.[14] For each toxic pollutant with a new or lower (more protective) human health criteria level (none are higher – less protective – under the proposed rule amendments), we calculated the implicit real cancer risk for each of the segments. This calculation entailed using updated scientific values that change under the proposed rule amendments (see discussion in subsection 3.2), and each fish-consumption segment's real fish consumption rate, to calculate the change in real cancer risk to that segment under the proposed rule amendments.

This calculation identified changes in real cancer risk for all segments of the fish consumption distribution at and above the 50th percentile, for the 54 carcinogens regulated by the rule. Sufficient data were not available on the lower half of the distribution to perform similar calculations, but we note that if carcinogen exposure is reduced over time, real risk for all segments of the population will decline. Our estimates based on only the upper half of the distribution are, therefore, conservative.

The analysis identifying costs resulting from the proposed rule amendments (Chapter 5) identifies five chemicals for which changes in the human health criteria under the proposed rule amendments would likely result in changes to levels of chemicals in effluent for a possible future remediation facility:

- 1,1,2,2-tetracholoroethane
- Carbon tetrachloride
- Tetrachloroethylene
- Trichloroethylene
- Vinyl chloride

For those chemicals, we identified the populations (numbers of people in each segment of percentiles) of people eating fish or shellfish from the water body impacted by the possible future remediation facility, and estimated the number of equivalent cases of cancer avoided under the proposed rule amendments.

6.3.1 Forecasting benefits for a single site

The facility for which we could identify an impact were it not for a baseline special circumstance, is located on Commencement Bay. We chose to use this as an illustrative context for improvements to water quality standards in one location with a similar facility. For changes to the effluent of just one

[13] Fish consumption rates are for adult populations, despite cancer risk addressing 70-year exposures. Assessing risks to children would require different assumptions for body weight, consumption rate, and include early life cancer potency adjustment factors for mutagenic compounds.

[14] Assuming the entire segment consumes fish and shellfish at the rate for the bottom of the percentile segment provides a conservatively low estimate of benefits because the people at the bottom of a percentile segment eat less fish, and therefore would experience fewer benefits from the proposed rule than people consuming fish at higher rates in the percentile segment.

facility like this, we assumed the relevant fish consumers are the tribal and sport fishing populations in Pierce County. Commencement Bay has a small amount of commercial tribal and commercial non-tribal fishing, historically (SAIC, 2009), but the majority of catches are made by sport anglers. It is likely that any signal change in the toxicity of commercial fish coming from Commencement Bay, or any single similar site is, in the short run, lost in the noise of the toxicity of all commercial fish consumed by the population.

In Pierce County there are 14 thousand persons (1.7 percent of the population) identifying as American Indian or Alaska Native (Census Bureau, 2013). There are also approximately 18 thousand anglers from Pierce County. Recall that the human health-based criteria values assume 70 years of exposure. We acknowledge that not all of this population will experience a short-run change to the toxicity of all the local fish they will consume over their lives. These base population numbers include individuals that will likely be impacted by the proposed rule amendments for less than 70 years, as well as those that will likely be impacted for more than 70 years. We did not directly take this into account. We did, however, adjust these populations down to reflect the general-population rate of survival to 70 years of age, 77.1 percent. This gave us likely impacted populations of approximately 11 thousand tribal members, and 14 thousand sport fishers in the existing population, for whom we did not quantify benefits.

We estimated long-run impacts of greater protectiveness against exposure to some carcinogens, for 20 birth cohorts, based on an annual affected birth cohort in the state (assumed to be held constant at 138 for tribal populations, and 176 potential subsistence fishers each year), with shifting life-expectancies and exposure timeframes. We performed this calculation for 20 years of birth cohorts, the scope of this analysis.

We also scaled this population's exposure by the percentage of local fish likely consumed for the relevant percentile, between 46.5 and 67.25, based on local fish consumed by state tribal populations (Ecology, 2013).

We allowed for a range of assumptions about the specific fish-consumption distributions of these sub-populations, from applying the 95th percentile and up consumption rate quantile to both, to applying the general state distribution across the whole populations. These sub-populations are intuitively more likely to consume high quantities of fish compared to other sub-populations or the state population as a whole. The results are presented in Table 6 below.

6.3.2 Summary of quantified cancer benefits

Table 6: Cancer Risk Reductions, in Equivalent Number of Cancers in the Population

Single-Site Reductions to Lifetime Excess Cancer Risk **Single Cleanup Site, Three Alternative Assumptions** **Benefits to affected cohorts born in the next 20 years**		
Tribe and Sport Fishing (General Distribution) 50th+ percentile[15]	**Tribe and Sport Fishing** (High Consumption) 95th+ percentile[16]	**Tribal Fishing** (High Consumption) 99th Percentile[17]
21.4	65.2	82.8

Note that the quantification above does not include benefits to existing populations. Members of those populations are also likely to benefit from reduced exposure to carcinogens, but quantification of those benefits would entail scaling for changes in exposure during the 70-year exposure. We could not do this with a sufficient degree of certainty as to how varying exposure (at varying ages) affects lifetime excess cancer risk, and so we note this benefit qualitatively, in addition to quantified benefits.

Note also that 99 percent of the impacts listed above are due to reduced exposure to vinyl chloride. Under the baseline, people are overexposed to vinyl chloride, based on updated toxicity knowledge, so in combination with increased protectiveness due to a higher input FCR (and despite the higher input excess cancer risk), the proposed rule amendments significantly reduce real risk for people exposed to vinyl chloride through fish/shellfish and water consumption.

We present the number of equivalent avoided cancers, related to chemicals currently in effluent, above. We present only the case for which cancer effects are additive, because:

- If cancer effects from chemicals in water and fish are additive, then we can add together the cumulative impacts on the number of cancers, across all chemicals likely to change in effluent (based on current effluent content).
- If cancer effects from chemicals in water and fish are interactive, then we cannot add together the cumulative impacts on the number of cancers, but we cannot say they entirely overlap either.
- If cancer effects from chemicals in water and fish are overlapping, then we can consider only the impacts on the number of cancers from the chemical with the greatest impact to cancers.

[15] This number gives the number of equivalent avoided cancers assuming fish consumption rates of the affected populations of tribes and sport fishers is distributed the same as the upper half of the general population, as described in the columns of Table 5.

[16] This number gives the number of equivalent avoided cancers assuming fish consumption rates of the affected populations of tribes and sport fishers is distributed the same as the 95th-and-above percentiles of the general population, as described in the three right-hand columns of Table 5.

[17] This number gives the number of equivalent avoided cancers assuming fish consumption rates of the affected populations of tribes consumes at the equivalent of the 99th percentile of the general population, as described in the right-most column of Table 5.

- **In the absence of information on how a mixture of carcinogens affects cancer risk, EPA guidance indicates we should assume independence of action. For carcinogens, this means the risks (expressed as a probability) attributable to each chemical in a mixture are summed regardless of type or target of cancer.**

Existing scientific research has not sufficiently addressed the degree to which multiple carcinogens interact to impact the development of cancers.

Cancer results in costs associated with illness, a value held for avoiding a cancer in the first place, and a value held for avoiding death (for the subset of cancers that result in mortality). In the discussion below we estimate the values associated with the proposed rule amendments' reduction in equivalent cancers in the population, then calculate the resulting mortality reduction, based on a mortality rate of 35.9 (US CDC, 2013).[18] The mortality reductions are summarized in Table 7 below.

Table 7: Cancer Mortality Reductions, in Equivalent Lives

For a Reduction in Mortality related to a Single-Site or a Single Cleanup Site, Three Alternative Assumptions Benefits to affected cohorts born in the next 20 years		
Tribe and Sport Fishing (General Distribution) 50th+ percentile	**Tribe and Sport Fishing** (High Consumption) 95th+ percentile	**Tribal Fishing** (High Consumption) 99th Percentile
7.69	23.42	29.74

Note that 99 percent of the impacts listed above are due to reduced exposure to vinyl chloride.

To estimate the value of equivalent reductions in mortality risk, Ecology uses an estimate of the Value of Statistical Life (VSL). The VSL is based on estimates of the value of small reductions in future mortality risk, and then is multiplied out to the equivalent of a 100-percent mortality risk reduction. We use a range of values estimated by Aldy and Viscusi (2003), of $2.1 million to $8.6 million, and performed expected value calculations in line with cost-estimation, to account for uncertainty as to the year of water-quality improvement (years 1-20). This is an estimate based on equivalent risk-reductions, and should not be interpreted as the value that Ecology, or other entities, hold for any given person. The resulting values of mortality risks, likely resulting from the proposed rule amendments' reductions in the short and long runs, to carcinogens, are presented in Table 8 below.[19]

The calculations underlying these numbers took the expected number of reduced cancer mortalities for each cohort, multiplied them by the range of VSL, calculated the present value for each year that the water quality improvement occurs, and assigned a 0.05 likelihood that the first benefits would begin accruing to each of the following 20 years. Note that after water quality improves, benefits accrue to that year's birth cohort, as well as the subsequent birth cohorts.

[18] Low-end percentage of cancer mortality to cancer incidence for Washington, based on 2010 data.

[19] Present values are calculated using the average risk-free, inflation-adjusted rate of return on I Bonds (US Treasury, 2014). The full range represents additional flow rates for a new air stripper of 50 – 500 gallons per minute. All dollar values are updated to 2014-dollars using the Consumer Price Index (US Bureau of Labor Statistics, 2014).

Table 8: Value of Avoided Cancer Risk under the Proposed Rule Amendments

Equivalent Value of Mortality Risk Reductions (Single-Site Actions) Single Cleanup Site, Three Alternative Assumptions 20-years of birth cohorts		
Tribe and Sport Fishing (General Distribution) 50th+ percentile	**Tribe and Sport Fishing** (High Consumption) 95th+ percentile	**Tribal Fishing** (High Consumption) 99th Percentile
$6 million - $23 million	$20 million - $70 million	$20 million - $90 million

Note that 99 percent of the impacts listed above are due to reduced exposure to vinyl chloride.

Note also that the quantification above does not include benefits to existing populations. Members of those populations are also likely to benefit from reduced exposure to carcinogens, but quantification of those benefits would entail scaling for changes in exposure during the 70-year exposure. We could not do this with a sufficient degree of certainty as to how varying exposure (at varying ages) affects lifetime excess cancer risk, and so we note this benefit qualitatively, in addition to quantified benefits.

6.3.3 Non-mortality benefits of avoided cancer risk

There are, of course, benefits of avoiding cancer in addition to simply avoiding the risk of death. These include:

- Pecuniary costs of illness:
  - Medical costs
  - Lost income
  - Interest costs of debt
- Non-pecuniary costs of illness:
  - Physical stress (illness itself)
  - Quality of life losses
  - Impacts to family
  - Lost spouse income
  - Lost children's schooling
  - Psychological impacts to family

By reducing the real risk of cancer for the population, the proposed rule amendments also reduce the risks of incurring these costs. Depending on income, wealth, individual attributes, family attributes, location, type of cancer, treatments, and illness duration, these costs vary considerably. We chose not to quantify most of these individual costs, as we could not confidently do so for a typical case of cancer, especially in the case of non-pecuniary costs. However, we did quantify the typical cost of cancer care.

The average initial cost of cancer treatment is, on average across sex and type of cancer, for persons age 65 and older (those likely experiencing long-term exposure to carcinogens), $52 thousand in the initial year, and $6 thousand in subsequent years. We discounted this value over 70 years, and allowed for 20-year variance in the year of cancer diagnosis, assuming a median duration of treatment of two years. We estimate, therefore, that the typical expected present-value avoided-cost of a cancer is approximately $20,000, in current dollars.

Multiplying this expected, discounted value by the numbers of cancer-equivalents likely avoided in Table 6, and performing expected value calculations in line with cost-estimation, to account for uncertainty as to the year of water-quality improvement (years 1-20), we estimate additional benefits of the reduced risk of treatment costs of future cancers in Table 9 below.

Table 9: Value of Avoided Cancer Treatment Costs, in present value

Single-Site Reductions to Cancer Treatment Costs (present value) **Single Cleanup Site, Three Alternative Assumptions** **20-years of birth cohorts**		
Tribe and Sport Fishing (General Distribution) 50th+ percentile	**Tribe and Sport Fishing** (High Consumption) 95th+ percentile	**Tribal Fishing** (High Consumption) 99th Percentile
$400 thousand	$1 million	$2 million

Note that the quantification above does not include benefits to existing populations. Members of those populations are also likely to benefit from reduced exposure to carcinogens, but quantification of those benefits would entail scaling for changes in exposure during the 70-year exposure. We could not do this with a sufficient degree of certainty as to how varying exposure (at varying ages) affects lifetime excess cancer risk, and so we note this benefit qualitatively, in addition to quantified benefits.

Table 10: Sources of Uncertainty in Quantitative Benefits

Sources of Uncertainty in Quantitative Benefits			
Source	**Effect on Analysis**	**Impact on Estimate**	**Why it Was Used**
Fish consumption rate distribution	The analysis uses the general population discount rate, using the upper distributions when addressing high-consuming sub-populations. Available data on tribal and Asian & Pacific Islander populations indicate they consume significantly more, in some percentiles.	Benefits underestimated	The source for the general population estimate was the most recent data available for the region and general population.
Cancer mortality rate	The analysis uses a cancer mortality rate for all cancers combined. The proposed rule amendments would change human health criteria for carcinogens that are associated with various types of cancer, which in turn have various durations and mortality rates.	Indeterminate	We did not use mortality rates specific to cancer-type, to correspond to the range of estimates used for the value of statistical life (below). We could not (given variation in cancer location, duration, treatment, demographic correlations, mortality, etc.) sufficiently match cancer mortalities with estimates of the value of risk-reductions.

Percentage of fish sourced locally	The analysis uses averages, by percentile, of consumed fish sourced from Puget Sound, of various sub-populations (tribes and Asian & Pacific Islander) in estimating the impact of local improvement to water quality on tribe and subsistence fisherman populations.	Indeterminate or benefits overestimated	Puget Sound-level data for fish consumption by local high-consuming populations was the most small-scale data available for scaling local fish consumption. As the quantitative estimates are for tribal and subsistence fishing, the tribal scaling values were appropriate for this scaling of fish consumption. As the data are for all of Puget Sound, however, a more local embayment or waterbody segment is likely a smaller source of consumed fish. We attempted to mitigate this by including data for Asian & Pacific Islander populations that, while high seafood consumers, consume relatively little local fish/shellfish.
Number of births per cohort	The analysis uses a stable number of births in each year (cohorts), for all 20 possible years of a contamination reduction occurring.	Benefits underestimated	Especially for subpopulations, we could not confidently forecast variance and growth over time of the size of each cohort. To maintain conservative (overestimated) benefits, we chose to use a stable number.
Value of statistical life (VSL) estimate	The analysis uses a range of VSL estimates, accounting for variation in types and sources of mortality risk, as well as the demographic of who values them.	Indeterminate	We used a broad range of VSL estimates to account for variance in the types of cancers affected, and their associated attributes, including mortality, treatment, and duration, as well as demographics. All of these variables can impact the VSL, so we determined that a broad range encompassing various values would mitigate for this uncertainty.
Exclusion of existing populations	The analysis estimates quantitative benefits for the next 20 years of birth cohorts, and does not include existing populations.	Benefits underestimated	Quantification of benefits for existing populations would entail scaling for changes in exposure during the course of the assumed 70-year exposure. We could not do this with a sufficient degree of certainty as to how varying exposure (at varying ages) affects lifetime excess cancer risk, and so we note this benefit qualitatively, in addition to quantified benefits.

6.4 Benefits of reduced non-cancer risks

We could not quantify noncancer benefits of the proposed rule amendments at this time. This is because of how noncancer toxic chemicals are treated both in the National Toxics Rule and in the Surface Water Quality Standards (in terms of exposures that do or do not likely result in non-cancer illness, rather than in degrees of those illnesses), as discussed below. Instead, we discuss here the likely impacts of the proposed rule amendments, qualitatively.

For noncancer effects, the magnitude of a health effect associated with contaminant exposure is characterized only as being above or below a dose at which there is no appreciable risk of an adverse effect. There is no indication of the probability of exposed individuals contracting such an effect, nor any measure of the severity of the effect – simply a dividing line between having effects and not having any.

For non-carcinogens, the proposed rule retains a hazard quotient of 1, as in the baseline. Although in many or most cases, we have the values for avoiding a noncancer health endpoint, or the costs associated with having a noncancer health effect, it is difficult or impossible to translate chemical exposure to the noncancer health endpoints themselves.

The Environmental Protection Agency states:

> In order to monetize the benefits associated with avoiding a non-cancer health effect, an analyst must first develop a full characterization of the effect itself. This includes a clear definition of the nature of the effect and a method for quantifying the likelihood of its occurrence within an exposed population. For non-cancer effects, the magnitude of a health effect associated with contaminant exposure is characterized only as being above or below a dose at which there is no appreciable risk of the adverse effect. There is no indication of the probability of exposed individuals contracting such an effect nor any measure of the severity of the effect.
>
> While standard cancer risk assessment methods can be used to quantify the magnitude of risk, analogous methods are not available for quantifying non-cancer risks. Specifically, cancer risk assessment methods can produce estimates of the probability associated with contracting cancer as a result of exposure to a contaminant. In contrast, available non-cancer risk assessment methods do not provide quantitative estimates of the probability of experiencing non-cancer effects from contaminant exposures. Non-cancer risk assessments are typically based on the use of the hazard quotient, a ratio of the estimated dose of a contaminant to the dose level below which there will not be any appreciable risk (the Reference Dose or RfD). Such an approach can only be used to determine how a contaminant dose compares to the RfD for that contaminant. If the dose for an exposed population is equal to or greater than the RfD, then the population is at risk of contracting the adverse effect associated with the contaminant.
>
> There are significant constraints in our ability to characterize and quantify non-cancer health effects in ways that can be monetized. These include difficulties in defining the nature of the effect itself and in quantifying the probability that a given exposure level will result in an individual contracting the effect. (EPA, 2000)

We can say to some degree, however, that noncancer health impacts of the proposed rule amendments, are likely similar to its effects on cancer incidence and mortality risk, above. In broad terms, the baseline is protective of only a small segment of the population, when it comes to non-carcinogens. By making some human health criteria lower (more protective), the proposed rule amendments expand the breadth of protectiveness afforded by the rule. More people are protected from entering a situation in which their hazard quotient is greater than 1 (where they would have some positive likelihood of experiencing noncancer health endpoints). Additionally, people who

were protected under the baseline are protected more – kept farther from the levels of exposure that would result in health impacts.

6.5 Implementation tools

The proposed rule includes proposed changes to compliance tools that can be used to comply with the human health criteria and other water quality standards. We have not included the use of compliance tools in our cost or benefit assumptions elsewhere in this analysis. That is, the previous analysis of costs and benefits assumes full compliance with the human health criteria. Here, we discuss the costs and benefits of the compliance tools, with context for how they would affect estimates. Functionally, any of these compliance tools affects the timing of real water-quality impacts of effluent controls.

6.5.1 Compliance schedules

The proposed rule removes the 10-year limit on compliance schedules that exists in the current rule. This change was made to comply with the legislature's 2009 directive to Ecology to authorize compliance schedules in excess of ten years under certain circumstances (RCW 90.48.605). In the context of economic analysis, compliance schedules affect the timing of costs and benefits. Where they allow gradual movement toward compliance, they delay or reduce costs, but also delay the onset of benefits. In this analysis, delaying both costs and benefits by any period of time, increases the degree to which both are discounted, and that degree is equal for both. In this sense, the ratio of costs and benefits for any given facility in the future remains the same, regardless of whether compliance is delayed by up to ten years, or by longer.

Compliance schedules also provide a benefit to discharges by reducing the costs of noncompliance and providing the ability to incur compliance costs over an extended period of time. At the same time, compliance schedules also add costs to the public associated with the time period for which the public is exposed to water not meeting water quality standards.

6.5.2 Intake credits

The proposed rule adds intake credits as a new tool for compliance with water quality standards. Intake credits allow facilities to account for chemicals in their intake when determining the limits and actions required to achieve compliance with the rule. This means intake credits prospectively reduce compliance costs because they allow dischargers to avoid managing chemicals in effluent that were already present in the intake water. As the degree to which costs might be reduced would vary widely depending on facility attributes, intake attributes, and the amounts and concentrations of chemicals in the water body segments involved, we could not quantify this cost-reduction benefit with a high degree of confidence. The benefits are likewise not quantifiable.

However, qualitative analysis indicates that intake credits would provide benefits to dischargers by reducing their costs of compliance. Intake credits likewise provide costs to the public by not requiring that all discharges meet water quality standards.

6.5.3 Variances

The proposed rule refines and elaborates on the existing rule provisions authorizing variances in compliance with water quality standards. Ecology has not issued a variance in the past, and we consider in this analysis that is the issuance of variances will likely remain a rare occurrence. However, by allowing the facility more time to comply with the rule (at least for a period of time), a variance would potentially reduce both costs and benefits. This would happen through a reduction in compliance costs (though likely traded for other monitoring and behavioral costs), with a delay in the removal of chemicals toxic to human health and the environment from discharges.

Variances also provide a benefit to discharges by reducing the costs of noncompliance and providing the ability to incur compliance costs over an extended period of time. At the same time, variances also add costs to the public associated with the time period for which the public is exposed to water not meeting water quality standards.

Chapter 7: Costs and Benefits under Future Improvements in Sampling and Testing

7.1 Introduction

As we have stated, this analysis is based largely on existing effluent data, as well as existing tissue-sample data. This means it may not represent all of the possible types of facilities impacted in the future, or locations that could become 303(d)-listed, and need to develop TMDLs at some point in the future. This chapter augments the analysis in chapters 5 and 6 to take into account possible future increases in sampling and possible future improvements in the sensitivity of sample testing. There is too much uncertainty in the locations, facilities, chemicals, concentrations, and timing of impacts associated with future improvements to sampling and testing to assess the impacts of these future actions quantitatively. However, we include this qualitative analysis as contemplated by the Administrative Procedure Act (APA, RCW 34.05.328).

Like the National Toxics Rule, the proposed human health criteria set water quality standards for some chemicals at levels below the level at which these chemicals can be detected in water using currently approved EPA test methods. For these chemicals, nondetection in effluent samples is deemed to be compliance with the standard. As test methods improve, however, some of these chemicals will become detectable at lower concentrations. In addition, not all water bodies or effluent has been tested for all of the chemicals listed in the proposed rule. For these reasons, future sampling of effluent or water bodies, and future testing using improved detection methods may detect chemicals of concern in places where they have not yet been detected. If these chemicals are present at levels that exceed the proposed human health criteria, dischargers will incur costs to decrease the amount of these chemicals in their effluent, and the public will receive benefits from decreased exposure to these chemicals.

7.2 Likely costs of the proposed rule amendments under future improvements in sampling and testing

This section examines compliance costs in the general case of new or improved sampling, associated with control technology and possible 303(d) listings in addition to those addressed in Chapter 5, in cases that would not have occurred under the baseline.

7.2.1 Context for size and scope of costs due to future improvements in sampling and testing

For context (from sections 5.2 and 5.3), given existing sample and effluent information, we determined that one existing facility was likely to be impacted by the proposed changes to human health criteria values, and to incur costs as a result. As a part of all facilities evaluated, this represents 0.25 percent of existing facilities, or approximately one in 400.

We also determined that five changes in 303(d) listing of impaired waterbodies were likely as a result of the proposed rule amendments, compared to:

- 543 existing 303(d) listings, and

- 157 current and in-progress TMDL projects (covering 1445 listings, of which approximately 70 are for a chemicals toxic to human health).

These listing changes do not impact existing dischargers because no dischargers discharge the chemicals that triggered the additional 303(d) listings.

Forecasting future TMDLs is difficult to do with a high degree of confidence, as the locations of the TMDLs and the chemicals involved depend on the number and location of future 303(d) listings. The table below summarizes Ecology's planned approach to ongoing TMDL implementation and the new human health criteria.

Table 11: Approach to ongoing TMDL work taking into account proposed new human health criteria

TMDL Status	Transition Solution
1. TMDL formally approved, submitted, or ready to be submitted	• Keep TMDL in place, even if human health criteria in the new rule are different • Continue implementation measures • Monitor compliance with TMDL allocations • Compare TMDL targets to new human health criteria, but dischargers not required to change targets • Water body will be placed in category 4a: Has a TMDL - in accordance with the new 303(d) listing policy
2. TMDL not yet approved or submitted, but field work completed and report may or may not be completed	• Proceed with submittal of TMDL package prior to the effective date of newly adopted human health criteria • The Summary Implementation Strategy in the TMDL needs to address monitoring plan to pick up new human health criteria if possible • Possible exceptions requiring closer evaluation involve point source dominated TMDLs
3. TMDL study in progress and field work begun but not completed	• Continue study but include new human health criteria • Analysis may still be based on old human health criteria • Extent of inclusion of new human health criteria depends on individual study and the difference between the old and new criteria • Develop monitoring plan that incorporates new human health criteria
4. TMDL study planned and no field work yet begun	• Include new human health criteria in study design and sampling and drop old criteria
5. 303(d) listed but no priority set for doing study	• Retain on 303(d) list • Continue to scope and schedule projects. When a project is selected for work, the project would be treated the same as in (4) above

The trajectory of future TMDLs also depends on whether and when large projects would be undertaken. For example, the Yakima River technical work is already done, but a formal TMDL and Load Allocation must still be developed.

7.2.2 Context for types of costs incurred

If an existing facility, or a new/expanded future facility, finds itself on a future 303(d)-listed waterbody segment that would not have been listed under the baseline, it would likely face more-stringent permit limits if it discharges the chemical for which the waterbody segment becomes listed. Depending on relevant concentrations of chemicals, facility attributes, and economic viability of additional controls, the facility might:

- Incur additional compliance costs for control technologies.
- Have a compliance schedule in its permit, facilitating long-run compliance.[20]
- Need to comply with a facility-specific load allocation, or other limits due to non-TMDL water-quality improvement projects.
- Need to comply with a load allocation resulting from a TMDL.

Overall, costs might include:

- Capital costs of new or additional control technologies.
- Operating and maintenance costs of new or additional control technologies.
- Monitoring costs.
- Costs of interim limitations on chemicals discharged, as necessary studies are completed to support a final load-allocation.

7.2.3 Analysis of possible costs incurred

Future improvements in sampling and testing will result in increased costs of compliance for affected dischargers. These costs could include capital costs for additional control technology, operating and maintenance costs of those technologies, monitoring costs, and costs associated with compliance with TMDLs. However, uncertainty about number of affected facilities, chemicals, concentrations, locations, and timing, makes it impossible to quantify these costs.

It is important to note that a number of water quality standards included in the baseline are already below detection limits. Of the criteria that change under the proposed rule, six fall below the detection limit. Improvements in sampling and testing would result in increased costs to dischargers to comply with these existing standards. These increases part of the baseline, and are not a consequence of the current proposed changes in human health criteria.

7.3 Likely benefits of the proposed rule amendments under future improvements in sampling and testing: reduced cancer

For the same reasons we could not confidently quantify costs in previous sections (lack of data that does not yet exist), we could not confidently quantify the benefits of the proposed rule amendments under a possible future scenario of increased and more-sensitive sampling. We therefore did not estimate the possible avoided cancer mortality for this section. Instead, we discuss

[20] A new facility would not be allowed to have a compliance schedule; it would need to meet limits based on the new human health criteria at startup.

this benefit qualitatively with some illustrative unit values. For an example of how this calculation applies to a future scenario under existing sample data and sensitivity, see Chapter 6.

To estimate the value of equivalent reductions in mortality risk, Ecology uses an estimate of the Value of Statistical Life (VSL). The VSL is based on estimates of the value of small reductions in future mortality risk, and then is multiplied out to the equivalent of a 100-percent mortality risk reduction. We use a range of values estimated by Aldy and Viscusi (2003), of $2.1 million to $8.6 million. This is an estimate based on equivalent risk-reductions, and should not be interpreted as the value that Ecology, or other entities, hold for any given person.

7.3.1 Non-mortality benefits of avoided cancer risk

There are, of course, benefits of avoiding cancer in addition to simply avoiding the risk of death. These include:

- Pecuniary costs of illness:
  - Medical costs
  - Lost income
  - Interest costs of debt
- Non-pecuniary costs of illness:
  - Physical stress (illness itself)
  - Quality of life losses
  - Impacts to family
  - Lost spouse income
  - Lost children's schooling
  - Psychological impacts to family

By reducing the real risk of cancer for the population, the proposed rule amendments also reduce the risks of incurring these costs. Depending on income, wealth, individual attributes, family attributes, location, type of cancer, treatments, and illness duration, these costs vary considerably. We chose not to quantify most of these individual costs, as we could not confidently do so for a typical case of cancer, especially in the case of non-pecuniary costs. However, we did quantify the typical cost of cancer care.

The average initial cost of cancer treatment is, on average across sex and type of cancer, for persons age 65 and older (those likely experiencing long-term exposure to carcinogens), $52 thousand in the initial year, and $6 thousand in subsequent years.

7.4 Future protectiveness benefit: Non-cancer

We could not quantify noncancer benefits of the proposed rule amendments at this time. This is because of how noncancer toxic chemicals are treated both in the National Toxics Rule and in the Surface Water Quality Standards. Instead, we discuss here the likely impacts of the proposed rule amendments, qualitatively. For a comprehensive discussion of these benefits, including EPA language addressing the issue, see section 6.4 of this document.

For noncancer effects, the magnitude of a health effect associated with contaminant exposure is characterized only as being above or below a dose at which there is no appreciable risk of an

adverse effect. There is no indication of the probability of exposed individuals contracting such an effect, nor any measure of the severity of the effect – simply a dividing line between having effects and not having any.

7.5 Non-use benefits

A value also held for both health and environmental goods and services, is the non-use value. One can think of it as the value held for something one may never encounter or use. This set of values includes empathetic values (values we have for others' ability to use something), historic value, cultural value, bequeathment value to children or future generations, and the value of something simply existing. We discuss these values qualitatively in this section.

We assume that non-use benefits for water quality in the state are likely only in the case of broad future protectiveness, and have therefore not included them in the benefits based on current data in Chapter 6.

7.5.1 General population values

Illustratively, there are various values in the literature for "water quality". In general, criteria levels decreasing could affect these values by improving perceived water quality. Such values are often difficult to quantify, particularly because they rarely rely on a quantitative measure of water quality. Instead, they rely on perceptions of water being "boatable", or "fishable", or "swimmable". The way many of these values are defined – on a qualitative or perception basis – may indicate that regardless of the underlying factors causing changes to criteria, the perception may, in fact, be that lower (more protective) criteria mean better "water quality".

7.5.2 Tribes' values

Tribes in the state hold long-standing cultural values for the quality of the environment, and as part of that, for safe consumption of fish. In communication with Ecology, representatives stated the following, to support Ecology's ability to better describe this set of values for tribal health, lifeways, communities, and economy:

> Tribes maintain treaty-reserved rights to the harvest of fisheries resources that the state of Washington is required to acknowledge and implement. The health, culture and lifeways of tribal communities and individuals are inextricably connected to water quality and the consumption of fisheries resources. These intangible and priceless benefits derived from clean water have been impaired by existing toxic contamination. A proposed rule that will reduce the concentration of toxic contamination, or eliminate the input of additional toxic contamination, serves to prevent additional harm and helps protect the priceless and intangible rights of tribes to treaty reserved resources and cultural lifeways for generations in the future.
>
> …
>
> Subsistence fishers harvest fish for cultural, spiritual, and economic reasons. Fishing closures and advisories deny these individuals the nutritional benefit, economic savings, and cultural satisfaction of the opportunity to harvest their own food.

…

Recent economic analyses have emphasized the value of "natural capital" and its role in sustaining human communities. Clean and healthy ecosystems produce food and other material provisions, regulate the quality of air and water, and support cultural values and activities.

…

Tribal fish consumers are, and will be, impacted by the state's water quality rules, and must be differentiated from the general population. Tribal leaders are resolute in their perspective that there is no appropriate price for a human life and human health, including the health of a tribal member or the loss of the tribal way of life in connection with natural resources. Leaders have also noted that the existing inadequate standards perpetuate the status quo, incurring continuing costs to fish consumers—particularly to tribal citizens in the form of diminished health and welfare, and the loss of access to treaty-reserved resources. Tribes are facing a future without fish, either due to the loss of "First Foods" resulting from reductions in the quantity of fish available for consumption, or the exposure to toxic chemicals which may render the fish inedible.

(Memo from Northwest Indian Fisheries Commission staff, received 5/12/14)

7.6 Co-benefits to nutrition and the environment

We note in this analysis, that fish consumption is also a means of getting nutrition that is either not available, or available at higher cost from other sources. The proposed rule amendments may offer an increased degree of protectiveness that allows fish-consumers to eat fish more safely, thereby reducing their costs of either acquiring nutrients, or the pass-through costs of a lack of nutrients (illness).

Where the benefits of reducing toxic chemicals in the water exist, as a likely result of the proposed rule amendments, there are also likely benefits to animals and plants. While there are varying impacts, and different degrees of impact, of different chemicals across species, we expect the proposed rule to have ancillary benefits to animals in water, as well as those that drink water directly. We expect that the bioaccumulative species, including fish, through which toxic chemicals eventually impact human health, to be among those benefitting. Where species – especially those with threatened populations – would experience reduced toxic exposure, we expect there would be a benefit to the environment in terms of both quality of the environment and quality of populations.

Chapter 8: Cost-Benefit Comparison and Conclusions

8.1 Cost and benefit summary

We estimated the following ranges of costs and benefits of the proposed rule amendments, as well as the following qualitative impacts.

8.1.1 Changes to HHC using existing data and sampling techniques

Costs (expected present values):

- $600 thousand to $3 million in costs for groundwater cleanup.

Benefits (expected present values):

- Cancer risk reductions valued at $6 million to $90 million in equivalent mortality risk avoided across affected populations for groundwater cleanup.
- Avoided cancer treatment costs of $400 thousand to $2 million.
- Reduced non-cancer health impacts in affected populations fishing in groundwater cleanup area.
- Reduced losses to income, debt, and non-pecuniary quality of life measures.

8.1.2 Changes to implementation tools

- Adjustment to both costs and benefits, in terms of delayed timing affecting the present values of compliance with all water quality requirements, including HHC as well as standards for values such as temperature and dissolved oxygen.
- Predictability and cost-smoothing for compliance with water quality regulations.

8.1.3 Changes to HHC under future improved sampling

Costs (expected present values):

- Ecology was unable to quantify costs to facilities and locations without existing data. Costs likely include:
  - Equipment capital costs
  - Operation and maintenance costs
  - Monitoring costs
  - Timing costs of interim limitations on chemicals discharged

Benefits (expected present values):

- Cancer risk reductions resulting in reduced mortality
- Avoided cancer treatment costs
- Reduced exposure to non-carcinogenic toxic chemicals

- Reduced losses to income, debt, and non-pecuniary quality of life measures
- Preservation of tribal values for cultural, treaty, and maintenance or improvement of tribal lifeways
- Preservation of general non-use values
- Prospective co-benefits to nutrition and the environment

8.2 Conclusion

After evaluating the likely costs and benefits of the proposed rule amendments, Ecology believes that the likely qualitative and quantitative benefits of the rule exceed its likely costs.

Chapter 9: Least-Burdensome Alternative Analysis

9.1 Introduction

Chapter 34.05.328(1)(e) 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 rule making 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.

In other words, Ecology is required to determine that the contents of the rule are the least burdensome set of requirements that still achieve the goals and objectives of the authorizing statute(s).

Ecology assessed alternatives to elements of the proposed rule, and determined whether they met the goals and objectives of the authorizing statues. Of those that would meet these goals and objectives, Ecology determined whether those chosen for the proposed rule were the least burdensome.

9.2 Goals and objectives of authorizing statutes

The authorizing statutes for the Water Quality Standards for Surface Waters of the State of Washington involve both federal and state regulations. We describe these regulations below, and then discuss their goals and objectives.

9.2.1 Federal requirement

Clean Water Act 303(c)(2)(A) states:

> …Such standards shall be such as to protect the public health or welfare, enhance the quality of the water and serve the purposes of this Chapter. Such standards shall be established taking into consideration their use and value for public water supplies, propagation of fish and wildlife, recreational purposes and agricultural, industrial and other purposes and also taking into consideration their use and value for navigation.

9.2.2 State requirements

In addition to the federal requirements the Department of Ecology is required under State Statute to "retain and secure high quality waters".

9.2.2.1 Water Pollution Control Act

90.48.010 Policy enunciated

It is declared to be the public policy of the state of Washington to maintain the highest possible standards to insure the purity of all waters of the state consistent with public health and public enjoyment thereof, the propagation and protection of wild life, birds, game, fish and other aquatic life, and the industrial development of the state, and to that end require the use of all known available and reasonable methods by industries and others to prevent and control the pollution of the waters of the state of Washington. Consistent with this policy, the state of Washington will exercise its powers, as fully and as effectively as possible, to retain and secure high quality for all waters of the state. The state of Washington in recognition of the federal government's interest in the quality of the navigable waters of the United States, of which certain portions thereof are within the jurisdictional limits of this state, proclaims a public policy of working cooperatively with the federal government in a joint effort to extinguish the sources of water quality degradation, while at the same time preserving and vigorously exercising state powers to insure that present and future standards of water quality within the state shall be determined by the citizenry, through and by the efforts of state government, of the state of Washington.

90.48.035 Rule-making authority

The department shall have the authority to, and shall promulgate, amend, or rescind such rules and regulations as it shall deem necessary to carry out the provisions of this chapter, including but not limited to rules and regulations relating to standards of quality for waters of the state and for substances discharged therein in order to maintain the highest possible standards of all waters of the state in accordance with the public policy as declared in RCW 90.48.010.

90.48.260 Federal Clean Water Act – Department designated as state agency, authority – Powers, duties and functions

The Department of Ecology is hereby designated as the State Water Pollution Control Agency for all purposes of the federal clean water act as it exists on February 4, 1987, and is herby authorized to participate fully in the programs of the act.

90.48.605 Amending state water quality standards – Compliance schedules in excess of ten years authorized

The department shall amend the state water quality standards to authorize compliance schedules in excess of ten years for discharge permits issued under this chapter that implement allocations contained in a total maximum daily load under certain circumstances. Any such amendment must be submitted to the United States environmental protection agency under the clean water act. Compliance schedules for the permits may exceed ten years if the department determines that:

(1) The permittee is meeting its requirements under the total maximum daily load as soon as possible;
(2) The actions proposed in the compliance schedule are sufficient to achieve water quality standards as soon as possible;

(3) A compliance schedule is appropriate; and
(4) The permittee is not able to meet its waste load allocation solely by controlling and treating its own effluent.

9.2.2.2 Water Resources Act of 1971

RCW 90.54.020 General declaration of fundamentals for utilization and management of waters of the state.

(b) Waters of the state shall be of high quality. Regardless of the quality of the waters of the state, all wastes and other materials and substances proposed for entry into said waters shall be provided with all known, available, and reasonable methods of treatment prior to entry. Notwithstanding that standards of quality established for the waters of the state would not be violated, wastes and other materials and substances shall not be allowed to enter such waters which will reduce the existing quality thereof, except in those situations where it is clear that overriding considerations of the public interest will be served.

9.2.3 Goals and objectives summary

We summarize the goals and objectives of the authorizing statutes as:

- To retain and secure high quality for all waters of the state.
- Insure the purity of all waters of the state consistent with:
  - Public health and public enjoyment thereof.
  - Propagation and protection of wild life, birds, game, fish and other aquatic life.
  - Industrial development of the state.
- Require the use of all known available and reasonable methods (AKART) by industries and others to prevent and control the pollution of the waters of the state of Washington.
- To protect the public health or welfare, enhance the quality of the water, taking into consideration their use and value for public water supplies, propagation of fish and wildlife, recreational purposes, and agricultural, industrial and other purposes.
- To authorize compliance schedules lasting longer than ten years under certain circumstances.

9.3 Alternatives considered and why they were not included

In this subsection we discuss alternatives that were considered, but were not included in the proposed rule amendments. We identify, for each alternative, why it was not included.

9.3.1 Higher fish consumption rate

A higher fish consumption rate would, were it the only element of the proposed rule amendments to change, result in lower (more protective) criteria values for discharged chemicals that are hazardous to human health. This would inherently be more burdensome, depending on the degree to which the rate was higher. Mathematically, any rate higher than the 175 g/day in the proposed rule amendments would lower (make more protective) criteria values and be more burdensome than the contents of the proposed rule amendments.

9.3.2 Lower fish consumption rate

Ecology believes that a lower fish consumption rate, were it the only element of the proposed rule amendments to change, would not be sufficiently protective of human health, as it would allow for higher (less protective) concentrations, in effluent, of chemicals toxic to human health – both carcinogens and non-carcinogens. As part of the overall package, combining the most-appropriate set of inputs to the EPA HHC equations, Ecology determined a fish consumption rate of 175 g/day was sufficiently protective (in light of other inputs such as cancer risk and toxicity and exposure attributes of various chemicals) as part of their risk-management decision, without being excessively burdensome. The risk-management decision included elements of both protectiveness and burden.

9.3.3 Higher cancer risk input

Ecology believes that a higher cancer risk input, were it the only element of the proposed rule amendments to change, would not be sufficiently protective of human health, as it would allow for higher (less protective) concentrations, in effluent, of carcinogenic chemicals toxic to human health. As part of the overall package, combining the most-appropriate set of inputs to the EPA HHC equations, Ecology determined a cancer risk input of one in one-hundred-thousand was sufficiently protective (in light of other inputs such as toxicity and exposure attributes of various chemicals), as part of their risk-management decision, without being excessively burdensome. Also, this difference would only impact half of the chemicals for which criteria are developed in this rulemaking. The risk-management decision included elements of both protectiveness and burden.

9.3.4 Lower cancer risk input

A lower or unchanged cancer risk input would, were it the only element of the proposed rule amendments to differ, result in lower (more protective) criteria values for discharged chemicals that are hazardous to human health. This would inherently be more burdensome, depending on the degree to which the rate was higher. Mathematically, any cancer risk lower than the one in one-hundred-thousand in the proposed rule amendments would lower (make more protective) criteria values and be more burdensome than the contents of the proposed rule amendments. Also, this difference would only impact half of the chemicals for which criteria are developed in this rulemaking.

9.4 Conclusion

After considering alternatives to the proposed rule's contents, as well as the goals and objectives of the authorizing statutes, Ecology determined that the proposed rule represents the least burdensome alternative of possible rule contents meeting these goals and objectives.

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