Washington State Department of Ecology

Model Toxics Control Act (MTCA) Cleanup Regulations

Preliminary Economic Analysis for Amendments to Chapter 173-340 WAC

Prepared for
Ecology's Toxics Cleanup Program

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ACRONYMS AND ABBREVIATIONS

ARAR	Applicable or Relevant and Appropriate Requirement
Cal-EPA	California EPA
CLARC	Cleanup Levels and Risk Calculation
CBA	Cost-Benefit Analysis
CDC	Centers for Disease Control
DLC	Dioxin-Like Compound
EPA	Environmental Protection Agency
HCA	Healthcare Authority
LBA	Least Burdensome Alternative
MCL	Maximum Containment Limit
MTCA	Model Toxics Control Act
PAC	Policy Advisory Committee
PAH	Polycyclic Aromatic Hydrocarbons
cPAH	Carcinogenic Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PCP	Pentachlorophenol
PEF	Potency Equivalency Factor
PLP	Potentially Liable Party
RCW	Revised Code of Washington
RPF	Relative Potency Factor
SBEIS	Small Business Economic Impact Statement
SIC	Standard Industry Classification
TCDD	Tetrachlorodibenzo-p-dioxin
TEF/TEQ	Toxic Equivalency Factor/Toxic Equivalency
TPH	Total petroleum hydrocarbon
VSL	Value of Statistical Life
WAC	Washington Administrative Code
WHO	World Health Organization

Executive Summary

The Washington State Department of Ecology is amending Chapter 173-340 WAC. The main features of this rule amendment include:

- Establishing risk policies for mixtures of dioxins and furans, carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs), and Polychlorinated Biphenyls (PCBs).
- Updating Toxic Equivalency Factors (TEF) for dioxin, furan, and dioxin-like PCB congeners to those recommended by the World Health Organization.
- Updating potency equivalency factors for carcinogenic PAHs to those adopted by the California EPA.
- Establishing a process for modifying one of the default exposure parameters (the gastrointestinal absorption fraction) used to establish soil cleanup levels for mixtures of dioxins and furans.
- Clarifying that cleanup proponents must consider the properties of individual dioxin/furan/PCB congeners and carcinogenic PAH compounds when evaluating cross-media impacts.

Cost-Benefit Analysis

The Cost-Benefit Analysis estimates the likely costs and benefits of the proposed rule relative to the current rule, and concludes that the quantitative and qualitative net benefit of the rule (accounting for both costs and benefits) is likely to be positive.

The Cost-Benefit Analysis estimates that the proposed rule will likely result in:

- Changes to cleanup levels for mixtures of dioxin/furan and cPAH
- Changes in remediation requirements at pulp and paper mill sites. Ecology expects those changes will be limited to areas that have been affected by air deposition of dioxin from stack emissions.
- Changes in the frequency and level of effort required to comply with evaluation requirements in other parts of the rule.

The number of affected sites is most likely to be low, and because of similar industrial processes and classification, may extend to thirteen sites in Washington State. Only three of these, however, have are known to be contaminated with dioxin.

The expected costs and benefits per site are:

- Costs of $148,800 (range $45,600 to $302,400) in increased remediation, if any
- Avoided compliance costs of Terrestrial Ecological Evaluation
- Avoided cost of noncancer illness
- Avoided cancer mortality and incidence

- Improved existence and bequest values for health and the environment

Small Business Economic Impact Statement

Ecology has reviewed the list of cleanup sites in Washington, the current and proposed rules, and experience administering the existing MTCA rule. Based on that review, Ecology concluded that small businesses are not likely to be affected by the proposed rule.

Given that small businesses are not affected, it is not possible to evaluate the relative impact on small business or to do the required content for an SBEIS in RCW 19.85.040, or to reduce the costs to small business under RCW 19.85.030.

Least Burdensome Alternative Analysis

The Least Burdensome Alternative Analysis determines that that the proposed rule achieves the general goals of the rulemaking and authorizing statutes, and is the least burdensome option for all those who are required to comply with it.

In the course of rulemaking, Ecology considered alternative rule language that would have imposed a larger burden on those required to comply with the rule. These alternatives include:

- Leaving the current MTCA rule as it is, which would not maintain Ecology's goal of stricter cleanup levels and mandate of updated scientific parameters.
- Options that would require sites to perform more cleanup and, therefore, incur greater cost:
    - Higher relative bioavailability.
    - Eliminating the TEF option from cleanup level calculation for dioxin/furan and cPAH mixtures.
    - Use of a single reference chemical for both dioxin/furan and PCBs.

CHAPTER 1: Background and Introduction

1.1 Introduction

This report reviews the economic analyses performed by Ecology to estimate the incremental expected benefits and costs of the proposed amendments to the Model Toxics Control Act (MTCA) Cleanup Regulation (Chapter 173-340 WAC). This document is intended for use with the associated Least Burdensome Alternative (LBA, Chapter 8) analysis and Small Business Economic Impact Statement (SBEIS, Chapter 7) to develop an understanding of the full impact of the proposed rule.

Ecology is proposing revisions to the Model Toxics Control Act (MTCA) Cleanup Regulation. The rule revisions will update and clarify the policies and procedures for establishing and evaluating compliance with cleanup levels and remediation levels for several types of mixtures. The rule revisions apply to mixtures of dioxins and furans, polychlorinated biphenyls (PCBs), and polycyclic aromatic hydrocarbons (PAHs).

The MTCA Cleanup Regulation currently specifies that cleanup proponents may use a U.S. Environmental Protection Agency (EPA) methodology to characterize mixtures of dioxins and furans. In 2001, Ecology published a guidance document to explain how to use the EPA methodology to establish cleanup levels for dioxin and furan mixtures. A recent lawsuit raised a number of issues related to the regulation and guidance. Ecology settled the lawsuit, concluding it could not continue to require responsible parties to use the guidance without revising the MTCA Cleanup Regulation.

Ecology decided to re-evaluate this issue and explicitly define in the rule how the federal methodology should be used within the MTCA regulatory framework.

The Washington Administrative Procedure Act (RCW 34.05.328) requires Ecology to evaluate significant legislative rules to "[d]etermine that the probable benefits of the rule are greater than its probable costs, taking into account both the qualitative and quantitative benefits and costs and the specific directives of the statute being implemented."

1.2 Regulatory Background

The Model Toxics Control Act (MTCA), Chapter 70.105D RCW, was passed by the voters of the State of Washington in November 1988 and became effective March 1, 1989. The law establishes the basic authorities and requirements for cleaning up contaminated sites in Washington State. The objective of the MTCA is to prevent or remedy threats to human health and the environment caused by hazardous waste sites.

The MTCA requires Ecology to periodically update and publish minimum cleanup standards. RCW 70.105D.030(2)(e). Ecology originally adopted cleanup standards by rule in February 1991 ("MTCA Cleanup Regulation" or "MTCA Cleanup Rule").

Ecology initiated a negotiated rule making process in 1997 that resulted in significant amendments to the MTCA Cleanup Regulation. The amendments were adopted in February

2001 and became effective on August 15, 2001. Many of the rule changes were developed in response to recommendations made by the MTCA Policy Advisory Committee (PAC). The PAC was a body established by the Washington State Legislature in 1995. The PAC represented the interests of:

- The Legislature
- Local governments
- Businesses
- Agriculture
- Environmental organizations
- Financing institutions
- Ports
- Environmental consultants
- The Science Advisory Board
- The Departments of Health and Ecology
- The public

Following amendment in 2001, the MTCA Cleanup Regulation defined the policies and procedures governing toxics clean up. This included the provision that a person undertaking cleanup action may use the US Environmental Protection Agency's (US EPA's) toxicity equivalency factors (TEFs) in calculating cleanup levels for mixtures of chlorinated dibenzo-p-dioxins and chlorinated dibenzofurans (called "dioxins" and "furans" in this report).

The text of the rule did not specify how the TEF must be used in calculating dioxin/furan cleanup levels because the EPA publication referenced by the regulation was thought to adequately describe the procedure. To help users of the rule that did not have access to EPA's publication, Ecology included TEF calculation guidance in the Cleanup Levels and Risk Calculation (CLARC) created later in 2001 (Ecology, 2001).

The EPA publication and CLARC guidance describe the process for converting dioxin and furan concentrations to a toxic equivalent concentration of the reference chemical—2,3,7,8 tetrachloro dibenzo-p-dioxin (2,3,7,8 TCDD). This means that a concentration of a dioxin or furan is converted to a concentration of the reference chemical that has the same toxicity. The toxic equivalent concentration of the reference chemical (2,3,7,8 TCDD) is then compared to its cleanup level to determine whether the site requires remedial clean up. The reference cleanup level is set by law and is based on the excess cancer risk[1] posed by the contaminant. The cleanup level applied can be different under federal and state law because the excess cancer risk limit adopted under federal and state law can differ.

1.3 Reasons for the Proposed Rule

In November 2005, Rayonier Properties LLC filed a lawsuit challenging Ecology's application of the CLARC guidance document at the Rayonier Port Angeles Mill Site. Rayonier argued that the CLARC guidance was not consistent with the procedures for establishing soil cleanup levels established in the MTCA rule, since the MTCA rule requires Ecology to establish cleanup levels using a cancer risk level of 10^{-6} applied to individual substances and 10^{-5} applied to mixtures of hazardous substances, but the CLARC guidance applied a 10^{-6} risk level to a dioxin mixture.

In April 2006, Ecology settled the lawsuit because the agency agreed that one plausible

[1] In excess of background cancer risk.

interpretation of the existing rule could allow the more general rule requirements for single substances and mixtures to be applied to dioxin and furan mixtures, so that dioxin and furan congeners could be considered individual substances, each regulated at a cancer risk level of 10^{-6} with each mixture additionally regulated at a cancer risk level of 10^{-5}. Ecology agreed to settle the lawsuit because neither the current MTCA rule nor the federal guidance referenced in the MTCA rule explicitly requires the procedures in the CLARC guidance.

Concurrent with the settlement discussions, several environmental organizations submitted a rulemaking petition to Ecology in March 2006. These groups requested that Ecology amend the rule to ensure that dioxin and furan mixtures would be regulated at a cancer risk level of 10^{-6}, as specified in the CLARC guidance, to protect against significant health threats posed by such mixtures.

Ecology reviewed the rulemaking petition and decided to launch a focused rulemaking process to address the issues raised in the lawsuit and rulemaking petition. Specifically, Ecology decided to re-evaluate this issue and explicitly define in the rule how the federal methodology should be used within the MTCA regulatory framework. In particular, Ecology feels the proposed rule will serve to better protect human health from the risks posed by such contamination, as outlined in the discussion of benefits in Chapter 5, below.

1.4 Document Organization

We have organized this document into the following sections:

- **Comparison of the Current Rule and Proposed Rule** (Chapter 2): Detailed description and comparison of the existing rule requirements and the proposed rule, including soil cleanup levels determined by both.
- **Comparison of Cleanup Standards under the Current and Proposed Rules** (Chapter 3)
- **Affected Site Analysis** (Chapter 4): Description and refinement of potentially impacted site types by site category.
- **Expected Costs and Benefits of the Proposed Rule** (Chapter 5): Analysis of the types and size of costs Ecology expects impacted sites to incur, including sampling and remediation costs. Analysis of the types and size of benefits expected to result from the proposed rule, including human health, ecological and wildlife health, and administrative benefits.
- **Comments and Conclusions** (Chapter 6): Summary of the analyses and results. Discussion of the complete implications of the Cost-Benefit Analysis. Comments on variability of results.
- **Small Business Economic Impact Statement** (Chapter 7): Analysis of disproportionate impacts that the proposed rule has on small businesses. Ecology concluded that—based on analysis of affected sites performed in this Cost-Benefit Analysis—Ecology cannot perform the required SBEIS tasks, because no small businesses are affected by the proposed rule.
- **Least Burdensome Alternative Analysis** (Chapter 8): Analysis of considered

alternatives to the proposed rule.

CHAPTER 2: Comparison of the Current and Proposed Rules

2.1 Statutory Background

The Model Toxics Control Act (Initiative 97), Chapter 70.105D RCW, was passed by the voters of the State of Washington in November 1988 and became effective March 1, 1989. The law establishes the basic authorities and requirements for cleaning up contaminated sites in a manner that will protect human health and the environment.

As a general declaration of policy, the Model Toxics Control Act (MTCA), Chapter 70.105D RCW, states that:

> Each person has a fundamental and inalienable right to a healthful environment, and each person has a responsibility to preserve and enhance that right. The beneficial stewardship of the land, air, and waters of the state is a solemn obligation of the present generation for the benefit of future generations.

RCW 70.105D.010(1). The statute further states that:

> A healthful environment is now threatened by the irresponsible use and disposal of hazardous substances. There are hundreds of hazardous waste sites in this state, and more will be created if current waste practices continue. Hazardous waste sites threaten the state's water resources, including those used for public drinking water. Many of our municipal landfills are current or potential hazardous waste sites and present serious threats to human health and the environment.

RCW 70.105D.010(2). The main purpose of MTCA is ensure these threats to human health and the environment are remedied, and to prevent new threats from being created by the improper disposal of hazardous waste (RCW 70.105D.010(2)).

To accomplish these statutory goals, MTCA establishes a wide range of powers and duties for the Department of Ecology. In particular, MTCA requires Ecology "to immediately implement all provisions of this chapter to the maximum extent practicable, including investigative and remedial actions where appropriate." RCW 70.105D.030(2). Furthermore, MTCA requires Ecology to adopt, and thereafter enforce, rules under Chapter 34.05 RCW. Ecology must:

> Publish and periodically update minimum cleanup standards for remedial actions at least as stringent as the cleanup standards under section 121 of the federal cleanup law, 42 USC. Sec. 9621, and at least as stringent as all applicable state and federal laws, including health-based standards under state and federal law[.][1]

RCW 70.105D.030(2)(e).

[1] The federal cleanup law referenced in MTCA is the Comprehensive Environmental Response Compensation and Liability Act of 1980 as amended by the Superfund Amendments and Reauthorization Act of 1986

2.2 MTCA Cleanup Standards – The Current Rule

Ecology originally adopted the original cleanup standards in 1991 ("MTCA Cleanup Regulation" or "MTCA rule"). Ecology completed significant changes to the cleanup standards in February 2001. Under the current MTCA rule, there are three methods (Methods A, B, and C) for establishing cleanup levels.

Method A

Can be used to establish cleanup levels at relatively small sites that involve few contaminants. Under Method A, cleanup levels must be at least as stringent as the following:

- Applicable or Relevant & Appropriate Requirements (ARARs): Standards in applicable state and federal laws. For example, Method A cleanup levels must be at least as strict as any applicable surface-water quality standards in the National Toxics Rule.
- Method A Tables: Cleanup levels are listed in Tables 720-1, 740-1, and 745-1. These tables provide values for carcinogenic PAHs and PCBs but not for dioxins and furans.
- Plants and Wildlife: Concentrations that result in no significant adverse effects on the protection and propagation of terrestrial ecological receptors using the procedures in WAC 173-340-7490 through WAC 173-340-7493, unless it is demonstrated under those sections that establishing a soil concentration is unnecessary.

Method B

Can be used to establish cleanup levels at any site. Under Method B, cleanup levels must be at least as stringent as the following:

- Applicable or Relevant & Appropriate Requirements (ARARs): Standards in applicable state and federal laws.
- Risk-Based Cleanup Levels: Cleanup levels calculated using the methods in WAC 173-340-720 through 173-340-750.

  Individual Hazardous Substances: The cancer risk for individual substances cannot exceed one in one million (1×10^{-6}). The non-cancer risk for individual substances cannot exceed a hazard quotient of one.

  Total Site Risk: The total site risk for carcinogens cannot exceed one-in-one hundred thousand (1×10^{-5}). Non-cancer total site risk cannot exceed a hazard quotient of one. The MTCA rule requires that the cleanup levels established for individual substances be adjusted downward if the total risk posed by the entire mixture exceeds either of these limits. Total site risk includes consideration of multiple hazardous substances and multiple pathways of exposure.
- Plants and Wildlife: Concentrations that are estimated to result in no adverse effects on the protection and propagation of aquatic life and no significant adverse effects on terrestrial ecological receptors using the procedures in WAC 173-340-7490 through WAC 173-340-7493.

Method C

Can be used to establish cleanup levels in limited situations—typically for soil cleanup levels for industrial land uses. Method C cleanup levels must be at least as stringent as the following:

- Applicable or Relevant & Appropriate Requirements (ARARs): Standards in applicable state and federal laws.
- Risk-Based Cleanup Levels: Cleanup levels calculated using the methods in WAC 173-340-720 through 173-340-750.

  Individual Hazardous Substances: The cancer risk for individual substances cannot exceed one in one hundred thousand (10^{-5}). The non-cancer risk for individual substances cannot exceed a hazard quotient of one.

  Total Site Risk: The total site risk for carcinogens cannot exceed one-in-one hundred thousand (10^{-5}). Non-cancer total site risk cannot exceed a hazard index of one. The MTCA rule requires that the cleanup levels established for individual substances be adjusted downward if the total risk posed by the entire mixture exceeds either of these limits. Total site risk includes consideration of multiple hazardous substances and multiple pathways of exposure.
- Plants and Wildlife: Concentrations that are estimated to result in no significant adverse effects on the protection and propagation of aquatic life, and no significant adverse effects on wildlife using the procedures in WAC 173-340-7490 through WAC 173-340-7493.

2.3 Toxicity Equivalency Factors (TEFs)

People and other organisms are exposed to a wide range of complex environmental mixtures. Yet toxicological information is available for only a limited number of the individual chemicals that comprise mixtures of hazardous substances. Over the last 20 years, scientists have nonetheless developed several approaches for evaluating and characterizing the toxicity of the whole mixture. One of the most frequently used approaches is the "Toxicity Equivalency Factor" or "TEF" methodology.

Under the TEF methodology, the toxicity of one member of the chemical group is selected as the index chemical.

The remaining members of the chemical group are assigned TEF values, which provide an order of magnitude estimate of potency relative to an index chemical. The TEF values can be used to calculate a toxicity equivalent concentration (expressed in terms of the index chemical), by multiplying the concentration of each chemical by its TEF value. The whole mixture can be characterized by the sum of the toxicity equivalent concentration for all of the chemicals in the mixture. (This is often referred to as the total toxicity equivalent concentration, "TTEC" or "TEQ"). The health risks posed by the whole mixture can then be assessed using total toxic equivalency concentration (TEQ) and the toxicological information for the index chemical.

The EPA first adopted the TEF methodology as an interim procedure for evaluating the toxicity and risks associated with exposures to dioxin and furan mixtures (EPA, 1987, 1989).

The majority of state, federal, and international environmental agencies currently use the TEF values developed by the World Health Organization (Van den Berg, et al., 1998) when evaluating the health risks posed by dioxin/furan mixtures. The World Health Organization recently updated the TEF values for dioxin, furan, and dioxin-like PCB congeners (Van den Berg, et al., 2006).

Dioxins and furans are generally present in the environment as a complex mixture of chemical "congeners" that differ in terms of the number and location of chlorine atoms. 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD, the index chemical) is the most toxic and best studied of the 210 polychlorinated dibenzo-p-dioxin and polychlorinated dibenzofuran congeners (CDDs and CDFs).

Polycyclic aromatic hydrocarbons (PAHs) are a group of chemicals formed during the incomplete burning of organic materials such as wood, garbage, oil, coal, gas, tobacco, and charbroiled meat. There are more than 100 different PAHs. EPA (1993) published provisional guidance for evaluating the carcinogenic risks associated with PAH mixtures using a relative potency factor (RPF) approach.

The EPA (1993) approach uses benzo(a)pyrene [BaP] as the index chemical (i.e., having a relative potency of 1.0) and includes RPF values for seven (7) carcinogenic PAHs. The California Environmental Protection Agency (Cal EPA, 1994) expanded upon the EPA approach when it developed Potency Equivalency Factors (PEFs) for use in evaluating PAH mixtures. The Cal EPA approach also uses BaP as the index chemical and includes PEFs for twenty-two (22) carcinogenic PAHs[2].

In February 2001, Ecology revised WAC 173-340-708(8) by adding new provisions applicable to mixtures of chlorinated dibenzo-p-dioxins, chlorinated dibenzofurans, and polycyclic aromatic hydrocarbons:

- **Chlorinated Dioxins/Furans: W**AC 173-340-708(8)(d) states that cleanup proponents may use EPA's TEF values and methodology when assessing the potential carcinogenic risk of mixtures of chlorinated dibenzo-p-dioxins and chlorinated dibenzofurans. Under the EPA methodology, 2,3,7,8 TCDD is the index chemical. The total toxicity equivalent concentration of the mixture is represented by the sum of the products of the TEF and the concentration of the respective dioxin or furan congener.

- **Polycyclic Aromatic Hydrocarbons (PAHs):** WAC 173-340-708(8)(d) states that cleanup proponents may use the Relative Potency Factors (RPFs) and methodology developed by the California EPA (Cal-EPA) when assessing the potential carcinogenic risk of mixtures of cPAH. Under the Cal-EPA methodology, benzo[a]pyrene (B[a]P) is the index chemical. The total toxicity equivalent concentration of the mixture is

[2] In 2001, Ecology amended the MTCA rule to explicitly authorize use of the Cal EPA (1994) methodology to evaluate the toxicity and assess the risks from exposure to carcinogenic PAH mixtures

represented by the sum of the products of the TEF and the respective cPAH compound concentrations.

2.4 Two Approaches for Using TEF/TEQ Methodology When Establishing Cleanup Levels

The existing MTCA rule does not clearly specify how the TEF methodology must be used within the context of the MTCA Cleanup Regulation, when calculating cleanup levels for mixtures of dioxins/furans and PAHs. Two approaches have been used to establish cleanup levels using the EPA TEF methodology under the MTCA rule:

- **Cleanup Levels and Risk Calculation (CLARC) Guidance**: In November 2001, Ecology published guidance on how to use the TEF methodology when establishing and evaluating compliance with MTCA cleanup levels. The guidance directed people to (1) use the TEF methodology to calculate a total toxic equivalency concentration and (2) compare the calculated value to the applicable cleanup level for the reference chemical (either 2,3,7,8 TCDD or benzo[a]pyrene). Under this approach, the mixture is characterized by a single value (the total toxicity equivalent concentration). Cleanup levels for the mixture are then established using a cancer risk level of one-in-one million (10^{-6}) under Method B and one-in-one hundred thousand (10^{-5}) under Method C.

- **Rayonier Settlement**: As discussed above, Rayonier Properties LLC argued that the MTCA rule requires Ecology to establish cleanup levels using a cancer risk level of 10^{-6} applied to individual substances and 10^{-5} applied to mixtures of hazardous substances, as opposed to applying 10^{-6} risk level to the whole mixture. Ecology agreed that Rayonier's approach was a plausible approach for using the TEF methodology to implement the current MTCA rule. Under this approach, the TEF methodology is used to calculate a toxic equivalent concentration for each congener, which can be compared to the cleanup level for 2,3,7,8 TCDD. The total site risk (taking into account all congeners, other hazardous substances, and multiple exposure pathways) cannot exceed a cancer risk of one-in-a-hundred thousand (10-5).

Because neither the current MTCA rule, nor the federal guidance referenced in the MTCA rule, explicitly requires the procedures in the CLARC guidance, Ecology will consider the Rayonier Settlement approach described above to be the baseline interpretation of the current rule on this issue. However, it is important to note that the proposed rule contains additional revisions that would result in changes to how cleanup levels are calculated under both approaches discussed above, in certain limited contexts.

2.5 Description of the Proposed Rule

Ecology developed the proposed rule to establish policies and procedures for calculating cleanup levels for mixtures of dioxin/furan, PCBs, and PAHs. The proposed rule includes:

- **Clear Statements on the Cancer Risk Policies Applicable to Dioxins/furans, cPAH and PCBs:** Ecology is proposing to amend WAC 173-340-708(8) to clarify how the TEF methodology should be used to establish cleanup levels for mixtures of dioxin/furan,

carcinogenic PAHs, and PCBs. Under the proposed revisions, cleanup levels for the mixture are to be established using a cancer risk level of one-in-one million (10^{-6}) under Method B and one-in-one hundred thousand (10^{-5}) under Method C.

- **Updated Toxic Equivalency Factors:** Ecology proposes to amend WAC 173-340-708(8) to incorporate the most recent toxicity equivalency factors (TEFs) for dioxin/furan and PCBs recommended by the World Health Organization (Van den Berg et al. 2006) and updated potency equivalency factors (PEFs) for carcinogenic PAHs adopted by the California EPA (Cal-EPA, 2005).

- **Relative Bioavailability:** Ecology is proposing procedures for modifying one of the default exposure parameters (the gastrointestinal absorption fraction) used to establish soil cleanup levels for mixtures of dioxins and furans.

- **Cross-Media Transfer:** Ecology proposes to amend the rule to clarify that cleanup proponents must consider the properties of individual dioxin/furan/PCB congeners and cPAH compounds when evaluating cross-media impacts (e.g., migration contaminants from soil to ground water).

CHAPTER 3: Comparison of the Cleanup Standards Under the Current and Proposed Rules

3.1 Introduction

The proposed rule described above in Section 2.3 may lead to changes in cleanup levels determined under the MTCA. **The costs and benefits associated with the proposed rule are due to differences between the cleanup levels established under the current and proposed rules.**

Ecology has calculated the cleanup levels that the proposed rule requires, and compared those to cleanup levels required under the current rule. In making that comparison, Ecology has evaluated the incremental changes relative to:

- **Regulatory Baseline**: Cleanup levels are established for each congener or PAH compound using a cancer risk level of 10^{-6} (as opposed to applying 10^{-6} risk level to the whole mixture). The TEF methodology published by the EPA (1989) is used to calculate a toxic equivalent concentration for each congener, which can be compared to the cleanup level for 2,3,7,8 TCDD. The total site risk (taking into account all congeners, other hazardous substances, and multiple exposure pathways) cannot exceed a cancer risk of one-in-a-hundred thousand (10-5). Under this approach, cleanup levels must also:
    - Comply with all applicable and relevant and appropriate requirements
    - Comply with the requirements based on preventing non-carcinogenic health risks (Hazard Index must be less than one)
    - Comply with the ecological protection requirements in the MTCA rule

3.2 Expected Changes to the MTCA Cleanup Levels

Ecology is proposing revisions to the policies and methods for establishing and evaluating compliance with cleanup levels and remediation levels. The proposed rule amendments will not result in significant changes to cleanup standards for PCBs because the use of the TEF methodology is optional.

However, the proposed rule revisions may result in changes to cleanup levels for cleanup sites with elevated levels of dioxin/furan and carcinogenic PAHs. **The incremental costs and benefits of the proposed rule amendments result from additional cleanup actions (if any) to achieve compliance with the revised cleanup standards.**

Ecology has calculated expected cleanup levels that might result from adopting the proposed rule. Based on that evaluation, Ecology has reached several conclusions:

Dioxin and Furan Mixtures

- **Ground Water and Surface Water Cleanup Levels**: The proposed rule revisions will not affect dioxin- and furan-mixture cleanup levels for ground & surface waters. Ground water cleanup levels established under WAC 173-340-720 will continue to be based on the Maximum Contaminant Limit (MCL) for dioxin in the state and federal drinking water regulations. Surface-water cleanup levels established under WAC 173-340-730 will continue to be based on the dioxin surface-water standard in the National Toxics Rule, Section 304 of the federal clean water act, state water-quality law, and other applicable or relevant and appropriate requirements (ARARs).

- **Method B Soil Cleanup Levels Based on Non-Cancer Human Health Risks** The proposed rule revisions will not change the methods and policies for establishing Method B soil cleanup levels based on non-cancer human health risks.

- **Method B Soil Cleanup Levels Based on Ecological Protection:** The proposed rule revisions will not change the methods and policies for establishing Method B soil cleanup levels based on ecological protection.

- **Method B Soil Cleanup Levels Based on Cancer Risks** The proposed rule revisions will result in changes to dioxin and furan mixture soil-cleanup levels based on human cancer risks. The proposed rule revisions will result in Method B soil cleanup levels for dioxin mixtures that are 40 percent higher (less stringent) than cleanup levels established using the approach specified in the CLARC guidance document. The proposed rule revisions will result in Method B soil cleanup levels that are 30 to 50 percent lower (more stringent) than cleanup levels that would be established under the baseline.

Table 1: Comparison of Method B Cleanup Levels for Dioxin

Comparison of Method B Soil Cleanup Levels* for Dioxin/Furan Mixtures			
Contaminants	Current MTCA Rule		Proposed Amendment
	CLARC comparison	Baseline	
2,3,7,8 TCDD	6.7 ppt	6.7 ppt	11 ppt
Dioxin/Furan Mixtures (TEQ)	6.7 ppt	16 – 24 ppt**	11 ppt***
*Assumes direct contact (via soil ingestion) is the controlling exposure pathway. **Based on median cleanup level at dioxin/furan contaminated sites in Washington State *** Based on a gastrointestinal absorption fraction (bioavailability) of 0.6.			

- **Industrial Soil Cleanup Levels:** The proposed rule revisions will result in changes to industrial soil cleanup levels for dioxin and furan mixtures based on human cancer risks. Under the current CLARC guidance and the baseline, the standard is the same, because both are based on a 10^{-5} cancer risk. In general, the levels established under the proposed rule revisions will be 70 percent higher (less stringent) than those established under the baseline and CLARC guidance (Table 2). However, the proposed revisions will not change the methods and policies establishing industrial soil cleanup standards based on ecological protection, which will control the soil cleanup at some industrial properties.

Table 2: Comparison of Method C Soil Cleanup Levels for Dioxin

Comparison of Method C Soil Cleanup Levels* for Dioxin Mixtures			
Contaminants	Current MTCA Rule		Proposed Amendment
	CLARC comparison	Baseline	
2,3,7,8 TCDD	875 ppt	875 ppt	1460 ppt
Dioxin/Furan Mixtures (TEQ)	875 ppt	875 ppt	1460 ppt**
*Assumes direct contact (via soil ingestion) is the controlling exposure pathway. ** Based on a gastrointestinal absorption fraction (bioavailability) of 0.6.			

Carcinogenic PAH Mixtures

- **Ground Water and Surface Water Cleanup Levels**: The proposed rule revisions will not significantly change ground water and surface water cleanup levels for carcinogenic PAH mixtures. Ground water cleanup levels established under WAC 173-340-720 will continue to be based upon the Method A cleanup level or the Maximum Contaminant Limit (MCL) for benzo[a]pyrene in the state and federal drinking water regulations. Surface-water cleanup levels established under WAC 173-340-730 will continue to be based on the National Toxics Rule, section 304 of the federal clean water act, state water-quality law, and other ARARs.
- **Method A Soil Cleanup Levels**: The proposed rule revisions will not change the Method A soil cleanup levels for carcinogenic PAH (cPAH) mixtures for unrestricted land use (0.1 mg/kg) and industrial land use (2 mg/kg). The change in the TEF value for dibenz(a,h)anthracene from 0.4 to 0.1 will result in approximately five percent higher mixture concentrations meeting this cleanup level (five percent less stringent cleanup levels).
- **Method B Soil Cleanup Levels Based on Non-Cancer Human Health Risks**: The proposed rule revisions will not change the methods and policies for establishing Method B soil cleanup levels based on non-cancer human health risks.
- **Method B Soil Cleanup Levels Based on Ecological Protection**: The proposed rule revisions will not change the methods and policies for establishing Method B soil cleanup levels based on ecological protection.
- **Method B Soil Cleanup Levels Based on Cancer Risks**: The proposed rule revisions may affect Method B soil cleanup levels for cPAHs that are based on cancer human health risk. The proposed rule revisions will not change the Method B cleanup level for benzo(a)pyrene (B(a)P) which is the reference chemical in the TEF approach.

  The proposed rule revisions will result in Method B soil cleanup levels that are 10 – 30 percent lower (more stringent) than cleanup levels that would be established under the baseline (Table 3). However, the change in the TEF value for dibenz(a,h)anthracene from 0.4 to 0.1 will result in approximately five percent higher mixture concentrations meeting this cleanup level (five percent less stringent cleanup levels), balancing this out to some extent. Overall, there is very little difference in

cleanup levels selected under the two rulemaking options because benzo[a]pyrene generally contributes 60-80% of the TEQ for the whole mixture.

Table 3: Comparison of Method B Cleanup Levels for PAHs

Comparison of Method B Direct Contact* Soil Cleanup Levels for PAHs			
Contaminants	Current MTCA Rule		Proposed Amendment
	CLARC comparison	Baseline	
Benzo[a]pyrene	0.14 ppm	0.14 ppm	0.14 ppm
cPAH mixtures (TEQ)	0.14 ppm	0.16 – 0.26 ppm**	0.14 ppm
*The direct contact pathway is expected to be the controlling pathway for soil CULs. ** Based on median cleanup level at cPAH contaminated sites in Washington State.			

- **Industrial Soil Cleanup Levels**: At industrial sites, the cancer risk target for the individual PAHs (10^{-5}) is the same as the cancer risk target for total site risk (10^{-5}). Consequently, the proposed rule revisions will not change Method C industrial soil cleanup levels (Table 3). However, the change in the TEF value for dibenz(a,h)anthacene from 0.4 to 0.1 will result in approximately five percent higher mixture concentrations meeting this cleanup level (five percent less stringent cleanup levels).

Table 4: Comparison of Method C Industrial Soil Cleanup Levels for PAHs

Comparison of Method C Direct Contact & Leaching* Soil Cleanup Levels for PAHs			
Contaminants	Current MTCA Rule		Proposed Amendment
	CLARC comparison	Baseline	
Benzo[a]pyrene	18 or 2 ppm	18 or 2 ppm	18 or 2 ppm
cPAH mixtures (TEQ)	18 or 2 ppm	18 or 2 ppm	18 or 2 ppm
*The cleanup level for the direct contact pathway is the first number. If the leaching pathway is a concern at the site, the cleanup level will be 2 ppm (based on the 3 phase model in WAC 173-340-747 using standard assumptions for soil above the water table.)			

Polychlorinated Biphenyl (PCB) Mixtures

- The proposed rule revisions will not affect PCB cleanup levels because cleanup proponents will not be required to use the Toxic Equivalency Factor (TEF) methodology when establishing cleanup levels for PCBs. Furthermore, evaluation of available PCB congener data from contaminated sites in Washington State indicates that using TEFs will not significantly change cleanup levels from the current method of using a slope factor from the EPA's IRIS database. Cleanup proponents will continue to have the option of using the current rule to establish soil cleanup levels for PCBs. Ecology expects that many cleanup proponents will continue to use Method A to establish cleanup levels. (Ecology is not proposing to revise the Method A cleanup levels.)
- Ecology also expects that ground water and surface water standards will continue to be based on applicable or relevant and appropriate requirements (ARARs). Ecology is not proposing to revise requirements established under other laws and regulations.

CHAPTER 4: Identification of Affected Cleanup Sites

4.1 Potentially Affected Industries[1]

Dioxin/Furan Mixtures

Currently 38 sites have dioxin soil contamination. They appear in multiple Standard Industry Classifications (SICs). The most common dioxin-contaminated sites are:

- Landfills (eight sites = 21%, SIC 4953)
- Wood preservation operations (five sites = 13%, SIC 2491)
- Pulp mills (four sites = 11%, SIC 2411)

The remaining sites include horticultural facilities, auto repair facilities, and mechanical and chemical manufacturers.

Carcinogenic PAH Mixtures

Currently 307 sites have cPAH soil contamination. These cPAH-contaminated sites occur in a more diverse set of SICs. The most common sites are:

- Landfills (32 sites = 10%, SIC 4953)
- Bulk oil facilities (Petroleum Bulk Stations and Terminals, 22 sites = 7%, SIC 5171)
- Scrap/salvage yards (Scrap and Waste Materials, 19 sites = 6%, SIC 5093)
- Auto repair (Motor Vehicle Parts, Used; 18 sites = 6%, SIC 5015; [General] Automotive Repair Shops, 18 sites = 6%, SIC 7531)
- Wood preservation operations (14 sites = 5%, SIC 2411) (Ecology, 2006)

Related facilities also populate the SIC list. They include:

- Air, Water, and Solid Waste Management
- Auto Repair
- Services and Parking
- Gasoline Service Stations
- Refuse Systems

The remaining sites contaminated with cPAH are distributed among manufacturers of ships and shipping industry materials, railroads, transportation, drycleaners, and chemical manufacturers.

PCB Mixtures

Currently 211 sites have PCB soil contamination. These PCB-contaminated sites are

[1] SIC codes listed in Appendix B.

most commonly:

- Disposal sites (Landfills, Refuse Systems, Recycle Operations, Hazardous Waste Disposal Sites; 39 sites = 18%, SIC 4953)
- Electric generation, transmission, or machinery sites (SIC categories 35, 36, and 49; 19 sites = 9%)
- Metal smelting, production, or forming locations (SIC categories 33 and 34; 18 sites = 9%)
- Scrap and Waste Materials sites (SIC 5093; 17 sites = 8%)
- Sawmills, pulp mills, and wood preserving sites (SIC categories 24 and 26; 13 sites = 6%)

The remaining sites in this category include locations with ship/boat-building, automotive maintenance, parts, and repair, petroleum product storage and delivery, transportation, and chemical manufacture.

Ecology's analysis in Chapter 3, determined that cleanup levels for PCBs do not change under the proposed rule. Therefore, Ecology found that none of the PCB-contaminated sites listed here will be affected by the proposed rule as it affects PCBs.

4.2 Expected Remediation Changes at Sites

While this section does not specifically address each industry listed as a contaminated site for dioxin or cPAH, Ecology expects the reasoning applied to these classes of sites to apply universally.

Dioxin and Furan Mixtures

Ecology expects the following impacts to remedial actions at the most common types of sites contaminated with dioxin and furan mixtures. Other sites not in these categories are expected to experience similar cost impacts.

- Wood Treatment Sites: Cleanup of wood treatment sites typically involves treatment or removal of contaminant "hotspots" and free product that has accumulated on the water table. It also typically involves consolidation and on-site containment of residual contamination. Ecology does not expect these remedial actions or the cost of these actions to change under the proposed rule.

- Landfills: Cleanup typically involves containment of the fill area by capping and/or ground water barriers. Ecology does not expect these remedial actions or the cost of these actions to change under the proposed rule.

- Pulp Mills: Cleanup typically consists of remediation of:
  - Pulp-mill sludge disposal areas.
  - Ash disposal areas.

- Air-deposition-contaminated soil: The papermaking process produces dioxin during the bleaching process. Dioxin remains in the "sludge" created as a byproduct of the process. This sludge contains paper fibers, and can be dewatered and burned. Smokestack emissions of dioxin eventually deposit on the surrounding soil. Burning of salt-water saturated bark that has been stripped from logs delivered to the mill in floating rafts also emits dioxin.

Ecology does not expect these remedial actions of sludge or ash disposal areas or the cost of these actions to change under the proposed rule.

Based on a review of actual site data and an air deposition model of smokestack emissions (see Chapter 4 and Appendices A and G), pulp mills may be required to remediate a somewhat larger area of soil in off property non-industrial areas contaminated by air deposition under the proposed rule than under the baseline. That portion of the pulp mills and nearby impacted area remaining in industrial land use may be required to remediate a smaller area of soil under the proposed rule.

Carcinogenic PAH Mixtures

Ecology expects the following impacts to remedial actions at the most common types of sites contaminated with carcinogenic PAH mixtures.

- Auto Repair and Related Trades: Auto repair and related trades sites tend to be small (1/4 acre or less). PAH contamination in auto repair comes from leaky hydraulic lifts and dumping of waste oil. Most of these sites establish cleanup levels using Method A, and based on this, Ecology expects future auto-repair sites to continue to use Method A. Since the proposed rule does not change Method A, most auto repair and related trades sites are not expected to incur additional remedial actions and costs under the proposed rule. In fact, there may be a small savings from the current rule due to the new TEFs resulting in slightly less stringent toxic equivalent concentrations.

  Sites not using Method A typically develop site-specific Total Petroleum Hydrocarbon (TPH) cleanup levels using petroleum fraction testing. At most of these sites, TPH cleanup levels—not cPAH—are expected to continue to drive cleanup levels, and thus additional remedial actions and costs are not expected under the proposed rule.

- Scrap and Salvage Yards: Salvage/scrap yards occupy larger areas of land but contamination typically occurs in the surface soils. PAH contamination for these sites comes from waste oil leaked on the ground from automobiles and poor housekeeping. Small sites in this category typically establish cleanup levels using Method A. Sites not using Method A typically develop site-specific TPH cleanup levels using petroleum fraction testing. Since cleanups at most of these sites are driven by TPH and metals—not cPAHs—Ecology does not expect additional remedial actions and cost to be incurred by these sites because of the proposed rule.

- Bulk Oil Facilities:

- Small: Small bulk oil facilities are expected to continue to use Method A cleanup levels. Since the proposed rule does not change Method A, most small bulk oil facilities are not expected to incur additional remedial actions and costs under the proposed rule. In fact, there may be a small savings from the current rule due to the new TEFs, resulting in slightly less stringent toxic equivalent concentrations.
- Large: These sites currently use Method B or Method C to determine cleanup levels for the mixture of petroleum products present at these sites (typically gasoline, diesel, and heavy fuel oil). Although cPAH cleanup levels change under the proposed rule for Method B, these petroleum products—not the cPAHs—typically drive the cleanup at these sites. Furthermore, many of these sites remain in industrial use after cleanup. As such, these sites are not expected to incur additional remedial actions under the proposed rule.

PCB Mixtures

To date, sites contaminated with PCB mixtures have used the Method A cleanup levels to establish the area needing remediation. Under the proposed rule amendments, most sites are expected to continue to use Method A cleanup levels. Since the proposed rule does not change Method A, and the use of Method B with TEFs is optional, PCB-contaminated sites are not expected to incur additional remedial actions and costs under the proposed rule.

4.3 Total Number of Sites Experiencing Change Under the Proposed Rule

Section 4.2 indicates the only type of site where cleanup could be affected by the proposed rule is the pulp and paper mill. There are currently fourteen operating or closed pulp and paper mill sites in Washington. They are:

- Abitibi, Steilacoom
- Boise White Paper, Wallula
- Georgia Pacific, Camas
- Georgia Pacific West, Bellingham
- Grays Harbor Paper, Hoquiam
- Kimberly-Clark, Everett
- Longview Fibre, Longview
- Nippon Paper Industries, Port Angeles
- Port Townsend Paper Company, Port Townsend
- Rayonier, Port Angeles
- Scott Paper, Anacortes
- Simpson Tacoma Kraft, Tacoma
- Sonoco, Sumner

- Weyerhaeuser, Longview

Of these facilities, Ecology's records(Ecology, 1998) indicate most have very small dioxin/furan air emissions. Only three identified to date as having confirmed or suspected dioxin/furan-contamination still needing additional investigation and potential remediation:

- Rayonier Port Angeles
- International Paper, Longview
- Scott Paper, Anacortes

This analysis assumes no new pulp mills could be affected by the proposed rule. There are two reasons for this assumption:

1. There are currently no known plans to build a new pulp and paper mill in Washington. In fact, the Weyerhaeuser mill in Cosmopolis closed in September 2006, indicating an over-capacity exists in pulp and paper production.
2. Changes in operational practices and new technology to control emissions have greatly reduced dioxin/furan emissions, so even if a plant does choose to build in Washington, Ecology does not expect it to undergo cleanup based on dioxin/furan contamination in the future. This is because of a change in EPA requirements that limited dioxin emissions into the air and water beginning in 2001.[2]

[2] *See:* 63 Fed. Reg. 18504-18751 (April 15, 1998) *and* 63 Fed. Reg. 42238-42240 (August 7, 1998). In response to the EPA requirements, pulp and paper mills now use chlorine dioxide (ClO_2) in the paper bleaching process instead of elemental chlorine or hypochlorite. Chlorine dioxide bleaching produces significantly less dioxin than previous technologies.

CHAPTER 5: Costs and Benefits of the Proposed Rule Relative to the Baseline

5.1 Expected Costs and Benefits of the Proposed Rule

Changes to the mandatory soil-contamination cleanup levels for dioxin/furan mixtures drive the expected cost impact of the proposed rule for pulp and paper mills (see Chapters 3 and 4 for affected-site analysis). The baseline calculates a cleanup level of 16 to 24 ppt. The proposed rule calculates a cleanup level of 11 ppt.

Moving from a cleanup level of 16 to 24 ppt to 11 ppt may result in increased remediation required by Ecology for pulp and paper-mill soil cleanup. Cleanup proponents may be required to undertake additional measures to comply with the proposed rule. In evaluating the effects of the proposed rule on cleanup proponents, Ecology considered four types of expenditures:

- Sampling expenditures associated with defining the nature and extent of soil contamination
- Expenditures associated with preparing Terrestrial Ecological Evaluations (TEE)
- Expenditures associated with evaluating multiple hazardous substances and multiple exposure pathways
- Site cleanup expenditures associated with measures to remove, treat, or cover contaminated soils with clean materials (e.g., soil or pavement)

In evaluating the effects of the rule on the populace, Ecology considered four types of values:

- Value of good health (i.e., avoidance of cancer, noncancer illness, mortality)
- Ecological value
- Public values
- Conceptual values that extend to populations outside of Washington state

Expected Costs and Benefits

Ecology expects the proposed rule to generate:

- Increased investigation and remediation costs
- Avoided compliance costs of Terrestrial Ecological Evaluation (TEE)
- Avoided costs of evaluating multiple hazardous substances and multiple exposure pathways
- Avoided cost of noncancer illness
- Avoided cancer mortality
- Avoided cancer morbidity

- Improved existence and bequest values for human health and low-cancer-risk environment

Costs do not include changes in applied ecological cleanup levels, because separate parts of the MTCA govern these and the proposed rule does not change them. Therefore, there is no increased cost imposed by this rule change. Because cleanup level calculation for ecological risk does not change under the proposed rule, Ecology concluded that there is no impact on cleanup or health at sites where cleanup is driven by ecological risk.

5.2 Changes in Cleanup Proponents' Compliance Expenditures

5.2.1 Additional Costs of Investigation and Remediation

Sampling Expenditures Associated with Defining the Extent of Soil Contamination

Cleanup proponents must characterize the nature and extent of contamination when preparing a Remedial Investigation (RI) report. The MTCA rule states that "…[t]he purpose of the remedial investigation is to collect data necessary to adequately characterize the site for the purpose of developing and evaluating cleanup alternatives…" Cleanup alternatives must protect human health and the environment.

In general, lower cleanup levels will require cleanup proponents to characterize larger areas of contamination. Consequently, the proposed rule revisions would tend to increase sampling costs relative to the baseline if the sole focus of the RI was to evaluate impacts on human health from dioxin and furan mixtures.

The actual impact of the proposed rule on sampling costs (if any) will depend on a wide range of site-specific factors such as the amount of covered surfaces in the potentially impacted area, whether other contaminants are driving sampling costs, and whether there are other sources of the contaminants in the area that need to be distinguished from site-related impacts.

Ecology believes the rule revisions may have minimal or no impact on RI sampling at most sites because:

- Site investigations typically characterize the full extent of impacts to non detect or background levels.
- Small differences in cleanup levels are unlikely to impact sampling requirements at sites where soil contamination was caused by spills and/or disposal of highly contaminated materials. Dioxins, furans, PAHs, and PCBs are highly immobile.
- Cleanup levels based on human cancer risk are not always the most stringent cleanup level. This is particularly true for contaminants that bioaccumulate in the food chain. For example, the ecological screening values for dioxins are similar to (slightly lower than) cleanup levels calculated based on human cancer risk. Ecology is not proposing changes to the requirements for ecological evaluations and cleanup levels based on ecological risks.

Pulp and paper mills—which Ecology determined are likely to be the only cleanup proponents affected by the proposed rule (see Chapter 4)—may, however, incur additional investigation costs due to the need to define a larger contaminated footprint in soil surrounding smokestacks. These costs may differ for each site depending on wind patterns and contaminant dispersal levels, however, Ecology has estimated below the likely additional acreage impacted at 1.65 acres. Sampling costs for this additional acreage are likely to be $11,550, based on typical costs of sampling and analysis and consultant time of $700 and ten samples taken per additional acre remediated.

Because this is a draft cost-benefit analysis, Ecology encourages those businesses most affected by the rule to provide comments on both Ecology's analysis of the costs imposed by this rule, and any additional data or cost analyses that will assist Ecology in preparing its final cost-benefit analysis.

Site Cleanup Expenditures Associated with Measures to Remove, Treat, or Cover Contaminated Soils with Clean Materials

Cleanup proponents are required to implement remedial measures to reduce threats to human health and the environment. In general, lower cleanup levels will require cleanup proponents to remediate larger areas of contamination. For pulp and paper mills—which Ecology determined are likely to be the only cleanup proponents affected by the proposed rule (see Chapter 4)—this means potentially incurring higher remediation costs due to a larger contaminated footprint in soil surrounding smokestacks.

Ecology expects a number of factors that play a part in determining actual remediation levels to reduce potential increases in pulp and paper-mill remediation activities:

- Cleanup requirements at many pulp and paper mill sites will continue to be driven by cleanup levels for other contaminants.
- Ecology does not expect that the proposed rule will result in meaningful differences in soil removal volumes at pulp and paper mill sites because (1) there is very little difference between cleanup levels under the two rulemaking options because one congener typically contributes a substantial amount of the TEQ for the whole mixture, and (2) it is difficult to make fine distinctions in soil contamination levels during removal (e.g., removal with a backhoe).
- Cleanup levels based on ecological risk will drive cleanup on some pulp and paper mill sites. If ecological cleanup levels drive remediation under both the baseline and proposed rule, Ecology expects no change in remediation.

Expenditures Associated with Distinguishing Site from Background Contamination

Sampling by the Department of Ecology in 1998 found the following concentrations of dioxin/furan mixtures in soils in Washington State. (1)

Land Use	Range of TEQ (ppt)	Mean TEQ (ppt)	Median TEQ (ppt)	Background TEQ (ppt)*
Forested Land	0.033 – 5.16	2.3	2.2	4.8
Open Areas	0.04 – 4.59	1.0	0.2	1.0
Urban Areas	0.133 – 19.5	4.1	1.7	7.7
Forested & Open	0.033 – 5.16	1.7	0.8	2.2
All Combined	0.033 – 19.5	2.8	1.2	3.9

*Upper 90% or 4X50%, whichever is less (WAC 173-340-709(3)(c)

(1) Screening Survey for Metals and Dioxins in Fertilizers, Soil Amendments, and Soils in Washington State, Ecology Publication #98-331, 1998.

Under MTCA the "natural background" level is defined by rule as concentrations consistently present in the environment not influence by localized human activity. Based on sampling done by Ecology (Ecology, 1999b), the natural background TEQ for dioxin mixtures in Washington soils is estimated at 2.2 ppt. This is the calculated background TEQ for sampling data combined from forested and open areas. MTCA does not require cleanup sites to perform remediation in excess of the natural background level of contamination. The proposed cleanup level is well in excess of this concentration and higher than typical urban background TEQ found in Washington State (7.7 ppt). Thus, extra expenses are not anticipated to distinguish site impacts from natural and area background concentrations.

Expected Remediation Ignoring Background Contamination

Ecology used a simple, four-step model to estimate the expected change in remediation costs associated with the proposed rule. See Figure 1 for a summary of the expected cost model.

Figure 1: Expected Remediation Model

Expected Remediation Model
Expected costs/site = ΔSV x TUC Where: ΔSV = Estimated change in soil volume cleaned up on a representative site (cubic yards) TUC = Cost of soil cleanup per unit ($/cubic yard)

Step 1: Cleanup Level Determination

Ecology determined the baseline and proposed cleanup levels for comparison. See Table 4 for a summary of cleanup levels. See Appendix A for an outline of the methodology used for this step.

Table 5: Soil Cleanup Levels for Typical Dioxin/Furan Mixture

Soil Cleanup Levels for Typical Dioxin/Furan Mixture			
	Past Practice: CLARC	Baseline	Proposed Rule

Cleanup Level (ppt)	6.7	16-24	11.0

Step 2: Change in Soil Volume

Ecology estimated the change in impacted soil area using an EPA-approved air deposition model for a hypothetical pulp and paper mill. See Appendix D for a description of the model methodology.

The simulation found that for soil contaminated with stack emissions, a site must clean 1.65 more acres at the median.[1] Based on a depth of six inches, and assuming 10% of the ground is covered by impervious surfaces, this translates to a volume of 1,200 cubic yards.

Note that this is a highly conservative value, given that 10 to 50% of soil at the periphery of existing pulp and paper mills in developed areas are likely to be covered by existing buildings, roads, and other structures. In addition, this estimate does not take into account the potential reduction in industrial properties needing remediation. Taking these factors into account, Ecology believes that the actual change in remediated soil volume will be considerably smaller than the above estimate.

Step 3: Unit Cost of Soil Remediation

Ecology calculated an expected price of remediation based on selected remedial options for dioxin/furan. See Appendix C for a summary of the unit cost calculations.

Ecology used a weighted average of remedial options based on primary excavation of soil, with additional capping measures. Per cubic yard, this weighted average remedy costs $124 per cubic yard.

To incorporate the most conservative—yet not as likely—unit cost, Ecology also used the highest per unit remedial cost to calculate an upper bound for remedial costs. This upper-bound remedy (complete excavation and disposal) costs $176 per cubic yard. To incorporate the lowest-cost alternative remediation, Ecology also developed a lower-bound value for cleanup per cubic yard. The lower-bound remedy (in-situ capping with wood chip surface) costs $38 per cubic yard.

Step 4: Total Expected Cost Estimate

The total per-site expected cost of the proposed rule equals the product of the unit cost of remediation and the increased volume of soil removed under the proposed rule.

Per-Site Result:

Ecology expects remediation under the proposed rule to cost $148,800 more per-site, at the weighted average unit cost. Depending on the remedial method chosen, this

[1] Assumes contamination has been mixed over a 3-inch depth of surface soil by natural or human influence: 0.9 more acres at the 25th percentile, and 3.49 more acres at the 75th percentile.

cost can fall in the range of $45,600 to $302,400 more per-site than the baseline.

In some cases, cleanup levels for ecological health may be lower (more stringent) than cleanup levels driven by human health concerns (cancer risk). The proposed rule does not change calculation of ecological cleanup levels, so Ecology concluded that for any site on which ecological cleanup levels are lower (more stringent) than human health driven cleanup levels, there will be no change in remediation. On sites where the ecological health risk drives cleanup, the per-site cost will be zero since the ecological based cleanup levels are not changing.

Ecology did not determine the cost impact of ecological vs. human health driven cleanup levels, because Ecology expects this to be site-specific. It is likely, however, that human health- based cleanup levels will drive cleanup only at some pulp mill sites; ecological risk will drive cleanup levels at other sites. This effect further mitigates the per-site remediation cost calculated above.

Note that this estimated remediation cost is a highly conservative value, given that in urbanized areas where cleanup is likely to be driven by human health risk (instead of ecological risk), larger areas are likely to be covered by existing buildings, roads, and other structures. In addition, industrial properties would need to cleanup less area, offsetting this increased area. Considering these factors, Ecology believes that the actual increase in remediation cost will be considerably smaller than the above estimate.

These additional costs of investigation and remediation outlined above are likely to be mitigated by the compliance costs that will now be avoided under the proposed rule, as outlined below.

5.2.2 Mitigating Factors that Reduce Additional Costs

Expenditures Associated with Terrestrial Ecological Evaluations (TEEs)

Ecology expects that any additional costs of investigation and remediation outlined above will be mitigated by certain avoided compliance costs, which are likely benefits of the proposed rule.

Cleanup proponents must evaluate the impacts of contamination on ecological receptors. In many cases, cleanup proponents must prepare a Terrestrial Ecological Evaluation (TEE). In general, lower cleanup levels based on human health protection will reduce the need for preparing a TEE. Consequently, the proposed revisions will tend to reduce the likelihood that a cleanup proponent will incur TEE costs, as compared to the baseline.

The proposed rule does not change calculations for ecological cleanup standards. Therefore, sites on which cleanup is driven by ecological standards under the baseline will not be affected by the proposed rule, and there will be no change in the ultimate level of remediation.

The proposed rule alters the likelihood that cleanup proponent will need to perform an ecological risk evaluation (see Appendix G). Compared to the baseline, where the cleanup level decreases (becomes more stringent) under the proposed rule, this will make dioxin/furan concentrations that are acceptable for human health risk less likely to exceed screening levels for ecological risk.

If concentrations are less likely to exceed screening levels, Ecology is less likely to require an evaluation of ecological risks on the site. WAC 173-340-7493(1)(d) states that Ecology may determine that a site-specific TEE is not necessary because "…the cleanup action plans developed for the protection of human health will eliminate exposure pathways of concern to all of the soil contaminants…" The proposed rule will result in lower (more stringent) cleanup levels for human health protection than those established under the baseline. Consequently, Ecology expects that the proposed rule will reduce (to an uncertain degree) the need to perform site-specific TEEs.

Expenditures Associated with Evaluating Multiple Hazardous Substances and Multiple Exposure Pathways

The MTCA rule specifies that total site cancer risk cannot exceed one-in-one hundred thousand (10^{-5}), and total noncancer site risk cannot exceed a hazard index of one. The MTCA rule requires that cleanup levels established for individual substances be adjusted downward if the total site risk (taking into account multiple hazardous substances and multiple pathways of exposure) exceeds these limits.

Under the baseline, total site risk adjustments will need to be made at nearly every site given the number of dioxin and furan congeners (19) and the likelihood of multiple exposure pathways at some site, resulting in the total risk exceeding 10-5. This is not a straight-forward process and can be quite confusing to the public. The proposed rule reduces the need to evaluate such adjustments because cleanup levels for the mixture are set using a cancer risk level of one-in-one million (10^{-6}) and a hazard quotient of one.

Cost Savings on Industrial (Method C) Sites

In addition, this analysis does not directly consider the reduced costs of higher cleanup levels for industrial properties. Depending on the extent of industrial properties impacted by the site, these reduced costs could potentially offset any increased cleanup costs in other non-industrial areas. Note that this change does not affect the level of human health cancer risk that would be applied to industrial properties (10^{-5}), so there would be no impact to cancer mortality or incidence.

5.2.3 Summary of Quantifiable Costs of the Proposed Rule

As outlined above, the proposed rule will likely result in $160,000 of increased cost for pulp and paper mills, from additional investigation and remediation costs. These costs are likely to be mitigated to some degree by the benefit of avoided compliance costs, avoided analysis of multiple hazardous substances, and cost savings in remediation of industrial

sites. Ecology consequently estimates that the proposed rule will result in an additional net, quantifiable cost for remediation and investigation at pulp and paper mills of $160 thousand. These represent the quantifiable costs of compliance on industry.

5.3 Changes to Population and Ecological Health

Ecology identified several potential impacts of the proposed rule on health and social values. Ecology expects increased remediation (if any) of contaminated soils to create the following types of benefits:

- Reduced risks to human health (cancer mortality and incidence, and noncancer health effects)
- Reduced ecological risks to plants and wildlife
- Improved existence and bequest values for health and the environment

Ecology has not prepared quantitative estimates for the benefits associated with reducing exposure to dioxin mixtures. Ecology believes that there are many sources of uncertainty and variability that prevent the Department from preparing meaningful quantitative estimates. These sources of uncertainty and variability are summarized in the subsection by that title. However, Ecology places great weight on the qualitative, unquantifiable benefits from the proposed rule. Ecology feels the risks posed by dioxin and furan contamination in particular, and the associated costs of related impacts on human health and the environment, outweigh the quantifiable costs to industry from compliance with the proposed rule.

Reduced Risks to Human Health

Ecology expects that the proposed rule changes will reduce dioxin exposures and health effects relative to the current rule. Children and adults are exposed when they come into contact with dioxin-contaminated soils at home, schools, parks and/or the workplace. Several authoritative scientific and regulatory bodies[2] have evaluated the wide range of toxic effects of dioxins and furans. This information is briefly summarized in two subsections (Cancer Mortality and Incidence and Non-Cancer Health Effects).

Ecology recognizes that the proposed rule will result in relatively small changes in exposure when compared with the current rule requirements. However, areas surrounding pulp and paper mills are sometimes residential, and given the higher likelihood of exposure to the general public in such areas, Ecology expects that even small reductions in exposure will produce some level of health benefits, in the form of both reduced cancer risk and reduced noncancer health effects (see Concerns About Environmental Exposures). Such health benefits will produce related but difficult-to-quantify benefits to

[2] World Health Organization (1989); International Agency for Research on Cancer (IARC, 1997); Agency for Toxic Substances and Disease Register (ATSDR, 1999); Environmental Protection Agency (2003): California Environmental Protection Agency/Office of Environmental Health Hazard Assessment (OEHHA, 2005); and the National Research Council (2006).

society in the form of decreased health costs, increased work productivity, and increased quality of life.[3]

- **Cancer Mortality and Incidence:**

  Numerous scientific organizations have concluded that 2,3,7,8 TCDD[4] is a carcinogen. The International Agency for Research on Cancer (IARC) has classified 2,3,7,8-TCDD as "probably carcinogenic to humans" based on limited evidence in humans, sufficient evidence in animals and extensive mechanistic information that indicates TCDD acts through a mechanism involving the aryl hydrocarbon receptor (AhR). The National Toxicology Program (2004) has classified TCDD has "known to be a human carcinogen". EPA (1985) has classified TCDD and hexachlorodibenzodioxin as "probable human carcinogens". In 2004, EPA classified TCDD as "carcinogenic to humans".[5]

  Ecology uses a health protective approach to evaluate health benefits. Specifically, Ecology has assumed that there is some level of risk at any level of exposure. This is consistent with the intent of the Model Toxics Control Act and the default assumptions specified in the MTCA Cleanup Regulation[6] and the 2005 EPA Cancer Guidelines[7].

  Ecology expects the proposed rule to reduce cancer risk in affected areas.

- **Non-Cancer Health Effects**:

  Exposure to dioxins/furans have been shown to increase the risks of developing a wide range of non-cancer health problems including hepatic, immunological, dermal, endocrine effects, neurological effects and reproductive and development effects:

  - Impaired Immune Systems: EPA (2003) reviewed a number of studies that show that DLCs suppress the immune system. The National Research Council (2006) reviewed EPA's evaluation and stated "…the committee agrees with EPA's

[3] Although some regulators may evaluate the health benefits of a proposed rule by attempting to place a market value on the amount of money people would be willing to trade for an associated reductioin of risk to life and death, Ecology does not feel that a "willingness to pay" approach is appropriate in this context, and that such an approach fails to capture personal losses from health impacts, which are difficult to place a dollar value on.

[4] All 2,3,7,8-substituted PCDDs/PCDFs and coplanar PCBs are believed to act through a common toxicological mechanism. This forms the basis for the TEF approach.

[5] The National Research Council (NRC, 2006) was split on the question of carcinogen classification. Some members of the review panel agreed with EPA's classification decision. Other members recommended that EPA consider classifying DLC mixtures (as opposed to TCDD only) as "likely to be carcinogenic to humans."

[6] The MTCA rule specifies that "… [t]he linearized multistage extrapolation model shall be used to estimate the slope of the dose-response curve unless the department determines that there is clear and convincing scientific data which demonstrates that the use of an alternate extrapolation model is more appropriate…" (WAC 173-340-708(8)(c)(i)(B)). The multistage model predicts a linear dose response at low doses.

[7] EPA (2005) states that "…[i]n the absence of sufficiently, scientifically justifiable mode of action information, EPA generally takes public health-protective, default positions regarding the interpretation of toxicologic and epidemiologic data: animal tumor findings are judged to be relevant to humans, and cancer risks are assumed to conform with low dose linearity." (pp. 1-10 & 1-11)

conclusion that these compounds are probably human immunotoxicants…" However, the NRC also discussed a number of uncertainties associated with extrapolating results from animal studies to the human populations.

- Endocrine Effects: EPA (2003) reviewed a number of studies showing that dioxins impair thyroid function and increased risk of developing Type II diabetes. Several studies of nursing infants suggest ingestion of breast milk with a higher dioxin concentration may alter thyroid function.

  The link to Type II diabetes rests on reduced glucose tolerance. Dioxin-like compounds have been linked to Type II diabetes. Exposure has been shown to decrease glucose tolerance as with Type II, "adult onset" diabetes. There is evidence of altered glucose transport in the blood and alterations to the insulin-signaling pathway in the body.

  While the overall causal relationship underlying the development of Type II Diabetes has not yet been established, Ecology expects some benefit of avoided Diabetes to arise under the proposed rule. The annual cost of this disease to men is $1,880, and is $2,323 for women in medical expenditures (Brandle, et al., 2004). Washington Department of Health (DOH) statistics indicate 90% of diabetics have Type II diabetes (Washington DOH, 2004).

  Ecology expects the total value of avoided immune and diabetes effects under the proposed rule to be large, and to include the costs of not only treating diabetes itself, but also to long-term complications of the disease affecting vision, nerves, kidney function, and sexual function, plus medical and psychological costs of possible amputation (National Institutes of Health, 2007).

- Reproductive Toxicity**:** EPA (2003) reviewed several studies indicating that dioxin mixtures have shown to cause decreased fertility in women, inability to maintain pregnancy for the full gestational period, ovarian dysfunction, and suppression of the estrous cycle. This is associated with disruption in levels of reproductive hormones, testosterone, lutenizing hormone (LH), and follicle-stimulating hormone (FSH).

  Women exposed to DLCs during childhood also exhibit alterations in menstrual duration and flow. Men exposed to DLCs exhibit reproductive alterations and reduced fertility, as well as low testosterone levels. Primate trials also indicate increased incidence and severity of endometriosis, which is considered an endocrine disorder that generates immune system alterations and affects estrogen homeostasis.

  Ecology estimated a minimum value of maternity or carrying a child to term as a parent or couple's willingness to pay to employ a surrogate mother, compensate for donated ova, or pay for fertility treatments.

In 2006 dollars, contracts for surrogate mothers pay between $13,730 and $16,480 (Hewiton, 1994). Egg donors are paid between $2,060 and $4,120 per cycle (Steinbock, 2004). Egg compensation only accounts for the fertility aspect of total value, however, excluding the value assigned to childbearing and childrearing.

Ecology expects the total value of successful childbearing to be large and to include costs to compensate for impacts of dioxin mixtures to reproduction, life stage, childrearing, and reduced risk to the mother during pregnancy.

- Developmental Toxicity**:** EPA (2003) reviewed a number of studies that indicate dioxins cause a wide range of developmental effects in animals. These include: (1) reduced viability; (2) structural malformations (e.g. cleft palate formation); (3) reduced growth; and functional alterations (e.g. effects on male and female reproductive systems and learning behavior.

  Changes to the development of the reproductive system can result from a single, low level of exposure, indicating long-term exposure may not be necessary to generate a developmental impact. Children born with developmental impairments can experience reduced intelligence quotient (IQ), behavioral and socialization disorders, and learning impairments.

  The economic literature pertaining to developmental dysfunction associates the loss of one IQ point with an average loss of $15,080 (2006 dollars) of lifetime income (Grosse, et al., 2002). However, there is insufficient information to quantify the relationship between dioxin exposure and developmental delay and loss of IQ. In particular, although there is a relationship between thyroid dysfunction and fetal development, the relationship between dioxin exposure and thyroid impacts currently cannot be quantified.

- **Concerns About Environmental Exposures**:

  Ecology uses a health protective approach when evaluating environmental exposures. With respect to carcinogenic effects, Ecology assumes that there is some level of cancer risk at any level of soil-related dioxin exposure. This is consistent with the intent of the Model Toxics Control Act and the default assumptions specified in the MTCA Cleanup Regulation[8], the 2005 EPA Cancer Guidelines[9]. It is also consistent with the wide range of scientific reviews and policies established over the last several decades.

[8] The MTCA rule specifies "…[t]he linearized multistage extrapolation model shall be used to estimate the slope of the dose-response curve unless the department determines that there is clear and convincing scientific data which demonstrates that the use of an alternate extrapolation model is more appropriate…" (WAC 173-340-708(8)(c)(i)(B)). The multistage model predicts a linear dose response at low doses.

[9] EPA (2005) states that "…[i]n the absence of sufficiently, scientifically justifiable mode of action information, EPA generally takes public health-protective, default positions regarding the interpretation of toxicologic and epidemiologic data: animal tumor findings are judged to be relevant to humans, and cancer risks are assumed to conform with low dose linearity." (pp. 1-10 & 1-11)

Traditional methods for evaluating non-cancer health are based on identifying exposure thresholds below which no adverse effects are expected to occur. However, Ecology also believes it is appropriate to assume there is some level of non-cancer risk at any level of soil-related dioxin exposure for the following reasons:

- Background Dioxin Exposures: The evaluation of soil-related dioxin exposure must take into account background exposures and existing body burdens. As noted below, EPA has elected not to establish a reference dose for dioxin based on the conclusion that any reference dose calculated using current data and methods would be 2-3 orders of magnitude below current background intakes and body burdens. Given that background exposures exceed a health-based threshold, additional soil exposure would presumably pose some level of health risk.

- Background Incidence of Non-Cancer Health Effects: One of the arguments for using a linear low-dose risk extrapolation approach for cancer risks is that the chemical effects are being added to an existing disease process. Clewell and Crump (2005) have concluded that similar arguments can be made with respect to the background incidence of non-cancer toxicities. They noted that there are several types of non-cancer effects with an existing background incidence in the general population (e.g. cardiovascular events, pulmonary insufficiency, male reproductive deficits, and developmental defects).

- Population vs. Individual Thresholds for Health Effects: Ecology believes that, even if thresholds for non-cancer effects can be shown for individuals, such thresholds are unlikely to apply to whole populations because (1) individual variations in human susceptibility and (2) the potential for additive, synergistic and antagonistic interactions with other chemicals and lifestyle factors.

- **Sources of Uncertainty and Variability**:

  Ecology has not prepared quantitative estimates for the health benefits associated with reducing exposure to dioxin mixtures. Ecology believes there are many sources of uncertainty and variability that prevent the Department from preparing meaningful quantitative estimates, as outlined below. In addition, any quantification of the direct health benefits associated with reducing exposure to dioxin mixtures would still fail to capture the associated costs avoided to both individuals and society from health impacts.

  Key sources of uncertainty and variability include:

  - Uncertainties and Variability in Dose-Response Relationships:

    - Cancer: EPA has developed oral cancer slope factors for 2,3,7,8 TCDD (156,000 $(mg/kg/day)^{-1}$) and hexachlorodibenzo-p-dioxin (6,200 $(mg/kg/day)^{-1}$). These slope factors were calculated using a linear non-threshold model. However, these calculations require a number of assumptions and the resulting estimates have a high degree of uncertainty. For example, EPA (2003) has evaluated available studies and calculated cancer slope factors that

range from 570,000 to 5,100,000 $(mg/kg/day)^{-1}$, with a recommended value of 1,000,000. Paustenbach et al. (2006) reported values ranging from 9,600 to 1,000,000 $(mg/kg/day)^{-1}$.

- Non-Cancer Health Effects: EPA has elected not to establish a reference dose for dioxin based on the conclusion that any reference dose calculated using current data and methods would be 2-3 orders of magnitude below current background intakes and body burdens. The ATSDR (2004a) has established a Minimal Risk Levels[10] for 2,3,7,8-TCDD (chronic MRL = 1 pg/kg/day). These calculations require a number of assumptions and estimates have a high degree of uncertainty. For example, Paustenbach et al. (2006) found that reference doses (or equivalent non-cancer toxicity measures) developed by federal and international organizations ranged from 0.013 to 100 pg/kg/day. EPA (2003) evaluated available studies and calculated benchmark doses that range over several orders of magnitude.

- Toxic Equivalency Factors: There are number of uncertainties associated with the use of the TEF approach (Finley et al. 2003; OEHHA, 2003; EPA 2003; NRC, 2006). The current TEF values have been developed using many sources of experimental data. For many congeners, TEF values can vary by several orders of magnitude depending on the health endpoint and test species.

- Variability and Uncertainty in Human Susceptibility to Dioxin Exposure: *Human variation* refers to person-to-person differences in biological susceptibility or in exposure. Susceptibility to carcinogens can vary greatly among individual humans due to genetic, life stage and environmental factors.

  Genetic Variations in Human Susceptibility: The human population is genetically heterogeneous and genetic variations may make people more or less prone to the effects of hazardous substances. For example, studies have shown that there are large (100 times or more) genetic differences in the metabolism of hazardous substances. The ability or inability to induce enzymes in the body responsible for activating or metabolizing chemicals is in part, a function of an individual's genetic makeup. Halogenated aromatic hydrocarbons, the prototype being 2,3,7,8-TCDD, induce a diverse spectrum of chemical activating and metabolizing enzymes. The variability in enzyme induction and biological responses is typical for halogenated aromatic hydrocarbons that interact with the AhR receptor (2,3,7,8-TCDD) resulting in tissue- / species-specific responsiveness or non-responsiveness (Naz, RK., 1999).

  - Life Stage Variations in Human Susceptibility: In general, the young and elderly are more susceptible to the adverse effects of hazardous substances. Children are more susceptible to hazardous substances than the general population because their organ systems are still developing and dividing cells

[10] When calculating MRLs, ATSDR uses methods similar to the EPA methods for calculating reference doses.

are more easily harmed than mature cells[11]. Children also consume more food per body weight than do adults while consuming fewer types of foods, i.e., have a more limited diet. In addition, children engage in crawling and mouthing (i.e., putting hands and objects in the mouth) behaviors, which can increase their exposures. Pregnancy may also result in changes in absorption, distribution, and metabolism of hazardous substances. These changes can alter a woman's sensitivity to the adverse effects of hazardous substances. Women may also have exposures that differ from the general population. Exposure to pregnant women may result in exposure to the developing fetus. The elderly and disabled may have important differences in their exposures due to a more sedentary lifestyle. In addition, the health status of this group may affect their susceptibility to the detrimental effects of hazardous substances exposure.

For example, ATSDR reviewed available literature regarding the susceptibility of children to chlorinated dibenzo-p-dioxins, dioxins (ATSDR, 1998). Most of the available information involves children living in Seveso, Italy, during the accidental release of airborne trichlorophenol contaminated with 2378-TCDD. Documented effects in children from airborne exposures of trichlorophenol contaminated with 2378-TCDD included chloracne, erythema and edema, peripheral nervous system effects, and potentially increased risks of Hodgkin's lymphoma, myeloid leukemia, and thyroid cancer were reported among children between 0-19 years old at the time of the Seveso accident.

- Interactions with Other Chemical Exposures: Cancer is a multi-stage process with a number of factors contributing the process at different stages. Exposure to other chemicals may increase or decrease an individual's sensitivity to dioxin exposures. Concurrent chemical exposures may result from exposure to other environmental contaminants, therapeutic drugs, and/or diet. There is very little information on the interactions between dioxin and other chemicals. However, the adverse biological effects associated with exposure to dioxin are mediated by the interaction of the chemical with the AhR receptor. Other halogenated aromatic compounds (co-planar PCBs, polynuclear aromatic hydrocarbons) interact with the AhR receptor and are associated with a similar spectrum of effects. When exposures occur to these complex environmental mixtures of halogenated aromatic hydrocarbons, binding with the AhR receptor may occur--which may exhibit a range of adverse effects (ATSDR, 1998).

[11] Ginsberg (2003) concluded that the cancer risk attributable to early-life exposure can be about 10-fold higher than the risk from an exposure of similar duration occurring later in life (Ginsberg, 2003) EPA (2005b) identified a number of factors that contribute to variations in child susceptibility to hazardous substances: (1) differences in the capacity to metabolize and clear chemicals can result in larger or smaller internal doses of the active agent(s); (2) more frequent cell division during development can result in enhanced expression of mutations due to the reduced time available for repair of DNA lesions; (3) some embryonic cells, such as brain cells, lack key DNA repair enzymes; (4) more frequent cell division during development can result in clonal expansion of cells with mutations from prior unrepaired DNA damage; (5) some components of the immune system are not fully functional during development; and (6) hormonal systems operate at different levels during different life stages.

- Uncertainties on the Current and Future Exposed Populations: Health benefit calculations require information and/or assumptions on exposed populations (including susceptible population groups such as children and women of childbearing age). Ecology has limited sampling data to support identification of contaminated areas. If that information was available, Ecology could use census data to prepare estimates of currently exposed populations. However, current exposures based on current land uses may be significantly different than exposure scenarios associated with future land uses. This is because under the Growth Management Act, the intent is to concentrate development within urban growth areas. Over time, this will likely significantly increase the potentially impacted population in areas impacted by air emissions from pulp and paper mill facilities.

- Uncertainties and Variability on Economic Values for Health Benefits: The value of statistical life (VSL) is generally the basis of an economic value of life. A statistical life is the extrapolated value of a person to society, though not of any particular person. The extensive VSL literature estimates a broad set of values between $100 thousand and $25 million per statistical life.

Reduced Risks to Plants and Wildlife

Numerous studies have estimated the public's willingness to pay for wildlife preservation—especially for threatened and endangered species. The household average willingness to pay for species conservation varies by the name recognition of the animal. The average value for less-recognizable species is in the $1-13/household per year, while values for the spotted owl range from $57/household per year to $123/household per year (Loomis and White, 1996).

Because of the limited geographic area impacted by dioxins, the proposed rule should not affect statewide endangered or threatened species status. However, it will help to maintain plant and animal populations in impacted areas since addressing human health concerns will also likely address contamination potentially toxic to plants and animals in these areas. In addition, Protection of local populations could play a role in a species' overall survival.

This benefit is uncertain and difficult to quantify. This benefit is mentioned as one potential qualitative benefit of the proposed rule, but is not emphasized by Ecology in the analysis to the same degree that human health benefits are emphasized above.

Existence Value

Both Washington residents and others outside of the state value human and wildlife health, and less ecological damage, without using the environment directly or indirectly.[12] This is commonly referred to as existence value.

[12] Individuals express concern over national and international events that affect human and wildlife health. Examples of this concern range from oil spills' effect on animals to the impact of toxic chemical exposure on distant communities. Many organizations exist that support improved conditions for humans and wildlife across the globe.

Ecology expects the proposed rule to generate a benefit by partially avoiding reduction in existence value that would occur under the baseline's higher (less stringent) cleanup levels.

Again, it is difficult if not impossible to put a dollar value on such a benefit. This benefit is mentioned as one potential qualitative benefit of the proposed rule, but is not emphasized by Ecology in the analysis to the same degree that human health benefits are emphasized above.

Bequest Value

Bequest value assigns worth to human health, the environment, and wildlife (and their quality and maintenance) for the values they might give in the future. This is a form of option value—when people value retaining a resource to maintain the option of using it themselves or by future generations.

Ecology expects the proposed rule to generate a benefit by partially avoiding reduction in bequest value that would occur under the baseline's higher (less stringent) cleanup levels.

Like existence value, bequest value may comprise a part of values associated above with health and the environment, but it is distinct in that it excludes use by the individual in the present.

This benefit is also mentioned as one potential qualitative benefit of the proposed rule, but is not emphasized by Ecology in the analysis to the same degree that human health benefits are emphasized above.

5.4 Summary

Over the baseline, Ecology expects the proposed rule to generate, for each affected site:

Potential costs of $160 thousand in increased investigation and remediation, if any, at affected sites. The only sites likely to be affected are pulp and paper mill sites with aerial deposition of dioxin and furan contamination. These costs are likely to be mitigated by avoided compliance costs (benefits) from the proposed rule as listed below under qualitative benefits.

Potential qualitative benefits in the form of:

- Avoided human health impacts and related personal and societal benefits that stem from improved health
- Avoided terrestrial ecological evaluation (TEE)
- Avoided evaluation of multiple hazardous substances
- Avoided investigation and remediation of industrial (Method C) sites
- Reduced risks to plant and wildlife

- Improved existence and bequest values for health and the environment

Note that lower (more stringent) ecological cleanup levels on some sites may mitigate these costs and benefits entirely. For sites at which ecological health risk drives cleanup, Ecology expects zero cost and zero benefit associated with changes in the amount of remediation performed. This is because the proposed rule does not alter cleanup levels based on ecological risks.

CHAPTER 6: Comments and Conclusions

6.1 Introduction

As discussed in Chapter 1, the Washington Administrative Procedure Act (RCW 34.05.328) requires Ecology to evaluate significant legislative rules to "[d]etermine that the probable benefits of the rule are greater than its probable costs, taking into account both the qualitative and quantitative benefits and costs and the specific directives of the statute being implemented."

Although there may be little or no increased compliance costs with the proposed rule, Ecology has conservatively assumed such costs would be incurred and quantified those costs for those sites that could be affected. In evaluating costs and benefits, Ecology has emphasized qualitative benefits of the proposed rule. Ecology has chosen to err on the side of conservatism under the proposed rule, based on the agency's current understanding of the risks posed by dioxin and furan contamination on human health, in particular. Ecology considers the qualitative benefits to individual health and society to consequently outweigh the quantifiable costs to industry from compliance with the proposed rule.

Based on the results of this economic analysis then, Ecology concludes the net benefits of the proposed rule—when considering both the quantitative and qualitative costs and benefits, as well as the uncertainty involved—outweigh the net costs.

6.2 Comments on Estimated Costs

Ecological Cleanup Levels

Note that costs may be mitigated by the lower (more stringent) ecological cleanup levels on some sites. For sites at which ecological health risk drives cleanup, Ecology expects zero cost and zero benefit associated with changes in the amount of remediation performed. This is because the proposed rule does not alter cleanup calculations based on ecological risks.

Conservative Estimates

- For likely costs, Ecology employed conservative estimates. This means that the estimates are probably higher than are likely to occur. Factors that will result in lower per site costs include a higher percentage of impervious surfaces than assumed (10%)

- Industrial properties are required to cleanup to less stringent cleanup levels, potentially offsetting increased remediation costs in other non-industrial areas

In addition, Ecology's estimation of costs assumed that all costs will be incurred immediately. It is more likely that sites will:

- Expend remediation funds over time as the cleanup process progresses
- Not begin cleanup immediately in 2007

These factors reduce the present value of both costs and benefits, in terms of 2006 dollars. The extent of the present value reduction depends on the timing and length of time of actual site remediation.

Uncertainty in the Cost Model

Four primary factors affect the actual costs and benefits that will be experienced by cleanup proponents under the proposed rule:

- The composition of the dioxin mixture at the site
- The actual cleanup level determined for the site, as based on excess cancer risk, noncancer human-health risks, and ecological risk
- The choice of remedial method(s) employed at the site
- The actual volume of additional soil needing remediation

The Composition of the Dioxin Mixture at the Site

The difference in cleanup levels between the proposal and the baseline depends on the actual composition of the dioxin mixture at the site. Ecology has examined several data sets from dioxin-contaminated sites in Washington State to determine this difference. The differences are summarized in Tables 6 and 7 below.

Table 6: Comparison of Method B Cleanup Levels for Dioxin

Comparison of Method B Soil Cleanup Levels* for Dioxin/Furan Mixtures			
Contaminants	Current MTCA Rule		Proposed Amendment
	CLARC comparison	Baseline	
2,3,7,8 TCDD	6.7 ppt	6.7 ppt	11 ppt
Dioxin/Furan Mixtures (TEQ)	6.7 ppt	16 – 24 ppt**	11 ppt***
*Assumes direct contact (via soil ingestion) is the controlling exposure pathway. **Based on median cleanup level at dioxin/furan contaminated sites in Washington State *** Based on a gastrointestinal absorption fraction (bioavailability) of 0.6. .			

Table 7: Comparison of Method C Soil Cleanup Levels for Dioxin

Comparison of Method C Soil Cleanup Levels* for Dioxin Mixtures			
Contaminants	Current MTCA Rule		Proposed Amendment
	CLARC comparison	Baseline	
2,3,7,8 TCDD	875 ppt	875 ppt	1460 ppt
Dioxin/Furan Mixtures (TEQ)	875 ppt	875 ppt	1460 ppt**
*Assumes direct contact (via soil ingestion) is the controlling exposure pathway. ** Based on a gastrointestinal absorption fraction (bioavailability) of 0.6.			

Actual Established Cleanup Level

The area needing remediation necessary on a site is based on the cleanup level . The proposed rule alters the calculation of cleanup levels based on excess cancer risk posed by contaminated soil. While this is one factor that is considered in determining an ultimate cleanup level on a site, it is not the only factor.

If ecological-risk screening levels are low, an ecological risk analysis may determine an even lower (more stringent) cleanup level is necessary. In this case, the ecological cleanup level may drive the site cleanup. Alternatively, the cancer-risk-based cleanup level may be below the ecological screening level, and the cancer-risk-based cleanup level will drive the site cleanup. Appendix G examines particular scenarios of relative cleanup levels under the baseline, the proposed rule, and ecological screening levels.

Because ecological screening levels and actual cleanup levels under the baseline and proposed rule are highly dependent on the mix of congeners on the site, the factor of actual established cleanup level adds a large degree of uncertainty to this analysis. One site may experience no change because its cleanup is driven by ecological cleanup levels, while Ecology may require another site to perform additional remediation.

What is more, if Ecology or the EPA develops a reference dose for the noncancer human-health effects of dioxin/furan during the life of the proposed rule, this may result in cleanups being driven by noncancer risk, rather than carcinogenic risk.

Choice of Remedial Method(s)

As this analysis indicates in Appendix C, there are many combinations of remedial methods available to cleanup proponents, and the overall unit cost of remediation can vary considerably. The actual cost of remediation is highly dependent on whether a cleanup proponent excavates and disposes of all contaminated soil, caps the contaminated soil in a number of ways, or uses a combination of some (or all) of the available methods.

Ecology estimated expected total cost of remediation based on a weighted average of remedial methods, and estimated a range of total cost based on the highest and lowest values per unit that would achieve the level of cleanup necessary and allow former pulp and paper mill sites to be redeveloped. The estimated range should encompass all possible weighted unit costs, but the actual cost experienced by cleanup proponents will vary with site characteristics and business decisions of the cleanup proponent.

Actual Remediated Soil Volume

In calculating the expected change in remediation cost under the proposed rule, Ecology used the median change in the volume of soil requiring remediation base on the distribution of results of an air deposition model (see Appendix D for methodology). The median change was used to represent the most likely change in soil volume.[1]

[1] Given the number of underlying variables and parameters in the air deposition model, Ecology decided not to assume a particular functional form for the distribution of change in soil volume.

The actual change in soil volume, however, will likely fall within a range (see footnote, page 23). The distribution of changes in soil volume is skewed so that smaller changes are more likely, so the estimated change in remediated soil volume is likely to be smaller than the median.

6.3 Comments on Estimated Benefits

Ecology chose not to quantify the health and ecological benefits of the proposed rule due to uncertainty and variability that would have prevented Ecology from developing meaningful estimates of these benefits. Chapter 5 provides an extensive discussion of this uncertainty, and includes reduced costs associated with Terrestrial Ecological Evaluation (TEE), multiple hazardous substance and multiple exposure pathway adjustments, noncancer and cancer health in humans, and environmental health.

Based on qualitative assessments, however, Ecology believes that the likely benefits of the proposed rule may be quite large. Ecology made this determination based, in part, on a protective approach toward being conservative in the face of uncertainty regarding health and environmental effects.

In particular, the value of avoided cancer mortality and incidence includes the values of avoided:

- Mortality
- Associated end-of-life expenses
- Income loss due to absenteeism or hospitalization
- Healthcare expenditures
- Illness and side effects
- Psychological effects of illness (“pain and suffering”)
- Negative impacts on family
- Long-term disability
- Loss of existence and bequest values

The value of avoided environmental and wildlife damage includes the values of:

- Interaction with (or observation of) wildlife
- Use of affected areas by humans and wildlife
- Reproductive value of healthy wildlife
- Protection of endangered, threatened, or sensitive species
- Existence and bequest values

Note that all of these costs and benefits may be mitigated by the lower (more stringent) ecological cleanup levels on some sites. For sites at which ecological risk drives cleanup, Ecology expects zero cost and zero benefit associated with changes in the amount of remediation performed. This is because the proposed rule does not alter cleanup levels based on ecological risks.

6.4 Final Comments and Conclusion

Based on qualitative and quantitative assessment of the likely costs and benefits, Ecology concludes that the net benefit of the proposed rule is likely to be positive. This conclusion is based on:

- The conservative nature of the quantitative cost estimate (the likelihood that it will be smaller than the median $148,800 per site), and the possibility that it will equal zero
- Reduced likelihood of TEE costs
- Higher cleanup levels for industrial properties
- Reduced likelihood of multiple-hazardous-substance adjustments to cleanup level calculations
- Reduced likelihood of multiple-exposure-pathway adjustments to cleanup level calculations
- Improvements in human health:
  - Avoided cancer incidence and mortality
  - Avoided noncancer illness and disability
- Improvements in ecological and wildlife health
- Ecology's protective approach to evaluation of the health effects of the rule

It is the conclusion of this analysis that the per-site benefits of the proposed MTCA rule are likely to exceed the costs, as compared to the baseline.

The total net benefit of the rule in Washington State depends on a number of additional variables—including actual cleanup levels, choice of remedial methods, actual remediated soil volume, and which cleanup levels drive remediation—for each pulp and paper mill involved in cleanup.

Without a predictable number of sites that will be affected by the proposed rule, Ecology bases its conclusions on a per-site evaluation. The total, statewide net benefit of the proposed rule will be a multiplicative function of the per-site net benefit; if benefits exceed costs on a representative site, then benefits exceed costs statewide.

CHAPTER 7: Small Business Economic Impact Statement

7.1 Introduction

Ecology did not produce a Small Business Economic Impact Statement (SBEIS) for the proposed rule. A SBEIS assesses any disproportionate impact on small business under the proposed rule. Based on the above analysis of affected sites, and given that small business is not affected it is not possible to evaluate the relative impact for small business or to do the required content for an SBEIS in RCW 19.85.040, or to reduce the costs to small business under RCW 19.85.030.

7.2 Purpose of the SBEIS

The Regulatory Fairness Act (RCW 19.85) requires State agencies to prepare a Small Business Economic Impact Statement (SBEIS) before proposing to amend or adopt a rule. The reason for the legislation was a concern that regulatory mandates could, "…threaten the very existence of some small businesses" (RCW 19.85.011). The act defines a small business as, "any business entity, including a sole proprietorship, corporation, partnership, or other legal entity, that is owned and operated independently from all other businesses and that has *fifty or fewer employees*" (RCW 19.85.020).

7.3 Basis of the Decision

Based on a review of the current list of cleanup sites in Washington and experience implementing the current MTCA rule, Ecology does not believe that the proposed rule will affect small businesses (see Chapter 4) for the following reasons.[1]

- **Sites with Dioxin and Furan Contamination:** Ecology's cleanup database includes a number of sites with dioxin contamination. Analysis of affected sites indicates that only cleanup costs incurred by certain pulp and paper mills are expected to increase. Pulp and paper mills in Washington State are components of large corporations. The existing mill sites in the state are owned by corporations employing between 970 and 57,000 people in 2005.[2] Thus, Ecology has concluded that the proposed rule amendments are not likely to affect small businesses with dioxin and furan contamination because:
  - Ecology has identified a limited number of sites that might be affected by the proposed rule amendments. None of those sites are owned or operated by small businesses.
  - Ecology expects that ground water and surface water standards will continue to be based on applicable and relevant and appropriate requirements (ARARs). Ecology is not proposing to revise requirements established under other laws and regulations.
  - Investigations and cleanup actions must address human health and ecological risks. The ecological screening levels in the current rule are slightly lower than cleanup levels based on

[1] 2005 corporate employment statistics (Hoover's, 2006): Weyerhaeuser = 49,900; Longview Fibre = 3,200; Georgia Pacific = 55,000; Port Townsend Paper = 970; Rayonier = 2000; and Scott Paper (Kimberly Clark) = 57,000.

[2] 2005 corporate employment statistics (Hoover's, 2006): Weyerhaeuser = 49,900; Longview Fibre = 3,200; Georgia Pacific = 55,000; Port Townsend Paper = 970; Rayonier = 2000; and Scott Paper (Kimberly Clark) = 57,000.

human health protection. Ecology is not proposing revisions to the requirements for evaluating ecological impacts and establishing cleanup levels to protect plants and wildlife.

- Ecology expects that cleanup requirements at many sites with dioxin-contaminated soils will continue to be driven by cleanup requirements for other contaminants (e.g. total petroleum hydrocarbons, metals). Cleanup requirements for these other hazardous substances will not be affected by the proposed rule revisions.

- **Sites with Carcinogenic Polycyclic Aromatic Hydrocarbon (cPAH) Contamination**: Ecology's cleanup database includes a number of cPAH-contaminated sites that are owned or operated by small businesses. However, Ecology has concluded that the proposed rule amendments are not likely to affect small businesses with cPAH contamination because:

  - Ecology expects that small businesses will continue to use Method A to establish cleanup levels. Ecology is not proposing to revise the Method A cleanup levels;

  - Ecology expects that ground water and surface water standards will continue to be based on applicable and relevant and appropriate requirements (ARARs). Ecology is not proposing to revise requirements established under other laws and regulations.

  - Ecology expects that cleanup requirements at many sites with cPAH-contaminated soils will continue to be driven by cleanup requirements for other contaminants (e.g. total petroleum hydrocarbons, metals). Cleanup requirements for these other hazardous substances are not be affected by the proposed rule revisions.

  - Ecology does not expect that the proposed rule revisions will result in meaningful differences in soil removal volumes because (1) there is very little difference in cleanup levels selected under the two rulemaking options because benzo[a]pyrene generally contributes 60-80% of the risk for these mixtures and (2) it is difficult to make fine distinctions in soil contamination levels during soil removal (e.g. removal via backhoe).

  - The new Cal EPA weighting factors will result in slightly less stringent total toxic equivalent concentrations for cPAH mixtures, making it easier to demonstrate compliance with cleanup levels.

- **Sites with Polychlorinated Biphenyl (PCB) Contamination**: Ecology's cleanup database includes a number of PCB-contaminated sites that are owned or operated by small businesses. However, Ecology has concluded that the proposed rule amendments are not likely to affect small businesses with PCB contamination because:

  - Ecology expects that small businesses will continue to use Method A to establish cleanup levels. Ecology is not proposing to revise the Method A cleanup levels.

  - Ecology expects that ground water and surface water standards will continue to be based on applicable and relevant and appropriate requirements (ARARs). Ecology is not proposing to revise requirements established under other laws and regulations.

  - Small businesses (as well as larger businesses) will not be required to use the Toxic Equivalency Factor (TEF) methodology when establishing cleanup levels for PCBs. All

businesses will continue to have the option of using the current rule to establish soil cleanup levels for PCBs.

- PCB cleanup levels calculated using TEFs are likely to be similar to the current approach.

For the general small-business impacts and impact mitigation in the existing MTCA, see Appendix E

CHAPTER 8: Least Burdensome Alternative Analysis

RCW 34.05.328(1)(d) requires a Ecology to "Determine, after considering alternative versions of the rule and the analysis required under (b) and (c) 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." This chapter is intended to establish that the proposed rule does not impose requirements on those affected by it in excess of what is necessary to achieve Ecology's rule-making goals.

Ecology considered a number of alternatives in developing the proposed rule.

1. Eliminating the TEF option from cleanup level calculation for dioxin/furan mixtures and cPAHs. Under this alternative, dioxin/furan and cPAH mixtures would be considered equally toxic to the reference compound (2,3,7,8 TCDD or benzo[a]pyrene).
2. Retain the use of TEFs to determine an equivalent concentration of 2,3,7,8 TCDD for sites with *both* dioxin/furan mixtures and PCBs. Under this alternative, the toxic equivalent concentration of dioxin, furan, and PCBs are summed as a group, and compared to the cleanup level for 2,3,7,8 TCDD.
3. Use of a soil gastrointestinal absorption fraction of 1.0 (100%) or higher, rather than the proposed 0.6 (60%)

Leaving the MTCA Cleanup Regulation written as is does not achieve the goals of this rulemaking. In particular, the purpose of this rulemaking is to clarify the existing rule and create consistency across Ecology rules and guidance. The intended result of the rulemaking is to:

- Clarify the interpretation of the existing rule and reduce uncertainty in how cleanup levels should be calculated
- Enact regulations that are protective of human health, and which are conservative in the face of any uncertainty regarding the human health and environmental effects from contamination
- Update certain values in the rule used for calculating cleanup levels

Elimination of TEFs in cleanup calculation in favor of toxicity equal to the reference compound would impose a burden on site owners in excess of what is necessary to meet rule-making goals.

Requiring the adding of the dioxin-like PCBs TEQ to the dioxin/furan mixture TEQ could result in significantly more stringent cleanup levels at sites with both contaminants (PCBs and dioxin/furan mixtures). It would also be more difficult and expensive to implement as compliance testing would require congener-specific PCB analyses.

Use of a gastrointestinal absorption fraction of 1.0 or higher would impose the highest burden on pulp and paper mill sites expected to comply with the proposed rule.

Of all the options considered when writing the rule language to meet the goals of the rule making, the proposed rule imposes the least burden on those sites required to comply with it.

Finally, Ecology assumes some level of risk from any exposure to dioxins and furans. Given the

potential impacts on human health (see Chapter 5), Ecology erred on the side of protecting human health even though the precise benefit cannot be quantified.

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APPENDICES

Appendix A: Cleanup Level Methodology

Ecology performed calculations for baseline and proposed rule cleanup levels.

Past Practice Cleanup Level Calculation
Using the standard formula exposure assumptions, Ecology calculated the cleanup value (Method B) using 2,3,7,8-TCDD as equipotent to the entire mixture. This resulted in a cleanup level of 6.7 ppt for dioxin/furan mixtures.

The Baseline Calculation:
Using the standard formula exposure assumptions, the soil cleanup value (Method B) was calculated for the baseline as follows:

- Compiled data from dioxin contaminated sites in WA State.
- For each sample analyzed, calculated a concentration that meets the 10-6 standard for individual congeners and a 10-5 standard for the total mixture, using the standard Method B direct contact (soil ingestion) assumption and standard Method B assumptions and the 2005 TEFs.
- Calculated the average cleanup level for each site

This resulted in a cleanup level of 16-24 ppt for dioxin/furan mixtures at several sites in Washington State, with the value depending on the mixture composition.

Proposed Rule Calculation:
Using the standard formula exposure assumptions, the soil cleanup value (Method B) was calculated for the proposed rule revisions as follows:

- Standard formula based Method B assumptions except for 60% bioavailability
- The cleanup level was calculated using the 2005 TEFs for each of the 17 dioxin/furan congeners

This resulted in a cleanup level of 11 ppt for dioxin/furan mixtures.

Appendix B: Potentially Affected Standard Industry Classifications (SIC)

Table K-1: Suspected and Confirmed Dioxin-Contaminated Sites in Washington State					
COUNTY	COMMON NAME	ADDRESS	CITY	SIC	SIC DESCRIPTION
CLARK	Pacific Wood Treating Corp	111 W DIVISION ST	RIDGEFIELD	2421	SAWMILLS AND PLANING MILLS, GENERAL
				2439	STRUCTURAL WOOD MEMBERS, NEC
				2491	WOOD PRESERVING
				2499	WOOD PRODUCTS, NEC
				3069	FABRICATED RUBBER PRODUCTS, NEC
				9199	GENERAL GOVERNMENT, NEC
COWLITZ	MT SOLO LANDFILL	4646 MT SOLO RD	LONGVIEW	4953	LANDFILL
	INTERNATIONAL PAPER LONGVIEW	10 INTERNATIONAL WAY	LONGVIEW	2411	LOGGING
				26	PAPER & ALLIED PRODUCTS
				4225	GENERAL WAREHOUSING AND STORAGE
				4953	REFUSE SYSTEMS
FRANKLIN	Pasco Landfill NPL Site	KAHLOTUS RD & HWY 12	PASCO	4953	LANDFILL
				9511	AIR, WATER, & SOLID WASTE MANAGEMENT
GRAYS HARBOR	RAYONIER INC	400 AIRPORT WAY	HOQUIAM	2491	WOOD PRESERVING
				24	LUMBER AND WOOD PRODUCTS
				2421	SAWMILLS AND PLANING MILLS, GENERAL
	RICHARDSON CUSTOM AUTO	136 HWY 101 N	HOQUIAM	75	AUTO REPAIR, SERVICES, AND PARKING
ISLAND	US NAVY WHIDBEY OU2	AULT FIELD NAS WHIDBEY ISLAND	OAK HARBOR	9711	NATIONAL SECURITY
	US NAVY WHIDBEY OU3	AULT FIELD NAS WHIDBEY ISLAND	OAK HARBOR	4953	HAZARDOUS WASTE MATERIAL DISPOSAL SI
KING	Seattle Port Terminal 117	8700 DALLAS AVE S	SEATTLE	2952	ASPHALT FELTS &COATINGS
	JH BAXTER & CO INC	5015 LAKE WASHINGTON BLVD N	RENTON	24	LUMBER AND WOOD PRODUCTS
				2491	WOOD PRESERVING
	HARBOR ISLAND	HARBOR ISLAND	SEATTLE	2999	PETROLEUM & COAL PRODUCTS
				3341	SECONDARY SMELTING & REFINING OF NON
				3731	SHIP BUILDING AND REPAIRING

	RAVENNA LANDFILL UNION BAY	NE 45TH & MONTLAKE	SEATTLE	4953	LANDFILL
	BOEING NORTH FIELD	7370 E MARGINAL WAY S	SEATTLE	372	AIRCRAFT & PARTS
				3721	AIRCRAFT
	Seattle City Light South Service Center	3613 4TH AVE S	SEATTLE	4911	ELECTRIC SERVICES
	King Cnty Regional Justice	421 6TH AVE N	KENT	2431	MILLWORK (INCL. WINDOW FRAMES)
				2499	WOOD PRODUCTS, NEC
KITSAP	US NAVY SUBASE	US HWY 99	SILVERDALE	4953	HAZARDOUS WASTE MATERIAL DISPOSAL SI
				9711	NATIONAL SECURITY
	WA ECY Manchester Lab	7411 BEACH DR E ECY LAB	PORT ORCHARD	4953	LANDFILL
				9999	NONCLASSIFIABLE ESTABLISHMENTS
	EAGLE HARBOR WYCKOFF	CREOSOTE PL NE	BAINBRIDGE ISLAND	2491	WOOD PRESERVING
	US NAVY PSNS OUB	1400 FARRAGUT AVE	BREMERTON	9711	NATIONAL SECURITY
	Wileys Body Shop Inc	1344 COLCHESTER DR SE	PORT ORCHARD	7532	TOP & BODY REPAIR & PAINT SHOPS
LEWIS	AMERICAN CROSSARM & CONDUIT	100 CHEHALIS AVE SW	CHEHALIS	24	LUMBER AND WOOD PRODUCTS
				4953	LANDFILL
				9511	AIR, WATER, & SOLID WASTE MANAGEMENT
	ROSS ELECTRIC OF WA COAL CREEK	346 COAL CREEK RD	CHEHALIS	3629	ELECTRICAL INDUSTRIAL APPARATUS, NOT
				9999	NONCLASSIFIABLE ESTABLISHMENTS
MASON	SIMPSON TIMBER COMPANY	215 N 3RD ST	SHELTON	24	LUMBER AND WOOD PRODUCTS
				2421	SAWMILLS AND PLANING MILLS, GENERAL
				2436	SOFTWOOD VENEER AND PLYWOOD
	SHELTON LANDFILL	C ST	SHELTON	4953	LANDFILL
PIERCE	US ARMY FORT LEWIS MULTI SITE	FORT LEWIS	TACOMA	3482	SMALL ARMS AMMUNITION
				4953	LANDFILL
	Marine VW Drums	1900 MARINE VIEW DR NE	TACOMA	9999	NONCLASSIFIABLE ESTABLISHMENTS
	REICHHOLD CHEM INC	2340 TAYLOR WAY	TACOMA	2672	COATED & LAMINATED PAPER

	Tacoma Landfill	3510 S MULLEN	TACOMA	4212	LOCAL TRUCKING, WITHOUT STORAGE
				4953	LANDFILL
				9199	GENERAL GOVERNMENT, NEC
SKAGIT	Scott Paper Mill Former	17TH-22ND ST & R AVE	ANACORTES	261	PULP MILLS
	IMPACT INDUSTRIES SULPHUR PILE	1325 HWY 237	MOUNT VERNON	2819	INDUSTRIAL INORGANIC CHEMICALS
	MJB PROPERTIES	17TH-30TH ST & T AVE	ANACORTES	2611	PULP MILLS
				4493	MARINAS
	PORT OF ANACORTES	Q AVE & 15TH ST	ANACORTES	2611	PULP MILLS
SNOHOMISH	US NAVY Station Everett	2000 W MARINE VIEW DR	EVERETT	3731	SHIP BUILDING AND REPAIRING
				9199	GENERAL GOVERNMENT, NEC
				9711	NATIONAL SECURITY
				9999	NONCLASSIFIABLE ESTABLISHMENTS
	Sultan Post & Pole	124 FOUNDRY DR	SULTAN	2429	SPECIAL PRODUCT SAWMILLS, NEC
				2491	WOOD PRESERVING
				2851	PAINTS AND ALLIED PRODUCTS
THURSTON	CASCADE POLE INC MCFARLAND	1100 WASHINGTON ST	OLYMPIA	2491	WOOD PRESERVING
	BRIGGS NURSERY	4407 HENDERSON BLVD SE	OLYMPIA	0181	ORNAMENTAL NURSERY PRODUCTS
WHATCOM	RG HALEY INTL CORP	CORNWALL AVE N	BELLINGHAM	24	LUMBER AND WOOD PRODUCTS
	WILDER LANDFILL	N OF 1524 SLATER RD	FERNDALE	4953	REFUSE SYSTEMS
YAKIMA	Cameron Yakima Inc	1414 S 1ST ST	YAKIMA	28	CHEMICALS AND ALLIED PRODUCTS
				2819	INDUSTRIAL INORGANIC CHEMICALS, NEC
				3564	BLOWERS AND FANS
				3569	GENERAL INDUSTRIAL MACHINERY, NEC
				3589	SERVICE INDUSTRY MACHINERY, NEC
				4953	INCINERATOR OPERATION
	Bay Zinc Co Inc	301 W CHARRON RD	MOXEE CITY	2879	AGRICULTURAL CHEMICALS, NEC

Table K-2: Suspected and Confirmed PAH-Contaminated Sites in Washington State

COUNTY	COMMON NAME	ADDRESS	CITY	SIC	SIC DESCRIPTION
ADAMS	BURLINGTON NORTHERN OTHELLO	BROADWAY & MAIN	OTHELLO	4011	RAILROADS, LINE HAUL OPERATING
				4013	SWITCHING AND TERMINAL SERVICES
CHELAN	Unocal Svs Sta 4942	405 S WENATCHEE AVE	WENATCHEE	7538	GENERAL AUTOMOTIVE REPAIR SHOPS
CLALLAM	FREDS AUTO	262 MT PLEASANT RD	PORT ANGELES	5093	SCRAP AND WASTE MATERIALS
	JONATHAN SHOTWELL CORPORATION	484 ECLIPSE PKWY	PORT ANGELES	1442	CONSTRUCTION SAND AND GRAVEL
				1459	CLAY AND RELATED MINERALS NEC
				2951	ASPHALT PAVING MIXTURES AND BLOCKS
				3273	READY-MIXED CONCRETE
	QUALITY 4 X 4	2509 EDDY LN	PORT ANGELES	55	AUTOMOTIVE DEALERS & SERVICE STATION
				75	AUTO REPAIR, SERVICES, AND PARKING
CLARK	AC SPECIALTY	13917 NE FOURTH PLAIN RD	VANCOUVER	75	AUTO REPAIR, SERVICES, AND PARKING
	BATTLE GROUND PLAZA MINI MA	717 MAIN ST	BATTLE GROUND	554	GASOLINE SERVICE STATIONS
				594	MISCELLANEOUS SHOPPING GOODS STORES
	CARBORUNDUM FILL	3103 LOWER RIVER RD	VANCOUVER	4953	LANDFILL
	CHERRY GROVE DUMP	PENDER RD & NE 249TH	BATTLE GROUND	4953	LANDFILL
	EXXON GAS STATION 2422	604 NE 179TH ST	RIDGEFIELD	2999	PETROLEUM & COAL PRODUCTS
				55	AUTOMOTIVE DEALERS & SERVICE STATION
	Fort Vancouver Plywood	W 8TH ST	VANCOUVER	2436	SOFTWOOD VENEER AND PLYWOOD
	KINGSBURY TERRACE APTS	2011 E BRANDT RD	VANCOUVER	9999	NONCLASSIFIABLE ESTABLISHMENTS
	LEWIS RIVER RANCH A	11001 NE 269TH ST	BATTLE GROUND	02	AGRICULTURAL PRODUCTION-LIVESTOCK
	LEWIS RIVER RANCH C	ACCESS RD	BATTLE GROUND	02	AGRICULTURAL PRODUCTION-LIVESTOCK
	MCCALL OIL	1309 W MCLOUGHLIN AVE	VANCOUVER	2999	PETROLEUM & COAL PRODUCTS
	OFFICER PROPERTY OIL PITS	2505 NE 134TH ST	VANCOUVER	9999	NONCLASSIFIABLE ESTABLISHMENTS
	Pacific Wood Treating Corp	111 W DIVISION ST	RIDGEFIELD	2421	SAWMILLS AND PLANING MILLS, GENERAL
				2439	STRUCTURAL WOOD MEMBERS, NEC

				2491	WOOD PRESERVING
				2499	WOOD PRODUCTS, NEC
				3069	FABRICATED RUBBER PRODUCTS, NEC
				9199	GENERAL GOVERNMENT, NEC
	PRI NORTHWEST INC VANCOUVER	1300 W 8TH ST	VANCOUVER	2951	ASPHALT PAVING MIXTURES AND BLOCKS
				9999	NONCLASSIFIABLE ESTABLISHMENTS
	SPRAGUE & FJERMESTAD	4206 NE 239TH ST	RIDGEFIELD	5015	MOTOR VEHICLE PARTS, USED
				5093	SCRAP AND WASTE MATERIALS
	ST Services Vancouver	5420 NW FRUIT VALLEY RD	VANCOUVER	5171	PETROLEUM BULK STATIONS & TERMINALS
	Toftdahl Drum Site	22033 NE 189 ST	BRUSH PRAIRIE	9511	AIR, WATER, & SOLID WASTE MANAGEMENT
				9999	NONCLASSIFIABLE ESTABLISHMENTS
	VANCOUVER ICE & FUEL OIL	1112 W 7TH ST	VANCOUVER	2951	ASPHALT PAVING MIXTURES AND BLOCKS
				2999	PETROLEUM & COAL PRODUCTS
				5171	PETROLEUM BULK STATIONS & TERMINALS
	WOODYS 4X4	6408 NE ST JOHNS RD	VANCOUVER	75	AUTO REPAIR, SERVICES, AND PARKING
COWLITZ	CLIFF KOPPE METALS	1610 S RIVER RD	KELSO	3449	MISCELLANEOUS METAL WORK
				9999	NONCLASSIFIABLE ESTABLISHMENTS
	INTERNATIONAL PAPER LONGVIEW	10 INTERNATIONAL WAY	LONGVIEW	2411	LOGGING
				26	PAPER & ALLIED PRODUCTS
				4225	GENERAL WAREHOUSING AND STORAGE
				4953	REFUSE SYSTEMS
	KALAMA FALLS HATCHERY	3900 KALAMA RIVER RD	KALAMA	0921	FISH HATCHERIES AND PRESERVES
	LONGVIEW FIRE DEPT	740 COMMERCE	LONGVIEW	9224	FIRE PROTECTION
	United Rentals NW Inc Longview	1002 TENNANT WAY	LONGVIEW	7359	EQUIPMENT RENTAL & LEASING, NEC
				7532	TOP & BODY REPAIR & PAINT SHOPS
				7538	GENERAL AUTOMOTIVE REPAIR SHOPS
FRANKLIN	Pasco Bulk Fuel Terminal Site	AINSWORTH & W 9TH	PASCO	2999	PETROLEUM & COAL PRODUCTS
GRAYS HARBOR	FRIENDLY AUTO SALES & SALVAGE	150 US HWY 101	HOQUIAM	5015	MOTOR VEHICLE PARTS, USED
	HILLIARD PROPERTY	323 W MARKET ST	ABERDEEN	75	AUTO REPAIR, SERVICES, AND PARKING
				7991	PHYSICAL FITNESS FACILITIES

	Little Hoquiam Boat Shop 1	119 ENDRESEN AVE	HOQUIAM	373	SHIP & BOATBUILDING AND REPAIRING
				3732	BOAT BUILDING AND REPAIRING
	LITTLE HOQUIAM BOAT SHOP 2	825 QUEEN AVE	HOQUIAM	373	SHIP & BOATBUILDING AND REPAIRING
				3732	BOAT BUILDING AND REPAIRING
	RODERICK TIMBER CO	712 HAGARA ST	JUNCTION CITY	24	LUMBER AND WOOD PRODUCTS
	SIERRA PACIFIC	301 HAGARA ST	JUNCTION CITY	24	LUMBER AND WOOD PRODUCTS
				2421	SAWMILLS & PLANNING MILLS, GEN
				4911	ELECTRIC SERVICES
				4953	LANDFILL
				9999	NONCLASSIFIABLE ESTABLISHMENTS
	VIRGIL FOSTER	254-19 MONTE ELMA RD	MONTESANO	24	LUMBER AND WOOD PRODUCTS
				2491	WOOD PRESERVING
ISLAND	HOLMES HARBOR ROD & GUN CLUB	3634 BROOKS HILL RD	LANGLEY	3484	SMALL ARMS
				7997	MEMBERSHIP SPORTS & RECREATION CLUBS
	ISLAND RECYCLING	20014 HWY 525	FREELAND	3714	MOTOR VEHICLE PARTS AND ACCESSORIES
				5093	SCRAP AND WASTE MATERIALS
				8999	SERVICES, NEC
	US NAVY Air Station Whidbey Island Ault	AULT FIELD BASE	OAK HARBOR	9711	NATIONAL SECURITY
	US NAVY WHIDBEY OU1	AULT FIELD NAS WHIDBEY ISLAND	OAK HARBOR	4953	HAZARDOUS WASTE MATERIAL DISPOSAL SI
	US NAVY WHIDBEY OU2	AULT FIELD NAS WHIDBEY ISLAND	OAK HARBOR	9711	NATIONAL SECURITY
	US NAVY WHIDBEY OU3	AULT FIELD NAS WHIDBEY ISLAND	OAK HARBOR	4953	HAZARDOUS WASTE MATERIAL DISPOSAL SI
	US NAVY WHIDBEY OU4	NAS WHIDBEY ISLAND	OAK HARBOR	9711	NATIONAL SECURITY
JEFFERSON	Jefferson County Transit Authority	1615 SIMS WAY	PORT TOWNSEND	4111	LOCAL AND SUBURBAN TRANSIT
				47	TRANSPORTATION SERVICES
	RURAL GARBAGE SERVICE	NEWBERRY HILL RD NW & SESAME ST NW	SILVERDALE	4953	REFUSE SYSTEMS
KING	Aesquivel Property	14325 35TH AVE NE	SEATTLE	88	PRIVATE HOUSEHOLDS
	AFFORDABLE AUTO WRECKING	9802 MARTIN LUTHER KING JR WAY S	SEATTLE	5015	MOTOR VEHICLE PARTS, USED
				5093	SCRAP AND WASTE MATERIALS
	Associated Grocers Inc Kent	7890 S 188TH	KENT	5141	GROCERIES, GENERAL LINE
	BALLARD PARTNERS PROPERTY	1455 NW LEARY WAY	SEATTLE	752	AUTOMOBILE PARKING

	BELLEFIELD OFFICE PARK BLDG N & O	1756-1800 114TH AVE SE BLDG N & O	BELLEVUE	9111	EXECUTIVE OFFICES
	Belshaw Brothers Inc	1750 22ND AVE S	SEATTLE	1541	INDUSTRIAL BUILDINGS AND WAREHOUSES
				3556	FOOD PRODUCTS MACHINERY
	BLACKBURN PROPERTY	31411 169TH AVE SE	AUBURN	75	AUTO REPAIR, SERVICES, AND PARKING
				7538	GENERAL AUTOMOTIVE REPAIR SHOPS
	BNRR QUENDALL LOADING RACKS	E OF RR TRACKS & 4503 LK WASHINGTON BLVD	RENTON	4011	RAILROADS, LINE-HAUL OPERATING
	BNRR SWITCHING YARD CEDAR FALLS	SE OF RATTLESNAKE LAKE & CEDAR FALLS RD	CEDAR FALLS	4013	SWITCHING AND TERMINAL SERVICES
	BNSF Railway Co Skykomish	RAILROAD AVE 5TH ST	SKYKOMISH	40	RAILROAD TRANSPORTATION
				4011	RAILROADS, LINE-HAUL OPERATING
				4013	SWITCHING AND TERMINAL SERVICES
				4785	INSPECTION & FIXED FACILITIES
	BOEING AUBURN GOVERNMENT CANAL	15TH ST SW	AUBURN	3471	ELECTROPLATING, PLATING, POLISHING,A
	BOEING ELECTRONIC MFG	7300 PERIMETER RD S	SEATTLE	5065	ELECTRONIC PARTS AND EQUIPMENT
	Boeing Plant 2	7755 E MARGINAL WAY S	SEATTLE	3721	AIRCRAFT
				3728	AIRCRAFT PARTS AND EQUIPMENT, NEC
				3761	GUIDED MISSILES AND SPACE VEHICLES
	Boeing Renton	800 N 6TH ST	RENTON	372	AIRCRAFT & PARTS
				3721	AIRCRAFT
	BOW LAKE LANDFILL	S 188TH ST & MILITARY RD S	TUKWILA	4953	LANDFILL
	BP West Coast Products	1652 SW LANDER	SEATTLE	29	PETROLEUM AND COAL PRODUCTS
				3533	OIL AND GAS FIELD MACHINERY
				5171	PETROLEUM BULK STATIONS & TERMINALS
				5172	PETROLEUM PRODUCTS, NEC
	BUDGET RENT A CAR BELLEVUE	111 108TH NE	BELLEVUE	7514	PASSENGER CAR RENTAL
	Burlington Environmental Inc Georgetown	734 S LUCILE ST	SEATTLE	4953	REFUSE SYSTEMS
	CADMAN PREMIX CO INC	1605 130TH AVE NE	BELLEVUE	177	CONCRETE WORK
	Coleman Creosoting Works	333 ELLIOTT AVE W	SEATTLE	2491	WOOD PRESERVING

				5171	PETROLEUM BULK STATIONS & TERMINALS
	DARIGOLD ELLIOTT AVENUE	635 ELLIOTT AVE W	SEATTLE	2026	FLUID MILK
	DELTA TRAIN CORP	209 41ST ST SE	AUBURN	5088	TRANSP. EQUIP. (WHOLESALE)
	DUWAMISH FILL SITE DOT	S 124TH ST & SR 99	SEATTLE	4953	LANDFILL
				3599	INDUSTRIAL MACHINERY, NEC
				3731	SHIP BUILDING AND REPAIRING
				3732	BOAT BUILDING AND REPAIRING
	EASTGATE ABANDONED LANDFILL	2805 160TH AVE SE	BELLEVUE	4953	LANDFILL
	Eat Em Up Hut	12640 RENTON AVE S	SEATTLE	554	GASOLINE SERVICE STATIONS
	ENUMCLAW LANDFILL	29000 SE 440TH ST	ENUMCLAW	4953	LANDFILL
	EVERGREEN MARINE LEASING PARCEL E	7343 E MARGINAL WAY S	SEATTLE	2491	WOOD PRESERVING
				4491	MARINE CARGO HANDLING
	FEDERAL COURTHOUSE	700 STEWART ST	SEATTLE	921	COURTS
	FIELDS CORP KENT	710 S RAILROAD AVE	KENT	2952	ASPHALT FELTS AND COATINGS
				5211	LUMBER & OTHER BLDG. MATERIALS DEALE
	Fishing Vessel Owners Marine Ways Inc	1511 W THURMAN	SEATTLE	3731	SHIP BUILDING AND REPAIRING
				3732	BOAT BUILDING AND REPAIRING
	Foss Maritime Co	660 W EWING ST	SEATTLE	3731	SHIP BUILDING AND REPAIRING
				3732	BOAT BUILDING AND REPAIRING
				4493	MARINAS
	Fox Ave Bldg	6900 FOX AVE S	SEATTLE	5169	CHEM. & ALLIED PRODUCTS (WHOLESALE)
	FREASE PROPERTY	1330 S 343RD ST	FEDERAL WAY	753	AUTOMOTIVE REPAIR SHOPS
	Fremont Bridge Approach	FREMONT AVE N & 4TH AVE N	SEATTLE	1622	BRIDGE, TUNNEL, & ELEVATED HIGHWAY
	GAS WORKS PARK WA NATURAL GAS	2000 N NORTHLAKE WAY	SEATTLE	1311	CRUDE PETROLEUM AND NATURAL GAS
				49	ELECTRIC, GAS, AND SANITARY SERVICES
	GATX Facility	1733 ALASKAN WAY S	SEATTLE	4226	SPECIAL WAREHOUSING AND STORAGE, NEC
				5171	PETROLEUM BULK STATIONS & TERMINALS
				9999	NONCLASSIFIABLE ESTABLISHMENTS
	GENESEE LANDFILL	GENESEE ST & 43RD AVE S	SEATTLE	4953	LANDFILL

	GRIFFITH PROPERTY	19 W GRIFFIN CREEK RD	CARNATION	88	PRIVATE HOUSEHOLDS
	HANGAR HOLDINGS INC	7675 PERIMETER RD S	SEATTLE	9999	NONCLASSIFIABLE ESTABLISHMENTS
	HARBOR ISLAND	HARBOR ISLAND	SEATTLE	2999	PETROLEUM & COAL PRODUCTS
				3341	SECONDARY SMELTING & REFINING OF NON
				3731	SHIP BUILDING AND REPAIRING
	Industrial Container Services WA LLC	7152 1ST AVE S	SEATTLE	3412	METAL SHIPPING BARRELS, DRUMS, KEGS,
				7699	REPAIR SERVICES, NEC
	INTERBAY BNR	1809 W EMERSON	SEATTLE	4013	RAILROAD SWITCHING & TERMINAL ESTABL
	INTERBAY OLD LANDFILL	W WHEELER ST & 15TH AVE W	SEATTLE	4953	LANDFILL
	JC Commercial Properties LLC	2955 WESTLAKE AVE N	SEATTLE	7521	AUTOMOBILE PARKING
	JH BAXTER & CO INC	5015 LAKE WASHINGTON BLVD N	RENTON	24	LUMBER AND WOOD PRODUCTS
				2491	WOOD PRESERVING
	John Dunato & Co Inc	2309 N NORTHLAKE WY	SEATTLE	3732	BOAT BUILDING AND REPAIRING
	JOSEPH SIMON & SONS KENT	1025 S CENTRAL AVE	KENT	5093	SCRAP AND WASTE MATERIALS
	JSWJ Property Former	301 1ST AVE N	KENT	5084	INDUSTRIAL MACHINERY AND EQUIPMENT
	JSWJ Property Former	301 1ST AVE N	KENT	752	AUTOMOBILE PARKING
	KENMORE IND PARK	6423 NE 175TH ST	KENMORE	2951	PAVING MIXTURES AND BLOCKS
				3531	CONSTRUCTION MACHINERY & EQUIPMENT
				4953	LANDFILL
	Kentwood Industrial Bldg	20215 84TH AVE S	KENT	9999	NONCLASSIFIABLE ESTABLISHMENTS
	Kinder Morgan Tank Farm	2720 13TH AVE SW	SEATTLE	5171	PETROLEUM BULK STATIONS & TERMINALS
	King Cnty DOT Metro Transit Lake Union	1602 N NORTHLAKE WY	SEATTLE	4111	LOCAL AND SUBURBAN TRANSIT
				4173	BUS TERMINAL AND SERVICE FACILITIES
				4225	GENERAL WAREHOUSING AND STORAGE
				5171	PETROLEUM BULK STATIONS & TERMINALS
	King Cnty Solid Waste	11724 NE 60TH ST	KIRKLAND	4953	LANDFILL

	Houghton			9511	AIR, WATER, & SOLID WASTE MANAGEMENT
	King Cnty Solid Wst Cedar Hills Landfill	16645 228TH AVE SE	MAPLE VALLEY	4911	ELECTRIC SERVICES
				4953	LANDFILL
	KING COUNTY STREET SWEEPING SITE	16TH AVE S & HWY 518	SEATTLE	4581	AIRPORTS, FLYING FIELDS, & SERVICES
	LAKE UNION STEAM PLANT	1179 EASTLAKE AV E	SEATTLE	4961	STEAM & AIR-CONDITIONING SUPPLY
	Lake Washington School Dist 414	6505 176TH NE MARYMOOR ANNEX	REDMOND	376	GUIDED MISSILES, SPACE VEHICLES, PAR
			REDMOND	8222	JUNIOR COLLEGES
			REDMOND	9999	NONCLASSIFIABLE ESTABLISHMENTS
	LAKE YOUNGS SUPPLY LINE	SE PETROVITSY & CEDAR RIVER PLN RD	MAPLE VALLEY	4941	WATER SUPPLY
	LAKESIDE INDUSTRIES EASTGATE	13620 SE EASTGATE WY	BELLEVUE	1611	HIGHWAY AND STREET CONSTRUCTION
	LAKESIDE INDUSTRIES KENT	19601 FRONTAGE RD	KENT	2951	PAVING MIXTURES AND BLOCKS
				7699	REPAIR SHOPS & RELATED SERVICES-MISC
	Lithia Lot A Car of Renton	700 S GRADY WAY	RENTON	55	AUTOMOTIVE DEALERS & SERVICE STATION
	LITTLE ETHELS AUTO WRECKING	13301 MARTIN LUTHER KING JR WAY S	SEATTLE	5093	SCRAP & WASTE MATERIALS
	LOCKHEED SHIPBLDG CO YARD 1	2929 16TH AV SW	SEATTLE	3731	SHIP BUILDING AND REPAIRING
				9999	NONCLASSIFIABLE ESTABLISHMENTS
	Longview Fibre Paper & Packaging Inc	5901 E MARGINAL WAY S	SEATTLE	2653	CORRUGATED AND SOLID FIBER BOXES
	Lous Chevron	1531 BROADWAY	SEATTLE	5499	MISCELLANEOUS FOOD STORES
				5541	GASOLINE SERVICE STATIONS
	Madrona Elementary	1121 33RD AVE	SEATTLE	5983	FUEL OIL DEALERS
	MANAGAN PROPERTY	19040 MAXWELL RD SE	MAPLE VALLEY	283	DRUGS
				5015	MOTOR VEHICLE PARTS, USED
	MARSHALL RESIDENCE	2909 MOUNTAIN VIEW AVE N	RENTON	88	PRIVATE HOUSEHOLDS
	MAUST TERMINAL	1762 6TH AVE S	SEATTLE	4214	LOCAL TRUCKING WITH STORAGE
	Maxines Floral & Gifts Inc	8811 ROOSEVELT WAY NE	SEATTLE	7216	DRYCLEANING PLANTS, EXCEPT RUG
	MC TERMINALS	40 S SPOKANE ST	SEATTLE	5153	GRAIN & FIELD BEANS

	Mercer Island Cleaners	7652 SE 27TH ST	MERCER ISLAND	7216	DRYCLEANING PLANTS, EXCEPT RUG
	MERIDIAN LANDFILL	170TH N & MERIDIAN AV	SEATTLE	4953	LANDFILL
	METRO EAST BASE	1975 124TH AVE NE	BELLEVUE	4111	LOCAL AND SUBURBAN TRANSIT
				417	BUS TERMINAL AND SERVICE FACILITIES
	METRO NORTH BUS BASE	N 165 ST & 1ST AV NE	SEATTLE	4953	LANDFILL
	MOBIL OIL CANAL BULK PLANT	1101 NW 45TH ST	SEATTLE	29	PETROLEUM AND COAL PRODUCTS
				5171	PETROLEUM BULK STATIONS & TERMINALS
	NEWCASTLE COAL CREEK LANDFILL	NEWCASTLE COAL CR RD SECT 26	ISSAQUAH	4953	REFUSE SYSTEMS
	NORTAR INC	1700 N NORTHLAKE WY	SEATTLE	2952	ASPHALT FELTS &COATINGS
	NORTH COAST CHEMICAL CO	6300 17TH AV S	SEATTLE	28	CHEMICALS AND ALLIED PRODUCTS
				2842	POLISHES AND SANITATION GOODS
				28	CHEMICALS AND ALLIED PRODUCTS
				2842	POLISHES AND SANITATION GOODS
	North Winds Weir Intertidal Restoration	2724 S 112TH ST	TUKWILA	5015	MOTOR VEHICLE PARTS, USED
				5015	MOTOR VEHICLE PARTS, USED
	Nucor Steel Seattle Inc	2424 SW ANDOVER ST	SEATTLE	3295	MINERALS, GROUND OR TREATED
				33	PRIMARY METAL INDUSTRIES
				3312	BLAST FURNACES AND STEEL MILLS
				3399	PRIMARY METAL PRODUCTS, NEC
	OLYMPIC HOME CARE PRODUCTS	1141 NW 50TH	SEATTLE	2865	CYCLIC COAL TAR CRUDES,DYES, PIGMENT
	PACCAR Inc	1400 N 4TH ST	RENTON	3325	STEEL FOUNDRIES, UNCLASSIFIED
				3462	IRON AND STEEL FORGINGS
				3531	CONSTRUCTION MACHINERY & EQUIPMENT
				4213	TRUCKING, EXCEPT LOCAL
				7374	DATA PROCESSING AND PREPARATION
				9999	NONCLASSIFIABLE ESTABLISHMENTS
	Pace International LP	500 7TH AVE S	KIRKLAND	28	CHEMICALS AND ALLIED PRODUCTS
				2841	SOAP AND OTHER DETERGENTS
				2842	POLISHES AND SANITATION GOODS
				2873	NITROGENOUS FERTILIZERS
				2879	AGRICULTURAL CHEMICALS, NEC

				2899	CHEMICAL PREPARATIONS, NEC
	Pacific City Park	3RD AVE SE & WHITE RIVER	PACIFIC	4953	LANDFILL
	PIER 1	2130 HARBOR AVE SW	SEATTLE	3731	SHIP BUILDING AND REPAIRING
	PILLON PROPERTY	15753 SE RENTON ISSAQUAH RD	RENTON	5015	MOTOR VEHICLE PARTS, USED
				5093	SCRAP AND WASTE MATERIALS
	PIONEER LUMBER & TREATING CO	1080 W EWING	SEATTLE	2491	WOOD PRESERVING
				4226	SPECIAL WAREHOUSING & STORAGE
	PUGET POWER AUBURN SERV CTR	33940 WEYERHAEUSER WAY S	AUBURN	7538	GENERAL AUTOMOTIVE REPAIR SHOPS
	PUYALLUP KIT CORNER LANDFILL	S 352ND & I5 PUYALLUP CUTOFF RD	FEDERAL WAY	4953	REFUSE SYSTEMS
	QUENDALL TERMINALS	4503 LAKE WASHINGTON BLVD N	RENTON	2411	LOGGING
				5169	CHEM. & ALLIED PRODUCTS (WHOLESALE)
	RAINIER BEACH AUTOMOTIVE	9479 RAINIER AVE S	SEATTLE	753	AUTOMOTIVE REPAIR SHOPS
				7532	TOP & BODY REPAIR & PAINT SHOPS
	Rainier Court	RAINIER AVE S	SEATTLE	01	AGRICULTURAL PRODUCTION - CROPS
	Rainier Precision LLC	1150 EASTLAKE AVE E	SEATTLE	3089	PLASTICS PRODUCTS, NEC
				3449	MISCELLANEOUS METAL WORK
				3451	SCREW MACHINE PRODUCTS
				8734	TESTING LABORATORIES
	RAVENNA LANDFILL UNION BAY	NE 45TH & MONTLAKE	SEATTLE	4953	LANDFILL
	Rexam Beverage Can Co	1220 2ND AVE N	KENT	3411	METAL CANS
				3441	FABRICATED STRUCTURAL METAL
	RICKS AUTO WRECKING	12621 STONE AV N	SEATTLE	5015	MOTOR VEHICLE PARTS, USED
	Salmon Bay Steel Ballard	4315 9TH AVE NW	SEATTLE	3312	BLAST FURNACES AND STEEL MILLS
				3325	STEEL FOUNDRIES, UNCLASSIFIED
				3399	PRIMARY METAL PRODUCTS, NEC
	SCHLICKER PROPERTY	1 MILES OFF HWY 2 NEAR MP 55.3	SKYKOMISH	283	DRUGS
				5015	MOTOR VEHICLE PARTS, USED
	Seattle City Dexter Horton Building	710 2ND AVE	SEATTLE	9111	EXECUTIVE OFFICES
	Seattle City DOT Maintenance Yard	2940 WESTLAKE AVE N	SEATTLE	379	MISCELLANEOUS TRANSPORTATION EQUIPME
				5198	PAINTS, VARNISHES, AND SUPPLIES
	Seattle City DOT Ship Canal Trail	6TH AVE W & EMERSON ST VIADUCT	SEATTLE	401	RAILROADS

	Seattle City Parks & Rec Magnuson Park	6500 SANDPOINT WAY NE	SEATTLE	9999	NONCLASSIFIABLE ESTABLISHMENTS
	SEATTLE IRON & METALS MAIN YRD	2955 11TH AVE SW	SEATTLE	33	PRIMARY METAL INDUSTRIES
				5093	SCRAP AND WASTE MATERIALS
	SEATTLE LIGHTING STA	1177 ELLIOTT AVE W	SEATTLE	1311	COAL GASIFICATION
	Seattle Port Terminal 117	8700 DALLAS AVE S	SEATTLE	2952	ASPHALT FELTS &COATINGS
	SEATTLE PORT TERMINAL 91	2001 W GARFIELD ST	SEATTLE	4222	REFRIGERATED WAREHOUSING AND STORAGE
				4449	WATER TRANSPORTATION OF FREIGHT, NEC
				9199	GENERAL GOVERNMENT, NEC
	SEATTLE PORT TERMINAL 91 TANK FARM	2001 W GARFIELD ST	SEATTLE	4953	RECYCLE OPERATION
				5171	PETROLEUM BULK STATIONS & TERMINALS
	SEATTLE STEAM CO WESTERN AV	1319 WESTERN AV	SEATTLE	4961	STEAM AND AIR-CONDITIONING SUPPLY
	Shell 120764	17010 PACIFIC HWY S	SEATAC	5541	GASOLINE SERVICE STATIONS
	SHELL OIL PRODUCT SEATTLE TERMINAL	2555 13TH AVE SW	SEATTLE	29	PETROLEUM AND COAL PRODUCTS
				2992	LUBRICATING OILS AND GREASES
				5171	PETROLEUM BULK STATIONS & TERMINALS
	SOUTHPARK LANDFILL	8200 2ND AVE S	SEATTLE	4953	LANDFILL
				5421	MEAT AND FISH MARKETS
				7692	WELDING REPAIR
	SR 519 Street Improvement	ALASKAN WAY S	SEATTLE	1611	HIGHWAY AND STREET CONSTRUCTION
	ST CHARLES HOTEL	619 3RD AVE	SEATTLE	6513	APARTMENT BUILDING OPERATORS
	STERNOFF METALS CORPORATION	1600 SW 43RD ST	RENTON	3449	MISCELLANEOUS METAL WORK
	SUNSET PARK & TUB LAKE DUMP	S 136TH ST & 18TH AV S	SEATAC	4953	REFUSE SYSTEMS
	SUNSET VIEW APARTMENTS	2101 SW SUNSET BLVD	RENTON	6513	APARTMENT BUILDING OPERATORS
	SW HARBOR PROJ BN BUCKLEY YD	26TH AV SW & SW SPOKANE ST	SEATTLE	4013	RAILROAD SWITCHING & TERMINAL ESTABL
	SW HARBOR PROJ LOCKHEED YD 2	2330 SW FLORIDA ST	SEATTLE	3731	SHIP BUILDING AND REPAIRING
	SW HARBOR PROJ WYCKOFF	W MARGINAL WY SW & FLORIDA ST SW	SEATTLE	2491	WOOD PRESERVING

	ToxGon Corp Seattle	631 S 96TH ST	SEATTLE	3567	INDUSTRIAL PROCESS FURNACES & OVENS
	UNION STATION SITE	JACKSON ST & 4TH AV	SEATTLE	1311	COAL GASIFICATION
				332	IRON & STEEL FOUNDRIES
	UNOCAL 4704	15623 1ST AVE S	BURIEN	5541	GASOLINE SERVICE STATIONS
	UNOCAL SEATTLE MARKET LOWER	BN ELLIOTT RR BAY & BROAD	SEATTLE	5171	PETROLEUM BULK STATIONS & TERMINALS
	UNOCAL SEATTLE MARKETING TERM	BROAD ST & WESTERN AV & BAY ST	SEATTLE	5171	PETROLEUM BULK STATIONS & TERMINALS
	US NAVY STATION PUGET SOUND	7500 SANDPOINT WAY NE	SEATTLE	9711	NATIONAL SECURITY
	WA ARMY National Guard OMS 6	1601 W ARMORY WAY	SEATTLE	4785	INSPECTION AND FIXED FACILITIES
				9711	NATIONAL SECURITY
	WA DSHS Fircrest School	15230 15TH AVE NE	SHORELINE	8052	INTERMEDIATE CARE FACILITIES
				8361	RESIDENTIAL CARE
	WA UW 815 Mercer	815 MERCER ST	SEATTLE	4924	NATURAL GAS DISTRIBUTION
	Washington Cedar Supply	223 W SMITH ST	KENT	752	AUTOMOBILE PARKING
				9999	NONCLASSIFIABLE ESTABLISHMENTS
				5093	SCRAP AND WASTE MATERIALS
	Westbridge Building	4201 W MARGINAL WAY SW	SEATTLE	9999	NONCLASSIFIABLE ESTABLISHMENTS
	Western Processing	7215 S 196TH ST	KENT	4953	RECYCLE OPERATION
	Weyerhaeuser Enumclaw Millpond	31002 CHINOOK PASS HWY	ENUMCLAW		SAWMILLS & PLANNING MILLS, GEN
				2421	SAWMILLS AND PLANING MILLS, GENERAL
				4212	LOCALTRUCKING WITHOUT STORAGE
				5031	LUMBER, PLYWOOD, MILLWORK (WHOLESALE
				7699	REPAIR SERVICES, NEC
	Wycoff Co West Seattle	2801 SW FLORIDA ST	SEATTLE	2491	WOOD PRESERVING
				9199	GENERAL GOVERNMENT, NEC
KITSAP	ACE PAVING MAINTENANCE SHOP	DICKEY RD	SILVERDALE	7542	CARWASHES
				7699	REPAIR SHOPS & RELATED SERVICES-MISC
	AIRPORT AUTO WRECKING I	6504 SW OLD CLIFTON RD	PORT ORCHARD	5093	SCRAP & WASTE MATERIALS
	AIRPORT AUTO WRECKING II	4275 HWY 3 SW	PORT ORCHARD	5015	MOTOR VEHICLE PARTS, USED

ARPER DICKEY ROAD LANDFILL	9546 DICKEY RD NW	SILVERDALE	4953	REFUSE SYSTEMS
BAINBRIDGE ISLAND LANDFILL	VINCENT RD	BAINBRIDGE ISLAND	4953	LANDFILL
BATTLE POINT SITE	VENICE LOOP RD & KIRK ST	BAINBRIDGE ISLAND	4953	REFUSE SYSTEMS
BREMERTON AUTO WRECKING LANDFILL	4275 SR 3 SW	PORT ORCHARD	4953	REFUSE SYSTEMS
CONSTITUTION AVE LANDFILL	CONSTITUTION AVE & PORTER	BREMERTON	4953	LANDFILL
EAGLE HARBOR	CREOSOTE PL NE	BAINBRIDGE ISLAND	2491	WOOD PRESERVING
EAGLE HARBOR WYCKOFF	CREOSOTE PL NE	BAINBRIDGE ISLAND	2491	WOOD PRESERVING
EGLON DUMP	SOUTH OF HANSVILLE RD & OLD HANSVILLE RD	HANSVILLE	4953	REFUSE SYSTEMS
HEAD OF BAY	3050 W SR 16	BREMERTON	4953	REFUSE SYSTEMS
HOLLY DUMP	NW SEABECK HOLLY RD	BREMERTON	4953	REFUSE SYSTEMS
INDIANOLA DUMP	S KINGSTON RD NE & S MALONE LANE NE	KINGSTON	4953	REFUSE SYSTEMS
KITSAP CNTY DPW BREIDABLICK PIT	NE CORNER OF PIONEER WAY & LOFALL RD	POULSBO	1442	CONSTRUCTION SAND & GRAVEL (QUARRY)
			3531	CONSTRUCTION MACHINERY & EQUIPMENT
KITSAP COUNTY SILVERDALE LANDFILL	DICKEY RD NW	SILVERDALE	4953	REFUSE SYSTEMS
LAMBERTS RADIATOR SHOP	3338 KITSAP WY	BREMERTON	7539	AUTO REPAIR SHOPS, MISCELLANEOUS
LOVGREN GRAVEL PIT	7500 LOVGREN RD	BAINBRIDGE ISLAND	1442	CONSTRUCTION SAND & GRAVEL (QUARRY)
Old Bremerton Gasworks & Sesko Property	1725 PENNSYLVANIA AV	BREMERTON	3312	BLAST FURNACES, COKE OVENS
			3499	FABRICATED METAL PRODUCTS, NEC
			5171	PETROLEUM BULK STATIONS & TERMINALS
PETERSON DUMP	KITSAP WAY & OYSTER BAY AVE	BREMERTON	4953	LANDFILL

	Pope & Talbot Inc Sawmill	VIEW DRIVE	PORT GAMBLE	2421	SAWMILLS AND PLANING MILLS, GENERAL
				2421	SAWMILLS AND PLANING MILLS, GENERAL
	PORT ORCHARD LANDFILL	CLIFTON RD SW & OLD CLIFTON RD SW	PORT ORCHARD	4953	REFUSE SYSTEMS
	Robinson Property	1118 CHARLESTON BEACH RD	BREMERTON	554	GASOLINE SERVICE STATIONS
	RURAL GARBAGE SERVICE WINDJAMMER	NW WINDJAMMER CT	BREMERTON	4953	REFUSE SYSTEMS
	SEBRING PROPERTY	11627 SE SEBRING DR	SOUTHWORTH	249	MISCELLANEOUS WOOD PRODUCTS
				3795	TANKS AND TANK COMPONENTS
				249	MISCELLANEOUS WOOD PRODUCTS
				3795	TANKS AND TANK COMPONENTS
	Seitz Property	BRIAN LN NW	SILVERDALE	5015	MOTOR VEHICLE PARTS, USED
	SKIRVING DUMP	WERNER RD SW	BREMERTON	4953	REFUSE SYSTEMS
	US NAVY JACKSON PARK	UNNAMED RD E OF ROOT RD	BREMERTON	2892	EXPLOSIVES
	US NAVY JACKSON PARK OU 1	ROOT RD	BREMERTON	2892	EXPLOSIVES
	US NAVY JACKSON PARK OU 2	UNNAMED RD E OF ROOT RD	BREMERTON	2892	EXPLOSIVES
	US NAVY KEYPORT	HWY 308	KEYPORT	9711	NATIONAL SECURITY
	US NAVY KEYPORT OU1	610 DOWELL ST	KEYPORT	3471	ELECTROPLATING, PLATING, POLISHING,A
	US NAVY KEYPORT OU1	610 DOWELL ST	KEYPORT	9711	NATIONAL SECURITY
	US NAVY PSNS	1ST ST	BREMERTON	9711	NATIONAL SECURITY
	US NAVY PSNS OUA	1ST ST	BREMERTON	9711	NATIONAL SECURITY
	US NAVY PSNS OUB	1400 FARRAGUT AVE	BREMERTON	9711	NATIONAL SECURITY
	US NAVY SUBASE	US HWY 99	SILVERDALE	4953	HAZARDOUS WASTE MATERIAL DISPOSAL SI
				9711	NATIONAL SECURITY
	VIP LANDFILL	OYSTER BAY AVE	BREMERTON	5093	SCRAP AND WASTE MATERIALS
	VOCKRODT DUMP	W COLUMBIA WAY & NATIONAL AVE	BREMERTON	4953	REFUSE SYSTEMS
	WA ECY Manchester Lab	7411 BEACH DR E ECY LAB	PORT ORCHARD	4953	LANDFILL
				9999	NONCLASSIFIABLE ESTABLISHMENTS
	ZINK DUMP	BONNEVILLE PL SE & PERDEMCO AVE SE	PORT ORCHARD	4953	REFUSE SYSTEMS

KITTITAS	CABIN CREEK PROPERTY	CABIN CREEK RD	EASTON	241	LOGGING
KLICKITAT	COLUMBIA ALUMINUM Corp	HWY 14	GOLDENDALE	3334	PRIMARY PRODUCTION OF ALUMINUM
LEWIS	AMERICAN CROSSARM & CONDUIT	100 CHEHALIS AVE SW	CHEHALIS	24	LUMBER AND WOOD PRODUCTS
				4953	LANDFILL
				9511	AIR, WATER, & SOLID WASTE MANAGEMENT
	COWLITZ STUD CO MORTON	302 SR 7	MORTON	2421	SAWMILLS AND PLANING MILLS, GENERAL
	DEGOEDE BULB FARM INC	409 MOSSYROCK RD	MOSSYROCK	01	AGRICULTURAL PRODUCTION-CROPS
MASON	MASON CNTY SALVAGE YARD	1840 W CLOQUALLUM RD	SHELTON	1795	WRECKING AND DEMOLITION WORK
				5015	MOTOR VEHICLE PARTS, USED
				5093	SCRAP AND WASTE MATERIALS
	SIMPSON TIMBER BUNKER C	700 S 1ST ST	SHELTON	24	LUMBER AND WOOD PRODUCTS
PIERCE	35TH ST LANDFILL CITY FILL	S 35TH ST & PACIFIC AVE	TACOMA	5039	CONSTRUCTION MATERIALS, NEC
	Airo Services Inc	4110 11TH ST E	TACOMA	4789	TRANSPORTATION SERVICES, NEC
				4953	GARBAGE: COLLECTING, DESTROYING, PRO
	ASARCO DEMOLITION	52ND ST & BALTIMORE ST	TACOMA	3331	NONFERROUS METALS, SMELT/ REFINE
				3351	COPPER ROLLING, DRAWING, EXTRUDING
	ASARCO SMELTER	52ND ST & BALTIMORE ST	TACOMA	3331	NONFERROUS METALS, SMELT/ REFINE
				3351	COPPER ROLLING, DRAWING, EXTRUDING
	CAMAS PROPERTY	2926 S M ST	TACOMA	5171	PETROLEUM BULK STATIONS & TERMINALS
	CASCADE TIMBER 2	S TAYLOR WAY	TACOMA	24	LUMBER AND WOOD PRODUCTS
	CLOVER PARK SCHOOL DISTRICT HANGAR BLDG	9219 LAKEWOOD DR SW	LAKEWOOD	415	SCHOOL BUSES
	COSKI INDUSTRIAL DUMP	5403 PENDLE LANGE RD	TACOMA	4953	LANDFILL
	Cummins NW Inc	3701 PACIFIC HWY E	TACOMA	3799	TRANSPORTATION EQUIPMENT, NEC
	D ST PETROLEUM	3RD-7TH & D ST	TACOMA	29	PETROLEUM AND COAL PRODUCTS
	Discount Auto Repair &	1009 S 9TH ST	TACOMA	7532	TOP & BODY REPAIR & PAINT SHOPS

	Bodyworks			9999	NONCLASSIFIABLE ESTABLISHMENTS
	DORMAN TIRE YARD FIRE	35707 KINSMAN RD E	ROY	3011	TIRES & INNER TUBES
	EDDON BOAT PARK	3805 HARBORVIEW DR	GIG HARBOR	3732	BOAT BUILDING AND REPAIRING
	FREDERICKSON INDUSTRIAL PARK	6200 176 ST E & 18300 CANYON RD	PUYALLUP	2421	SAWMILLS & PLANING MILLS, GENERAL
				2491	WOOD PRESERVING
	Glenn Springs Holdings Inc	709 ALEXANDER AVE	TACOMA	29	PETROLEUM AND COAL PRODUCTS
				5171	PETROLEUM BULK STATIONS & TERMINALS
				9999	NONCLASSIFIABLE ESTABLISHMENTS
	HIDDEN VALLEY LANDFILL THUN FLD	17975 MERIDIAN S	PUYALLUP	01	AGRICULTURAL PRODUCTION-CROPS
				4953	LANDFILL
	INS CORRECTIONAL SERVICES CORP	1623 E J ST	TACOMA	9999	NONCLASSIFIABLE ESTABLISHMENTS
	JOHNSONS JEWELRY & GIFTS	103 S MERIDIAN	PUYALLUP	59	MISCELLANEOUS RETAIL
	KAPOWSIN ELEMENTARY SCHOOL	10412 264TH ST	GRAHAM	821	ELEMENTARY AND SECONDARY SCHOOLS
	KLEENBLAST DIVISION	1448 ST PAUL AVE	TACOMA	3291	ABRASIVE PRODUCTS
				5032	BRICK, STONE, & RELATED MATERIALS
				5039	CONSTRUCTION MATERIALS, NEC
	KURT CHRISTIANSEN PROPERTY	4521 PIONEER WAY E	TACOMA	1795	WRECKING AND DEMOLITION WORK
		4521 PIONEER WAY E	TACOMA	75	AUTO REPAIR, SERVICES, AND PARKING
	LEWIS AUTO WRECKING	6012 160TH ST SE	PUYALLUP	9999	NONCLASSIFIABLE ESTABLISHMENTS
	LUCKY LEOS CARWASH	4920 109TH ST SW	LAKEWOOD	7542	CARWASHES
	McFarland Cascade Pole & Lumber Co	1640 E MARC ST	TACOMA	2491	WOOD PRESERVING
	NATIONAL OIL DUMP	25TH & WILKESON	TACOMA	4953	LANDFILL
	Olson Brothers Chevrolet	5502 PT FOSDICK DR NW	GIG HARBOR	5511	NEW AND USED CAR DEALERS
	Pacific Functional Fluids LLC Tacoma	2244 PORT OF TACOMA RD	TACOMA	2911	PETROLEUM REFINING
				5093	SCRAP & WASTE MATERIALS
				5172	PETROLEUM PRODUCTS, NEC
				7389	BUSINESS SERVICES, MISCELLANEOUS
	Petroleum Reclaiming Service Inc	3003 TAYLOR WAY	TACOMA	2999	PETROLEUM AND COAL PRODUCTS, NEC
	PORT OF TACOMA	3400 TAYLOR WAY	TACOMA	3334	PRIMARY PRODUCTION OF ALUMINUM
				3355	ALUMINUM ROLLING & DRAWING, NOT ELSE

	Precision Tune 122nd Puyallup	10212 122ND ST E C	PUYALLUP	9999	NONCLASSIFIABLE ESTABLISHMENTS
	PSE BUCKLEY DEBRIS PILE FILL TERRACE BUR	NE OF BUCKLEY NEAR DIVERSION DAM	BUCKELY	4911	ELECTRIC SERVICES
				7999	AMUSEMENT AND RECREATION, NEC
	PUGET SOUND OIL CO	21716 ORVILLE RD E & FISK RD	ORTING	2999	PETROLEUM & COAL PRODUCTS
	REFLEX RECYCLING	2432 E 11TH ST	TACOMA	2911	PETROLEUM REFINING
				291	PETROLEUM REFINING
	Robert Rosch Property	30220 72ND AVE S	ROY	4953	RUBBISH COLLECTION & DISPOSAL
				9511	AIR, WATER, & SOLID WASTE MANAGEMENT
				9999	NONCLASSIFIABLE ESTABLISHMENTS
	SHEAR TRUCKING	26719 SR 410 E	BUCKLEY	421	TRUCKING & COURIER SERVICES, EX. AIR
				4212	LOCAL TRUCKING, WITHOUT STORAGE
				4214	LOCAL TRUCKING WITH STORAGE
	Shore Terminal LLC Valero LP	250 E D ST	TACOMA	4226	SPECIAL WAREHOUSING AND STORAGE, NEC
				5171	PETROLEUM BULK STATIONS & TERMINALS
				5172	PETROLEUM PRODUCTS, NEC
	SIMON & SONS TARPITS	2200 E RIVER ST	TACOMA	2999	PETROLEUM & COAL PRODUCTS
	SOUND MILL INC	2021 MARC AVE	TACOMA	2421	SAWMILLS & PLANNING MILLS, GEN
	SOUND TRANSIT SUMNER STATION	711 NARROW ST	SUMNER	4011	RAILROADS, LINE-HAUL OPERATING
	Stadium High School	111 N E ST	TACOMA	9999	NONCLASSIFIABLE ESTABLISHMENTS
	STANDARD CHEMICAL CO SITE FORMER	22ND ST & DOCK ST	TACOMA	28	CHEMICALS AND ALLIED PRODUCTS
	SUBURBAN MECHANICAL INC	99TH ST E & 10TH AVE E	TACOMA	1794	EXCAVATION WORK
				3531	CONSTRUCTION MACHINERY
	TACOMA COAL GASIFICATION	22ND ST & A ST	TACOMA	1311	COAL GASIFICATION
				29	PETROLEUM AND COAL PRODUCTS
	TACOMA METALS SITE	1919 PORTLAND AVE	TACOMA	3449	MISCELLANEOUS METAL WORK
				5093	SCRAP AND WASTE MATERIALS
				9999	NONCLASSIFIABLE ESTABLISHMENTS
	TACOMA REDEVELOPMENT PROP	THEA FOSS WATERWAY	TACOMA	2869	INDUS. ORGANIC CHEMICALS
	TRANSMISSION HOUSE	13417 PACIFIC AVE S	TACOMA	7537	AUTOMOTIVE TRANSMISSION REPAIR SHOPS

	Tvetens Lakewood Inc	10002 BRIDGEPORT WAY SW	TACOMA	7538	GENERAL AUTOMOTIVE REPAIR SHOPS
	UNION PACIFIC RR	1119 MILWAUKEE WAY	TACOMA	4011	RAILROADS, LINE HAUL OPERATING
	US ARMY RUSTON WAY MILITARY SITE	3000 N RUSTON WAY	TACOMA	3728	AIRCRAFT PARTS & AUXILIARY EQUIPMENT
	US ARMY WSMC Pier 23	401 ALEXANDER AVE	TACOMA	99	NONCLASSIFIABLE ESTABLISHMENTS
	USAF MAFB MTCA	62 CES CEV	MCCHORD AFB	4581	AIRPORTS, AIRFIELDS, AIR TERMINALS
				9711	NATIONAL SECURITY
	USAF MAFB WASHRACK	62ND CES CEV	MCCHORD AFB	4581	AIRPORTS, AIRFIELDS, AIR TERMINALS
				9711	NATIONAL SECURITY
	WA DOC McNeil Island Corrections Center	MCNEIL ISLAND CC	STEILACOOM	9223	CORRECTIONAL INSTITUTIONS
	WA DOT BRIDGEPORT WAY INTERCHANGE	12320 BRIDGEPORT WAY SW	TACOMA	5541	GASOLINE SERVICE STATIONS
	WA DOT STORAGE	S OF 38TH ST & SR 7	TACOMA	4226	SPECIAL WAREHOUSING AND STORAGE, NEC
	WA NATIONAL GUARD CAMP MURRAY	CAMP MURRAY BLDG 33	TACOMA	9711	NATIONAL SECURITY
	WEYERHAEUSER DUPONT 1	2301 CENTER DR	DUPONT	2892	EXPLOSIVES
				4953	LANDFILL
				6552	SUBDIVIDERS AND DEVELOPERS, NEC
SKAGIT	A Ave Landfill	A AVE & 37TH ST	ANACORTES	5093	SCRAP AND WASTE MATERIALS
				7999	AMUSEMENT AND RECREATION, NEC
	AMERICAN RECYCLING & MANUFACTURING	2045 BROWN RD	FERNDALE	1442	CONSTRUCTION SAND AND GRAVEL
	Anacortes Port	1019 Q AVE	ANACORTES	4491	MARINE CARGO HANDLING
				4493	MARINAS
				4581	AIRPORTS, FLYING FIELDS, & SERVICES
	ARTS AUTO WRECKING	23536 RIVER RD	SEDRO WOOLLEY	5015	MOTOR VEHICLE PARTS, USED
	CUSTOM PLYWOOD MILL	35TH & V ST	ANACORTES	2436	SOFTWOOD VENEER & PLYWOOD
				2436	SOFTWOOD VENEER & PLYWOOD
	FOREST ESTATES LANDFILL	SECTION ST & WOODLAND DR	MOUNT VERNON	4953	REFUSE SYSTEMS
	GLENNS DIESEL	14885 SR 9		7538	GENERAL AUTOMOTIVE REPAIR SHOPS
	HERBS MUFFLER & TUNE UP CENTER	224 W FERRY ST	SEDRO WOOLLEY	5541	GASOLINE SERVICE STATIONS
	His Place Community Church	1480 BURLINGTON BLVD	BURLINGTON	3714	MOTOR VEHICLE PARTS AND ACCESSORIES

				866	RELIGIOUS ORGANIZATIONS
	MARCH POINT LANDFILL	1/4 MI E OF BN WHITMARSH	ANACORTES	4953	LANDFILL
	MJB PROPERTIES	17TH-30TH ST & T AVE	ANACORTES	2611	PULP MILLS
				4493	MARINAS
	Motor Trucks Inc Mount Vernon	2501 HENSON RD	MOUNT VERNON	5511	NEW AND USED CAR DEALERS
				753	AUTOMOTIVE REPAIR SHOPS
	Padilla Heights Rd Property	9655 PADILLA HEIGHTS RD	ANACORTES	283	DRUGS
	PM Northwest Dump	PADILLA HEIGHTS RD OFF HWY 20	ANACORTES	4953	LANDFILL
	PORT OF ANACORTES	Q AVE & 15TH ST	ANACORTES	2611	PULP MILLS
	Scott Paper Mill Former	17TH-22ND ST & R AVE	ANACORTES	261	PULP MILLS
	SINNES ROAD LANDFILL	SINNES RD	MOUNT VERNON	5093	SCRAP AND WASTE MATERIALS
	SKAGIT COUNTY PORT	15400 AIRPORT DR	BURLINGTON	4581	AIRPORTS, FLYING FIELDS, & SERVICES
	TRIDENT SEAFOODS CORP 5TH ST & L AVE	5TH ST & L AVE	ANACORTES	2092	FISH PROCESSING FACILITY
SNOHOMISH	ARLINGTON CITY AIRPORT	18204 59TH AVE NE	ARLINGTON	4581	AIRPORTS, FLYING FIELDS, & SERVICES
				7999	AMUSEMENT AND RECREATION, NEC
	Boeing Everett	3003 W CASINO RD	EVERETT	3721	AIRCRAFT
	Bonneville Power Admin Snohomish	914 AVE D	SNOHOMISH	491	ELECTRIC SERVICES
				4911	ELECTRIC SERVICES
				9199	GENERAL GOVERNMENT, NEC
	Buse Timber & Sales Inc	3812 28TH PL NE	EVERETT	2421	SAWMILLS AND PLANING MILLS, GENERAL
				2491	WOOD PRESERVING
				5211	LUMBER & OTHER BLDG. MATERIALS DEALE
	EDMONDS PORT W DAYTON	120-190 W DAYTON ST	EDMONDS	8999	SERVICES, MISCELLANEOUS
	EVERETT CITY BOND STREET	BOND ST & KROMER AVE	EVERETT	4911	ELECTRIC SERVICES
				493	COMBINATION UTILITY SERVICES
	EVERETT LANDFILL TIRE FIRE	2900 36TH ST	EVERETT	4953	REFUSE SYSTEMS
	Former Bryant Property	MERIDIAN AVE N	ARLINGTON	88	PRIVATE HOUSEHOLDS
	GREAT NORTHERN BNRR TANK FARM	1621 MUKILTEO BLVD	EVERETT	5171	PETROLEUM BULK STATIONS & TERMINALS
	Hansens Towing	3813 & 3827 RUCKER	EVERETT	7532	TOP & BODY REPAIR & PAINT SHOPS

	AVE		5015	MOTOR VEHICLE PARTS, USED
HOFGESANG PROPERTY	9116 LAKEWOOD RD	STANWOOD	73	BUSINESS SERVICES
			88	PRIVATE HOUSEHOLDS
HOGLAND TRANSFER CO INC	3221 PAINE AVE	EVERETT	4214	LOCAL TRUCKING WITH STORAGE
James Auto Service	21000 70TH AVE W	EDMONDS	753	AUTOMOTIVE REPAIR SHOPS
JH Baxter & Co Arlington	6520 188TH ST NE	ARLINGTON	2491	WOOD PRESERVING
MARYSVILLE CITY WATERFRONT PARK	SW OF 1ST ST & STATE AVE	MARYSVILLE	35	INDUSTRIAL MACHINERY AND EQUIPMENT
MCCOLLUM PARK	128TH ST SE & 4TH DR SE	EVERETT	4953	REFUSE SYSTEMS
			7999	AMUSEMENT & RECREATION SERVICES-MISC
Old Mill Town Mall	201 5TH AVE S	EDMONDS	75	AUTO REPAIR, SERVICES, AND PARKING
Penske Truck Leasing Co LP Everett	3225 MCDOUGALL AVE	EVERETT	7513	TRUCK RENTAL AND LEASING, NO DRIVERS
PSE Everett Operating Facility	3630 RAILWAY AV	EVERETT	1311	COAL GASIFICATION
			3312	BLAST FURNACES, COKE OVENS
			4924	NATURAL GAS DISTRIBUTION
ROTARY PARK	LOWELL SNOHOMISH RIVER RD & S 1ST	EVERETT	2491	WOOD PRESERVING
SATHER MFG CO INC	3330 MCDOUGALL AVE	EVERETT	3321	GRAY AND DUCTILE IRON FOUNDRIES
SISCO LANDFILL	7500 WADE RD	ARLINGTON	4953	LANDFILL
Sno Isle Skills Center	9001 AIRPORT RD	EVERETT	8249	VOCATIONAL SCHOOLS
Snohomish Cnty Used Oil Collect	11020 19TH AVE SE	EVERETT	599	RETAIL STORES, NEC
			7539	AUTOMOTIVE REPAIR SHOPS, NEC
			9999	NONCLASSIFIABLE ESTABLISHMENTS
SNYDER ROOFING BROADWAY	20203 BROADWAY AVE	SNOHOMISH	5033	ROOFING, SIDING, & INSULATION
UNOCAL EDMONDS BULK FUEL TERM 0178	11720 UNOCO RD	EDMONDS	5093	SCRAP AND WASTE MATERIALS
			5171	PETROLEUM BULK STATIONS & TERMINALS
			5541	GASOLINE SERVICE STATIONS
US DFSP MUKILTEO	1 FRONT ST	MUKILTEO	9711	NATIONAL SECURITY
US DOJ DEA YTTRI WOZOW PROPERTY	9218 171ST AV SE	SNOHOMISH	9211	COURTS
US NAVY Station Everett	2000 W MARINE VIEW DR	EVERETT	3731	SHIP BUILDING AND REPAIRING
			9199	GENERAL GOVERNMENT, NEC
			9711	NATIONAL SECURITY
			9999	NONCLASSIFIABLE ESTABLISHMENTS

	WA AIR NATIONAL GUARD PAINE FLD N PARCEL	2701 112TH ST SW	EVERETT	9711	NATIONAL SECURITY
	WA DOT PARCEL 1-15780 LYNNWOOD	BETWEEN SR 525 & LAKE RD	LYNNWOOD	5012	AUTOMOBILES AND OTHER MOTOR VEHICLES
	Weyerhaeuser Paper Co Everett	515 E MARINE VIEW DR	EVERETT	242	SAWMILLS AND PLANING MILLS
	WOLFORD RECYCLING FACILITY	8624 219TH ST SE	WOODINVILLE	4212	LOCALTRUCKING WITHOUT STORAGE
SPOKANE	Appleway Chevrolet Inc	8500 E SPRAGUE AVE	SPOKANE	7538	GENERAL AUTOMOTIVE REPAIR SHOPS
	Avista Corp Dollar Rd	2406 N DOLLAR RD	SPOKANE	4225	GENERAL WAREHOUSING & STORAGE
	Avista Corp Dollar Rd	2406 N DOLLAR RD	SPOKANE	4939	COMBINATION UTILITIES, NEC
	BNSF Hillyard Lead Soil Site	4800 TO 5300 BLOCK N FERRALL ST	SPOKANE	4013	SWITCHING AND TERMINAL SERVICES
	BNSF Railway Black Tank Property	3202 E WELLESLEY	SPOKANE	4011	RAILROADS, LINE-HAUL OPERATING
	BROADWAY TRUCK STOP	6606 E BROADWAY AVE	SPOKANE	5541	GASOLINE SERVICE STATIONS
	Costco Wholesale 670	5601 E SPRAGUE AVE	SPOKANE	5331	VARIETY STORES
	FOUR LAKES TIRE FIRE FLTF	FOUR LAKES	FOUR LAKES	1442	CONSTRUCTION SAND & GRAVEL (QUARRY)
				4953	REFUSE SYSTEMS
	Inland Empire Paper	3320 N ARGONNE RD	SPOKANE	2621	PAPER MILLS
				4953	REFUSE SYSTEMS
	Midwest Pacific Resources	3808 N SULLIVAN RD BLDG N10	SPOKANE	3743	RAILROAD EQUIPMENT
	North Market St	N MARKET ST & FREYA ST	SPOKANE	291	PETROLEUM REFINING
				4613	REFINED PETROLEUM PIPELINES
				5171	PETROLEUM BULK STATIONS & TERMINALS
	SHERATON SPOKANE HOTEL PROPERTY	322 N SPOKANE FALLS CT	SPOKANE	70	HOTELS & OTHER LODGING PLACES
	Spokane City Central Park Maintenace Pro	809 N WASHINGTON ST	SPOKANE	7538	GENERAL AUTOMOTIVE REPAIR SHOPS
	SPOKANE COMMUNITY COLLEGE	2000 N GREEN ST	SPOKANE	8221	COLLEGES, UNIVERSITIES, PROFESSIONAL
	SPOKANE CONCRETE CUTTING INC	4114 E WELLESLEY AVE	SPOKANE	1541	INDUSTRIAL BUILDINGS AND WAREHOUSES

	SPOKANE INDUSTRIAL PARK G	3808 N SULLIVAN RD	SPOKANE	39	MISCELLANEOUS MANUFACTURING INDUSTRI
	Stockland Livestock Exchange	1004 N FREYA ST	SPOKANE	9999	NONCLASSIFIABLE ESTABLISHMENTS
	Texaco Former	322 W 7TH AVE	SPOKANE	5541	GASOLINE SERVICE STATIONS
	Unocal SS 2938	301 1ST ST	CHENEY	5541	GASOLINE SERVICE STATIONS
				9999	NONCLASSIFIABLE ESTABLISHMENTS
	US AF FAIRCHILD AFB	US HWY 2	SPOKANE	4581	AIRPORTS, FLYING FIELDS, & SERVICES
				9199	GENERAL GOVERNMENT, NEC
				9711	NATIONAL SECURITY
	USAF FAFB PR3	US HWY 2	SPOKANE	29	PETROLEUM AND COAL PRODUCTS
				3728	AIRCRAFT PARTS & AUXILIARY EQUIPMENT
				4952	SEWERAGE SYSTEMS
				753	AUTOMOTIVE REPAIR SHOPS
	WA WSU Academic Building Site	310 N RIVERPOINT BLVD	SPOKANE	8221	COLLEGES AND UNIVERSITIES
	Yellowstone Pipeline Otis Orchards	OTIS ORCHARDS	OTIS ORCHARDS	461	PIPELINES, EXCEPT NATURAL GAS
THURSTON	17936 LITTLEROCK ROAD SE DRUG LAB	17936 LITTLEROCK RD SE	ROCHESTER	99	NONCLASSIFIABLE ESTABLISHMENTS
	Aztec Technology Corp	19950 OLD HWY 99 SW	ROCHESTER	3792	TRAVEL TRAILERS AND CAMPERS
				76	MISC. REPAIR SERVICES
				9999	NONCLASSIFIABLE ESTABLISHMENTS
	CASCADE POLE INC MCFARLAND	1100 WASHINGTON ST	OLYMPIA	2491	WOOD PRESERVING
	CEDAR CREEK CORRECTIONS DNR	BORDEAUX RD	LITTLEROCK	2491	WOOD PRESERVING
	CITIFOR Inc	13120 TILLEY RD S	OLYMPIA	2892	EXPLOSIVES
				4953	LANDFILL
	DaPaul Inc	19444 IVAN ST	ROCHESTER	241	LOGGING
				75	AUTO REPAIR, SERVICES, AND PARKING
	FONES ROAD DITCH	1300 BLOCK FONES RD	OLYMPIA	4952	SEWERAGE SYSTEMS
	Hardel Mutual Plywood	1210 W BAY DR NW	OLYMPIA	2436	SOFTWOOD VENEER AND PLYWOOD
	INDUSTRIAL PETROLEUM DISTRIBUTORS	1117 W BAY DR NW	OLYMPIA	5171	PETROLEUM BULK STATIONS & TERMINALS
	JOHNS AUTO WRECKING	411 93RD AVE SE	OLYMPIA	5015	MOTOR VEHICLE PARTS, USED
	MINITRIE TIRE FIRE	16017 CASE RD SW	ROCHESTER	3011	TIRES & INNER TUBES

WALLA WALLA	Walla Walla City Burdine Property	2690 E ISAACS AVE	WALLA WALLA	4953	REFUSE SYSTEMS
WHATCOM	A & H Auto Dismantlers	1887 NEWKIRK RD	FERNDALE	5015	MOTOR VEHICLE PARTS, USED
	ALS SALVAGE	3525 Y RD	BELLINGHAM	5015	MOTOR VEHICLE PARTS, USED
				5093	SCRAP AND WASTE MATERIALS
	BC CORP	4809 GUIDE MERIDIAN	BELLINGHAM	283	DRUGS
				753	AUTOMOTIVE REPAIR SHOPS
	Bellingham Port Harris Ave Shipyard	201 HARRIS AVE	BELLINGHAM	3731	SHIP BUILDING AND REPAIRING
	BELLINGHAM PORT WELDCRAFT SITE	9 SQUALICUM WAY	BELLINGHAM	3732	BOAT BUILDING AND REPAIRING
	Blaine Shipyard	9088 SHIPYARD LANE	BLAINE	4482	FERRIES
	Blaine Shipyard	9088 SHIPYARD LANE	BLAINE	5171	PETROLEUM BULK STATIONS & TERMINALS
	BOULEVARD PARK	BAYVIEW DR	BELLINGHAM	1311	COAL GASIFICATION
				7999	AMUSEMENT & RECREATION SERVICES-MISC
	BURLINGTON NORTHERN RR ACME	BEHIND RESIDENCE AT END OF CHURCH RD	ACME	401	RAILROADS
	CHEVRON BELLINGHAM PORT	1020 C ST	BELLINGHAM	5171	PETROLEUM BULK STATIONS & TERMINALS
				9999	NONCLASSIFIABLE ESTABLISHMENTS
	Everson Cordage Works Inc	7180 EVERSON GOSHEN RD	EVERSON	2298	CORDAGE AND TWINE
				3552	TEXTILE MACHINERY
	EXXON MOBIL OIL CORP	908 10TH ST	BELLINGHAM	5171	PETROLEUM BULK STATIONS & TERMINALS
	FERNDALE LANDFILL	NEILSEN RD	FERNDALE	5093	SCRAP AND WASTE MATERIALS
	HOLLY ST LANDFILL	600 W HOLLY ST	BELLINGHAM	4953	REFUSE SYSTEMS
				7999	AMUSEMENT & RECREATION SERVICES-MISC
	Laurel Street Site	210 E LAUREL ST	BELLINGHAM	99	NONCLASSIFIABLE ESTABLISHMENTS
	Lavergne Property	1469 SUNSET AVE	FERNDALE	598	FUEL DEALERS
				88	PRIVATE HOUSEHOLDS
	Little Squalicum Park	MARINE VIEW DR	BELLINGHAM	494	WATER SUPPLY
	Mountain View Motors	5499 GUIDE MERIDIAN	BELLINGHAM	5093	SCRAP AND WASTE MATERIALS
	MT BAKER PRODUCTS	2929 ROEDER AVE	BELLINGHAM	2435	HARDWOOD VENEER AND PLYWOOD
				2436	SOFTWOOD VENEER AND PLYWOOD
				5031	LUMBER, PLYWOOD, AND MILLWORK

	NW TRANSFORMER HARKNESS	107 S HARKNESS ST	EVERSON	9999	NONCLASSIFIABLE ESTABLISHMENTS
	OLIVINE CORP HILTON AVE	HILTON AVE & ROEDER AVE	BELLINGHAM	3532	MINING MACHINERY & EQUIPMENT, EXCEPT
	RG HALEY INTL CORP	CORNWALL AVE N	BELLINGHAM	24	LUMBER AND WOOD PRODUCTS
	Westman Marine Inc	218 MCMILLAN AVE	BLAINE	373	SHIP AND BOAT BUILDING AND REPAIRING
				3732	BOAT BUILDING AND REPAIRING
WHITMAN	WA WSU LANDFILL	AIRPORT RD .25 MI FROM HWY 270	PULLMAN	4953	LANDFILL
YAKIMA	Tidricks Quality Transmission Inc	1802 S 1ST ST	YAKIMA	9999	NONCLASSIFIABLE ESTABLISHMENTS
	US ARMY Yakima Training Center	DENR BLDG 810	YAKIMA	2992	LUBRICATING OILS & GREASES
				3449	MISCELLANEOUS METAL WORK
				3568	MECHANICAL POWER TRANSMISSION EQUIPM
				3612	POWER, DISTRIBUTION, AND SPECIALTY T
				3621	MOTORS AND GENERATORS
				4953	REFUSE SYSTEMS
				7521	AUTOMOBILE PARKING
				7549	AUTOMOTIVE SERVICES, EXC. REPAIR & C
	YAKAMA JUICE LLC	1 RAILROAD AVE	SELAH	2033	CANNED FRUITS AND VEGETABLES

Appendix C: Unit Cost of Remediation

Ecology calculated the unit cost of remediation as the weighted average of individual remediation costs by remedial method. The individual remedial costs were determined using a model developed for Ecology by Landau Associates to estimate the cost of arsenic remediation. The similar means of remediation make the model ideal for estimating dioxin/furan remediation costs as well.

Remedial Methods

- Protective Measure A: Excavation and Offsite Disposal at a Subtitle C Landfill.
- Protective Measure B: In-Situ Capping with an Engineered Soil Cover.
- Protective Measure C: In-Situ Capping with a Vegetated Surface.
- Protective Measure D: In-Situ Capping with a Wood Chip Surface.
- Protective Measure E: Fencing.

Because they are common features of the baseline and the proposed rule, the cost estimates excluded additional investigation, design and planning, oversight and administrative costs, and contingency.

An additional sampling cost was included in all cost estimates, assuming:

- $700 cost per sample taken and analyzed.
- Ten samples per acre remediated.

This additional sampling cost was equivalent to $1.03306 per square yard.

Input values and specific parameters are outlined in Table C-1.

Table C-1: Unit Cost Input and Parameter Summary	
Input Values:	
Unit Area of Exposed Dioxin/Furan-Contaminated Soil at the Site (Acres)	1
Depth of Dioxin/Furan Contamination that Exceeds Cleanup Goals (ft)	0.25
Management Area Type: 1=Industrial/Commercial 2=Other Pre-Development 3=Other Post-Development	3
Calculated Total Soil Volume (yd3): density of soil: 1 yd3=1.5 ton	726
Calculated Total Tonnage (tons)	1089
Specific Parameters:	
For “Other Post-Development” Management Area, Percent Excavated by Hand (default 20%)	20%
Ex-Situ Capping, Consolidation of Soil (Default reduction to 33% of the original area)	33%
Indirect Costs, Excavation and Tilling Alternatives (default 42%)	42%
Indirect Costs, Capping Alternatives (default 42%)	42%
Mixing Factor (3 inches contamination equals 6 inches cleanup depth)	2

The resulting costs for these remedial actions are presented in Table C-2, below.

Table C-2: Cost Estimates by Remedial Method			
Method	**Total Cost (method alone)**	**Cost per Ton**	**Cost per Cubic Yard**
A: Excavation and Disposal at a Subtitle D Landfill	$128,000	$117.5	$176.3
B: In-Situ Capping with an Engineered Soil Cover	$73,000	$67.0	$100.6
C: In-Situ Capping with a Vegetated Surface	$13,000	$11.9	$17.9
D: In-Situ Capping with a Wood Chip Surface	$25,800	$23.7	$35.5
E: Fencing	$27,200	$25.0	$37.5

Weighting

Ecology calculated a weighted average of remedial unit costs in order to reflect a typical cleanup that would involve a mixed cleanup strategy. To maintain conservative estimates, the highest weight was placed on excavation and disposal of soils, as this unit cost was the largest. Table C-3 summarizes the unit costs estimated and assumed weights assigned to the five applicable remedial options.

Table C-3: Weighting Scheme for Weighted Average Remedial Cost per Cubic Yard		
Remedial Options Selected for final remedy	**Unit cost, $/yd^3**	**Remediation Portion, %**
A: Excavation and Disposal at a Subtitle D Landfill	$176	50%
B: In-Situ Capping with an Engineered Soil Cover	$101	30%
C: In-Situ Capping with a Vegetated Surface	$18	10%
D: In-Situ Capping with a Wood Chip Surface	$36	5%
E: Fencing	$37	5%

The weighting scheme is assumed based on Toxics Cleanup program experience applying the MTCA rule, and is both likely and relatively conservative in placing a higher weight on the most expensive remedial action.

The above weighting scheme generated Ecology's weighted average cost, per unit, of $124 per cubic yard of soil remediated.

Appendix D: Air Deposition Model Methodology

The EPA approved atmospheric dispersion modeling system was used as an air dispersion model to compute the 30-year total deposition of the dioxin/furan mixture emitted by a hypothetical pulp and paper mill and calculate the incremental surface area difference between two cleanup level alternatives.

Using data from the Rayonier Pt. Angeles mill to define the physical characteristics of the emissions, the steady-state, Gaussian air deposition model ISCST3 was run in flat topography with ten-year meteorological data sets from 17 airports in or near Washington State. The ISCST3 model computed the ten-year deposition of the dioxin/furan mixture at points within a user-defined domain for each meteorological data set. The modeled air deposition was used to compute the total toxicity equivalent concentration of the dioxin/furan mixture, as well as that for a single congener (2, 3, 7, 8-TCDD). Ecology used four dioxin/furan emission rates of 5, 10, 20, and 50 ug/s to develop tables of area with TEQ soil concentrations greater than 6.7, 17, 20, and 67 pg/g-soil

The inputs to the air deposition model included the following parameters:
* Particle scavenging coefficients;
* Emissions and stack data used in the modeling; and
* Particle size distribution,

Because no meteorological data were readily available at every mill sites, meteorological data for 17 airports were obtained from the archives of the Atmospheric Sciences Department at the University of Washington and suitably processed for use in ISCST3. Using a large number of reporting sites helped identify the variability in deposition produced by the different climatologies across the state.

The archived observations report the daily total precipitation once every 24 hours. Because deposition modeling requires an hourly precipitation amount, the precipitation was allocated equally to those hours with a relative humidity greater than 90 percent or to the hour with the highest relative humidity if no observations were greater than 90 percent.

Dispersion modeling also requires estimates of mixing height. Since this exercise was for a hypothetical mill and was to apply generally for all thirteen mills in the state, Spokane climatological mixing heights from the report by Holzworth (1971) were used. These mixing heights tend to be lower than heights reported for Seattle during winter days and spring, summer, and autumn mornings and will tend to produce somewhat higher values of deposition. EPA regulatory models do not use mixing height at night.

Ecology calculated the total deposition for each ten-year meteorological period on a regular grid of points with a 25-meter spacing for a domain 2 kilometers on a side centered at the point of emission. The thirty-year total deposition was calculated by multiplying the modeled ten-year deposition by three. The TEQ deposition rate was calculated using the WHO TEF (2005) and relative emission rates for the congeners for a typical pulp and paper mill.

Soil concentrations resulting from air deposition was based on assumed source strengths (stack emission rates) and an average weighted proportion for each of the 17 congeners to normalize the concentrations from the stack emissions. In consideration of the total mass associated with the different emission rates (5, 10, 20, and 50 ug/s), 1.2 to 69 mg TEQ per day was used to calculate the soil concentrations and contours. The mass 1.2 to 69 mg TEQ per day is approximately equivalent to 1μg / m^3 TEQ ~ 45 μg TEQ deposited onto soil.

Model output was processed to determine the number of meteorological data sets that the TEQ deposition exceeded each of the above levels of interest at each point. This processed output was written in a form suitable for input to a GIS program for display with population and other attributes in the vicinity of the pulp and paper mills in the state.

GIS Mapping: The results from the air deposition modeling was used in conjunction with GIS mapping program to determine different soil concentration contours from air deposition of hypothetical pulp and paper mill located in Washington State. The soil concentrations from the air deposition modeling were used to evaluate potentially exposed populations using census data from the year 2000 broken down by age and gender.

Appendix E: MTCA and Small Businesses

Previous analyses of the MTCA Cleanup Regulation established that the MTCA itself imposes disproportionate costs on small businesses. The initial SBEIS document developed for the creation of the MTCA in 1989 states, "the draft regulation does have a disproportional impact on small business," (Ecology, 1989)

The 2001 SBEIS reiterates this point, stating, "The principle finding of that analysis was that cleanup costs are proportional to business size—larger businesses have a larger sales base over which to spread regulatory costs...In this rule revision, more sophisticated methods are available to make risk assessment and risk management decisions, but these methods may not be as readily used by small business as large business because they are more complex and technical," (Ecology, 1999a).

While Ecology concluded no existing small businesses are affected by the proposed 2006 rule, it is plausible that in the future a small business could become responsible for funding cleanup on a current pulp mill site (through land acquisition, for example).

Hypothetical small businesses are not subject to an SBEIS. It is important to note, however, the numerous forms of existing regulatory relief provided to small businesses under the MTCA:

1. A remediation level that leaves hazardous substances at the site in concentrations above cleanup levels may be considered protective of human health and the environment.
2. Ecology accepts a wide variety of financial assurance mechanisms.
3. Ecology provides for technical consultations and assistance for independent remedial actions. Independent remediation is largely undertaken by small businesses, which are directly benefited by this provision.
4. Method A and Method B calculation of cleanup levels allows businesses flexibility in business decisions relating to remediation costs.
5. Assistance with remediation efforts is available through some State Toxics Control Account funds.
6. Ecology can facilitate resource sharing during data collection activities related to monitoring.
7. Ecology considers financial resources available to cleanup proponents for site remediation when deciding which cleanup proponents to pursue.
8. Ecology has a provision establishing an administrative process for issuing agreed orders that will help to mitigate the impacts of the proposed rule on small business.
9. Interim cleanup actions on a site may spread remediation costs over time, reducing the real (inflation-adjusted) cost of complete remediation.

These provisions, one the whole, mitigate the MTCA's disproportionate impact on small businesses. While the proposed rule is not expected to affect existing small businesses, the MTCA rule itself attempts to reduce regulatory threat to small business.

Appendix F: Cases for Ecological Evaluation

Case 1

Under the baseline, cleanup level is below ecological screening level.

(BL2 < EC)

Under the proposed rule, cleanup level is below the baseline cleanup level.

(PR < BL2 < EC)

Here, ecological evaluation is not necessary under the baseline or proposed rule.

Case 2

Under the baseline, cleanup level is above ecological screening level.

(EC < BL2)

Under the proposed rule, cleanup level is between ecological screening level and the baseline cleanup level.

(EC < PR < BL2)

Here, ecological evaluation is necessary under both the baseline and proposed rule.

Case 3

Under the baseline, cleanup level is above ecological screening level.

(EC < BL2)

Under the proposed rule, cleanup level is below the ecological screening level.

(PR < EC < BL2)

Here, ecological evaluation is only necessary under the baseline.