CONCISE EXPLANATORY STATEMENT
for the
Amendments
to the
The Model Toxics Control Act
Cleanup Regulation
Chapter 173-340 WAC

Prepared by:

Washington State Department of Ecology
Toxics Cleanup Program

February 12, 2001

Publication Number: 01-09-043

Table of Contents

List of Tables

List of Figures

List of Acronyms and Abbreviations

APA	Administrative Procedure Act
ARARs	Applicable or Relevant and Appropriate Requirements
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act – The federal Superfund law
CFR	Code of Federal Regulations
DOH	Department of Health
Ecology	Department of Ecology
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
GQ	Generalized Question
mg/Kg	milligrams per kilogram (same as ppm)
mg/L	milligrams per liter
MTCA	Model Toxics Control Act
PAC	Policy Advisory Committee
PLP	Potentially Liable Person
POG	TPH Project Oversight Group
PQL	Practical Quantitation Limit
ppm	parts per million (same as mg/Kg)
RCRA	Resource Conservation and Recovery Act
RCW	Revised Code of Washington
RME	Reasonable Maximum Exposure
RI/FS	Remedial Investigation/Feasibility Study
SEPA	State Environmental Policy Act
SSRA	Site-Specific Risk Assessment
TPH	Total Petroleum Hydrocarbons
µg/L	micrograms per liter
µg/Kg	micrograms per Kilogram
WAC	Washington Administrative Code
1999 Proposal	Proposed Rule Amendments filed on November 2, 1999
2000 Proposal	Proposed Rule Amendments filed on August 2, 2000.

Chapter 1 Introduction

1.1 Purpose

The Washington Administrative Procedure Act (APA) requires that an agency prepare a concise explanatory statement of the rule:

> (i) Identifying the agency's reasons for adopting the rule;
> (ii) Describing the differences between the text of the proposed rule … and the text of the rule as adopted, other than editing changes, stating the reasons for differences; and
> (iii) Summarizing all comments received regarding the proposed rule, and responding to the comments by category or subject matter, indicating how the final rule reflects agency consideration of the comments, or why it fails to do so.

RCW 34.05.325(6)(a). The concise explanatory statement must be prepared prior to final rule adoption and must be provided to any person upon request or from whom the agency received comment. RCW 34.05.325(6)(a), (b). This document constitutes the concise explanatory statement for the amendments to the Model Toxics Control Act Cleanup Regulation, chapter 173-340 WAC.

This document relies on documentation found in the rule-making file. This documentation includes, but is not limited to, several documents summarizing analyses conducted and determinations made in accordance with the specific requirements for significant legislative rules under RCW 34.05.328, including the APA Memorandum, the Estimates of the Probable Costs and Benefits (CBA), the Least Burdensome Alternative Analysis (LBA Analysis), and the Rule Implementation Plan**.**

1.2 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 purpose of MTCA is to prevent or remedy these threats to human health and the environment. As stated in MTCA's general declaration of policy, "[t]he main purpose of this act is … to clean up all hazardous waste sites and to prevent the creation of future hazards due to improper disposal of toxic wastes into the state's land and waters." Id.

To accomplish these statutory goals, MTCA requires Ecology to accomplish several objectives. The statute specifies those objectives in RCW 70.105D.030(2). 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." Id. Furthermore, MTCA requires Ecology to adopt, and thereafter enforce, rules under chapter 34.05 RCW to:

> (a) Provide for public participation…; [and]
> …
> (e) 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 U.S.C. Sec. 9621, and at least as stringent as all applicable state and federal laws, including health-based standards under state and federal law[.]

Id. 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.

MTCA also provides Ecology with the authority to accomplish several specific statutory objectives. These objectives are specified in RCW 70.105D.030(1) and include the following:

> (a) Investigate, provide for investigating, or require potentially liable persons to investigate any releases of hazardous substances, including but not limited to inspecting, sampling, or testing to determine the nature or extent of any release or threatened release…;
> (b) Conduct, provide for conducting, or require potentially liable persons to conduct remedial actions (including investigations under (a) of this subsection) to remedy releases or threatened releases of hazardous substances…. In conducting, providing for, or requiring remedial action, the department shall give preference to permanent solutions to the maximum extent practicable and shall provide for or require adequate monitoring to ensure the effectiveness of the remedial action;
> …

(d) Carry out all state programs authorized under the federal cleanup law and the federal resource, conservation, and recovery act, 42 U.S.C. Sec. 6901 et seq., as amended;
(e) Classify substances as hazardous substances…;
(f) Issue orders or enter into consent decrees or agreed orders that include deed restrictions where necessary to protect human health and the environment from a release or threatened release of a hazardous substance from a facility….;
(g) Enforce the application of permanent and effective institutional controls that are necessary for a remedial action to be protective of human health and the environment;
(h) Require holders to conduct remedial actions necessary to abate an imminent or substantial endangerment…;
(i) Provide informal advice and assistance to persons regarding the administrative and technical requirements of this chapter.… As part of providing this advice for independent remedial actions, the department may prepare written opinions regarding whether the independent remedial actions or proposals for those actions meet the substantive requirements of this chapter or whether the department believes further remedial action is necessary at the facility….; and
(j) Take any other actions as necessary to carry out the provisions of this chapter, including the power to adopt rules under chapter 34.05 RCW.

RCW 70.105D.030(1).

To achieve the general goals and specific objectives and requirements of MTCA, Ecology adopted the MTCA Cleanup Regulation, chapter 173-340 WAC. The rule was developed in two phases and adopted in 1990 and 1991 respectively.

1.3 MTCA Policy Advisory Committee Process (1995-1996)

In 1995, the legislature in HB 1810 established the MTCA Policy Advisory Committee (PAC) and directed it to provide advice to the legislature and Ecology on administrative and legislative actions to more effectively implement the goals and objectives of the MTCA.

The committee was comprised of 22 members representing a broad range of interests. These interest groups included the Legislature, local government, large and small business, agriculture, environmental organizations, financing institutions, ports, the Department of Ecology, the Department of Health, the environmental consulting industry, the MTCA Science Advisory Board, and the public at large. The PAC elected a chair and hired the services of a professional facilitator. The consensus report to the Legislature reflects the work of committee members representing the noted broad range of interests and substantial input from a consistently large and diverse group of non-members.

During 1995 and 1996, the PAC held 26 full committee meetings, and many more subcommittee meetings. All issues were discussed first in subcommittee, then brought to the PAC for information, discussion, and ultimately consensus or broad support recommendation. There were

four subcommittees, each chaired by a PAC member and comprised of PAC member representatives and interested members of the public:

- **Site-Specific Risk Assessment:** Considered issues related to risk assessment and its use under the MTCA.
- **Remedy Selection:** Considered procedures and criteria for selecting remedies at MTCA sites.
- **Independent Cleanup:** Considered issues related to independent cleanups under MTCA.
- **Implementation:** Considered issues related to rule implementation such as public participation, information management and decision making, liability, groundwater plume clause and budget issues.

Generally, at least one subcommittee or workgroup meeting occurred in preparation for issues to be considered at the next meeting of the PAC. At times, several such subcommittee meetings were necessary to fully discuss an issue in preparation for a recommendation to the PAC.

The PAC process was inclusive of public participation throughout with opportunities for public comment at each meeting and subcommittees also being open for attendance by the public. The PAC hosted a special meeting to discuss the public involvement requirements of the current rule and invited MTCA Regional Citizen Committee membership participation in this and other PAC meetings.

In December 1996, the PAC submitted its final report to the Legislature. The report included regulatory, statutory and guidance document recommendations. As a member of the PAC, Ecology endorsed these recommendations. The final report and related documentation is included in the rule-making file.

1.4 Duwamish Coalition's Total Petroleum Hydrocarbon Project Oversight Group (1996-1999)

The purpose of the Duwamish Coalition's TPH Project was to provide recommendations to Ecology regarding the evaluation of risks and the selection of cleanup actions for sites affected by complex mixtures of contamination with a petroleum-compound base, or what is referred to under current state regulations as Total Petroleum Hydrocarbons (TPH). A "site-specific" approach was needed for TPH, similar to what was available for other substances.

When the process for establishing cleanup standards was adopted as part of the MTCA Cleanup Regulation in 1991, the regulation established three methods for establishing cleanup levels – Method A, Method B, and Method C. The regulation established a straightforward process of setting cleanup levels for "individual chemicals." For TPH, however, it was difficult to derive cleanup levels using this newly established process since toxicity data was not available for complex mixtures such as TPH. In fact, very little was known to even use the risk assessment approach.

In an effort to facilitate TPH cleanups and the redevelopment of industrial properties, the Duwamish Coalition formed an intergovernmental partnership and project designed to work with the state to help evaluate TPH contaminated sites.

In 1994, the "National TPH Criteria Working Group" was formed to address the task of setting site-specific cleanup standards for petroleum. Ecology expressed a desire to participate and contribute. The Duwamish Coalition agreed to work with Ecology in this effort.

The Coalition is a broad-based partnership that includes more than 200 representatives of local and state government, local Native American Indian tribes, U.S. EPA Region 10, King County Labor Council, Port of Seattle, King County Airport, non-profit economic development agencies, small and large businesses, banks, residential, and environmental groups.

The Duwamish Coalition and the government jurisdictions that are partners in this project are interested in furthering redevelopment of vacant or underutilized industrial sites in the Duwamish industrial corridor. This type of redevelopment is necessary to the expansion of the industrial job base, and better use of existing industrial lands is essential to achieving growth management planning goals. Contamination issues are an important part of the redevelopment equation.

In January 1996, Ecology hosted two scoping meetings with the public, industry, the Duwamish Coalition, and the National TPH Criteria Working Group. From this, a "Project Oversight Group" (POG) was formed consisting of key staff from the Washington State Department of Ecology, the U.S. Environmental Protection Agency Region 10, King County, the Port of Seattle, and the Cities of Seattle and Tukwila. Other participants included technical specialists from the Department of Ecology, the Pollution Liability Insurance Agency, industry, U.S. Naval Laboratories, project consultants, and others. In mid-1996 an interagency Memorandum of Agreement governing the actions of the POG was signed.

In April 1996, four public meetings with interested groups (including environmental consultants, electric utilities, and environmental groups) were held to solicit input on the scope of the work being undertaken by the POG. From the input received, a "framework" was developed using the ASTM "RBCA" (Risk-Based Corrective Action") model as a guide. As required by the Memorandum of Agreement, this "framework" was consistent with the requirements of the Model Toxics Control Act and its implementing cleanup regulation. It was not the intent of the Project Oversight Group to change MTCA policy. Instead, this Project Oversight Group incorporated the technical approaches of the ASTM, the National TPH Criteria Working Group and others into a methodology for deriving TPH cleanup levels under the Model Toxics Control Act. In May 1996, a meeting of over 100 people was held to present the framework and solicit further discussion.

After a series of meetings and submittal of proposals, the Foster Wheeler Environmental Corporation was hired by the POG to provide technical development work. One of their important qualifications was their expertise in the ASTM Risk-Based Corrective Action process. Foster Wheeler developed recommendations on such issues as risk-based screening levels, indicator chemicals, ecological standards, and exposure pathway analysis.

It was soon clear that the most significant pathway of concern for much of the TPH and its constituents would be the leaching pathway. An intensive effort was made to quantify this pathway through modeling. The science associated with this issue has been greatly advanced due to the input that Ecology has received from the POG, the MTCA Science Advisory Board (SAB), the Pollution Liability Insurance Agency, state universities, local governments, environmental consultants, and other states.

After over a hundred meetings, the POG submitted its final report in April 1999. The final report and related documentation are included in the rule-making file.

The POG played an important role in the review of draft documents related to the development of TPH cleanup levels prepared as part of the rule-making process. Non-Ecology members of the POG discussed these changes with Ecology and made recommendations. Many of the recommendations were accepted by Ecology and incorporated into the proposed rule amendment.

1.5 Negotiated Rule-Making Process (1997 - 2001)

Ecology is currently proposing to adopt amendments to the MTCA Cleanup Regulation. These amendments reflect changes developed through a negotiated rulemaking process that began in 1997. The proposed rule amendments were developed in response to:

- The recommendations of the MTCA Policy Advisory Committee (PAC);
- The recommendations of the MTCA Science Advisory Board (SAB);
- The recommendations of the Duwamish Coalition's Total Petroleum Hydrocarbon (TPH) Project Oversight Group (POG);
- The statutory requirement in RCW 70.105D.030(2)(d) that Ecology publish and periodically update minimum cleanup standards for remedial actions;
- The regulatory requirement in WAC 173-340-702(3) that Ecology review and, as appropriate, update cleanup standards every five years based on new scientific information and changes in other state and federal laws;
- The amendment of the Model Toxics Control Act;
- The statutory objective in the Administrative Procedure Act (RCW 34.05.230) that agencies convert long-standing interpretative and policy statements into rules; and
- The need to clarify and improve the readability of the rule.

To facilitate the negotiated rule-making process, Ecology established the MTCA External Advisory Group (EAG). The EAG included 20 members that represented the same interest groups that were represented on the PAC (except the legislature). The EAG also included a facilitator under contract to Ecology. The process began with a meeting on April 27, 1997. Eight meetings were held to discuss issues related to the development of the proposed rule amendments, including the recommendations of the MTCA Policy Advisory Committee (PAC), the Duwamish Coalition's TPH Project Oversight Group (POG), and the Science Advisory Board (SAB). Meeting topics included: site-specific risk assessment; terrestrial ecological evaluation;

total petroleum hydrocarbons; vapor exposure pathway; changes in the protection of ground water for drinking water purposes; and replacing one-hundred-times (100x) ground water with a scientific model that is based on the fate and transport of contaminants from soil to water.

On February 14, 1998, a discussion draft of the proposed rule amendments was distributed to the EAG, POG, and staff at Ecology and the Office of the Attorney General. Members of the EAG and POG shared this draft with the constituents they represented. Sixteen commentors submitted comments on the draft proposal. Comments were submitted by members of the EAG and the POG, as well as the public. After careful consideration and review of the comments submitted, Ecology identified issues where significant conceptual differences among commentors remained. From July through November 1998, meetings with the members of the EAG were held to address and attempt to reach a consensus regarding the outstanding issues. A mediator under contract to Ecology was used to mediate this process.

On December 14, 1998, a draft of the proposed rule amendments was made available for public review and comment. Three public meetings (workshops) were held from January 5th through 6th the following year to discuss the proposed rule amendments. Sixty-seven commentors submitted comments on the draft proposal. Comments were submitted by members of the EAG and the POG, as well as the public. An additional meeting was held for EAG members on May 6, 1999. Throughout this period, Ecology also continued to receive input from the members of the EAG.

After careful consideration and review of the comments received, Ecology revised the amendments. On November 2, 1999, Ecology filed with the Office of the Code Reviser proposed amendments to the Model Toxics Control Act Cleanup Regulation (chapter 173-340 WAC). These proposed rule amendments were published on November 17, 1999, in the Washington State Register, Issue #99-22. The proposed rule amendments were subject to a sixty-day formal comment period. Six public hearings were held where participants were briefed and afforded an opportunity to provide comment. Sixty-one commentors responded with comments during the public comment period.

The following documents were made available at the time the 1999 proposal was filed: Small Business Economic Impact Statement, Draft Environmental Impact Statement, and the Terrestrial Ecological Evaluation Pilot Study Report. These documents were included in a mailing of the amendments to nearly 400 interested persons. A notice of the availability of the proposed rule and companion documents was sent to another 400 individuals who had requested such notification.

On April 18, 2000, Ecology filed a notice of withdrawal of these proposed rule amendments with the Office of the Code Reviser.

After careful consideration and review of the comments received, Ecology revised the amendments. On August 2, 2000, Ecology filed with the Office of the Code Reviser proposed amendments to the Model Toxics Control Act Cleanup Regulation (chapter 173-340 WAC). These proposed rule amendments were published on August 16, 2000, in the Washington State Register, Issue #00-16. The proposed rule amendments were subject to a thirty-day formal

comment period. The public comment period was extended to October 27, 2000, to provide an opportunity for the public to review within the public comment period the Preliminary Draft of the Estimates of the Probable Costs and Benefits of the Proposed Rule Amendments, which was made available on October 12, 2000. Two public hearings were held where participants were briefed and afforded an opportunity to provide comment. Fifty-eight commentors responded with comments during the public comment period.

The following documents were made available at the time the 2000 proposal was filed: Briefing Paper, Document Highlighting Changes to the 1999 Proposed Rule Amendments, and the Small Business Economic Impact Statement. These documents were included in a mailing of the amendments to nearly 400 interested persons. A notice of the availability of the proposed rule and companion documents was sent to another 400 individuals who had requested such notification. The Preliminary Draft of the Estimates of the Probable Costs and Benefits was subsequently made available on October 12, 2000.

1.6 MTCA Science Advisory Board

The MTCA Science Advisory Board (SAB) was established by Ecology pursuant to RCW 70.105D.030(4) to render advice to Ecology with respect to the hazard ranking system, cleanup standards, remedial actions, deadlines for remedial actions, monitoring, and the classification of hazardous substances. The SAB was asked to participate as a member of the MTCA Policy Advisory Committee (PAC). In this role, they advised the committee about the scientific implications of policy recommendations being discussed by the committee.

The SAB, as a member of the PAC, provided guidance to the Committee with regard to best available science. During the development of the proposed rule amendments, the SAB met often to advise Ecology on a range of issues including: fate and transport models, terrestrial ecological evaluations, dermal pathway, ground water cleanup levels, and toxicity equivalence factors. The SAB consists of five experts representing different areas of expertise such as environmental engineering, soil to ground water fate and transport, petroleum issues, terrestrial ecological risk assessment and human health risk. They also represented different sectors, such as academia and environmental consulting.

The Board utilized subcommittees to assist in analysis of topics related to Terrestrial Ecological Risk Assessment and Soil to Ground Water Fate and Transport. The subcommittees were chaired by an SAB member and comprised of a panel of scientists with topical expertise. These committees reported to the Board, who in turn provided advice to Ecology. Formal letters were ultimately submitted by the SAB to Ecology. Documentation of issues considered and advice rendered by the SAB as part of the rule-making process are referenced in the rule-making file.

1.7 Public Involvement Process

Ecology conducted an intensive public involvement and outreach effort throughout the development of the proposed rule amendments. Ecology strove to meet the information needs of the general public and the desire of the public for inclusion throughout the process. Policy

Advisory Committee, External Advisory Group, and Science Advisory Board meetings were open to public attendance and provided the public with an opportunity for comment. Numerous information meetings and public hearings were offered. Presentations were made to individual groups as requested, including the Regional Citizens Advisory Committees and environmental interest groups. Ecology also met individually with representatives of the Yakima Indian Nation. Both informal and formal public comment periods were provided. Informational materials were developed and updated throughout the development of the proposal.

1998 Draft

On December 14, 1998, Ecology made available for informal public review and comment a draft of the proposed rule amendments. The following three public workshops were held in January 1999:

January 5, 1999
1:00 p.m. – 4:00 p.m.
Mountaineers Building, Pinnacle Room
300 Third Avenue West
Seattle, WA

January 6, 1999
6:00 p.m. – 8:00 p.m.
Washington State Department of Ecology
Eastern Regional Office
N. 4601 Monroe, Suite 100
Spokane, WA

January 5, 1999
6:00 p.m. – 8:00 p.m.
Denny Park Administration Building
Parks Board Room
100 Dexter Ave N.
Seattle, WA

Sixty-seven commentors responded with comments on the 1998 draft rule amendments.

1999 Proposal

On November 2, 1999, Ecology filed with the Office of the Code Reviser proposed amendments to the Model Toxics Control Act (MTCA) Cleanup Regulation (chapter 173-340 WAC), Public Participation Grants (chapter 173-321 WAC), and Remedial Action Grants (chapter 173-322 WAC). These proposed rule amendments were published on November 17, 1999, in the Washington State Register, Issue #99-22. The proposed rule amendments were subject to a sixty-day formal comment period. Sixty-one commentors responded with comments during this period.

1999 Proposal – Focus Sheets

Ecology published several focus sheets to describe proposed rule changes for each of the major issue areas including:

- Proposed Changes to the MTCA Cleanup Regulation
- Risk Assessment

- Petroleum Cleanups
- Terrestrial Ecological Evaluation
- Institutional Controls
- Remedy Selection
- Public Participation Grants and Remedial Action Grants and Loans
- Deriving Soil Cleanup Levels for Groundwater Protection

1999 Proposal – Public Hearings

Six public hearings were held on the 1999 proposal. Printed notice of hearing dates was direct-mailed to over 800 citizens, environmental organizations, and special interest groups. The mailings were based on lists of interested persons maintained by the Toxics Cleanup Program. Notices of the public hearings were also advertised by display ad or legal notice in local newspapers in the cities where the hearings were conducted. Newspapers utilized include the Columbian (Vancouver); SeattleTimes/Post Intelligence (Seattle); Spokesman Review (Spokane); News Tribune (Tacoma); Yakima Herald (Yakima).

The following public hearings were held on the 1999 proposal:

December 9, 1999
6:00 p.m.
Washington State University
Satellite Room SS129
14204 Salmon Creek Avenue
Vancouver, WA

December 14, 1999
1:30 p.m.
Mountaineers Building
Tahoma Room
300 Third Avenue West
Seattle, WA

December 14, 1999
6:00 p.m.
Denny Park Administrative Building
Parks Board Room
100 Dexter Ave N.
Seattle, WA

December 15, 1999
6:00 p.m.
Washington State Department of Ecology
Eastern Regional Office
N. 4601 Monroe, Suite 202
Spokane, WA

December 16, 1999
6:00 p.m.
Washington State Department of Ecology
Central Regional Office
15 West Yakima Avenue, Suite 200
Yakima, WA

January 4, 2000
10:00 a.m.
Waste Water Treatment Plant
Transmission Room
2201 Portland Avenue
Tacoma, WA

2000 Proposal

On August 2, 2000, Ecology filed with the Office of the Code Reviser proposed amendments to the Model Toxics Control Act (MTCA) Cleanup Regulation (chapter 173-340 WAC), Public Participation Grants (chapter 173-321 WAC), and Remedial Action Grants (chapter 173-322 WAC). These proposed rule amendments were published on August 16, 2000, in the

Washington State Register, Issue #00-16. The proposed rule amendments were subject to a thirty-day formal comment period, which was subsequently extended 42 days to October 27, 2000, resulting in a 72-day formal comment period. Fifty-eight commentors responded with comments during this period.

2000 Proposal – Public Hearings
Two public hearings were held on the 2000 proposal. Printed notice of hearing dates was directly mailed to over 800 citizens, environmental organizations, and special interest groups. The mailings were based on lists of interested persons maintained by the Toxics Cleanup Program. Notices of the public hearings were also advertised by display ad or legal notice in local newspapers in the cities where the hearings were conducted. Newspapers utilized include the Columbian (Vancouver); SeattleTimes/Post Intelligence (Seattle); Spokesman Review (Spokane); News Tribune (Tacoma); Yakima Herald (Yakima).

The following public hearings were held on the 2000 proposal:

September 6, 2000
6:00 p.m.
Mountaineers Building
Pinnacle Room
300 Third Avenue West
Seattle, WA

September 7, 2000
6:00 p.m.
Washington State Department of Ecology
Eastern Regional Office
N. 4601 Monroe St., Suite 100
Second Floor Conference Room
Spokane, WA

1.8 Organization and Format of the Concise Explanatory Statement

The Concise Explanatory Statement (CES) is organized based on the structure of the MTCA Cleanup Regulation. The CES provides a brief overview of the amendments of each section of the regulation at the beginning of each section of the CES. For each of those sections of the regulation, the CES then responds to comments received on those sections.

The CES responds to comments received on both the 1999 proposal and the 2000 proposal. Comments were received in writing and transcribed from oral testimony provided at the public hearings. Sixty-one commentors submitted comments on the 1999 proposal. Fifty-eight commentors submitted comments on the 2000 proposal. Ecology reviewed these comments and identified 2,100 separate comments. Please note that these comments incorporate by reference any attachments.

The CES primarily responds to the identified comments in a question and answer format. The 2,100 comments were numbered and grouped into several generalized questions**.** Each of the generalized questions corresponds to a section or subsection of the rule and reflects a particular issue raised by one or more of the commentors. The numbered comments addressed by each of the generalized questions are listed in parentheses below the respective question. Ecology's

response to those comments follows. Note that some comments are addressed by and appear under more than one generalized question

The CES also responds to some comments in a table format at the end of each section of the CES. The table identifies the comment ID, the commentor, the section of the rule commented upon, the comment, and the response to the comment. Note that several responses indicate that the comment has been addressed in the 1999 proposal, the 2000 proposal, or the adopted rule amendments. This means that the rule language has been amended as appropriate in response to the comment(s).

Appendix A – Document Highlighting Differences between the Proposed Rule Amendments and the Adopted Rule Amendments presents the text of the proposed rule amendment. This document highlights the language in the 2001 adopted rule amendments that differs from the language in the 2000 proposed rule amendments.

Appendix B – Comments on the 1999 Proposal presents the text of the comments received on the 1999 proposal. Sixty-one commentors submitted comments on the 1999 proposal. Ecology reviewed these comments and identified 1,435 separate comments. These individual comments are identified with a unique "comment ID," which is indicated in the left-hand margin of each page. Note that the "comment IDs" associated with the comments on the 1999 proposal begin with 1 and end with 1,435.

Appendix C – Comments on the 2000 Proposal presents the text of the comments received on the 2000 proposal. Sixty-one commentors submitted comments on the 2000 proposal. Ecology reviewed these comments and identified 665 separate comments. These individual comments are identified with a unique "comment ID," which is indicated in the left-hand margin of each page. Note that the "comment IDs" associated with the comments on the 2000 proposal begin with 2,001 and end with 2,665.

Appendix D – Calculations for Method A Cleanup Levels provides background information and calculations leading to the Method A soil and ground water cleanup levels in Tables 720-1, 740-1, and 745-1.

Chapter 2 Rule-Making Process

Several comments were received regarding the rule-making process. These comments are listed and addressed below.

(1, 7, 19, 28, 37, 170, 327, 328, 358, 359, 360, 556, 557, 558, 563, 566, 567, 568, 573, 579, 580, 582, 583, 584, 667, 673, 699, 700, 701, 702, 703, 704, 705, 706, 707, 718, 806, 822, 823, 824, 902, 911, 912, 924, 925, 926, 936, 937, 946, 993, 1070, 1097, 1098, 1099, 1100, 1101, 1102, 1103, 1105, 1114, 1167, 1172, 1173, 1174, 1183, 1184, 1186, 1187, 1191, 1213, 1291, 1292, 1295, 1299, 2005, 2014, 2021, 2022, 2023, 2033, 2113, 2114, 2115, 2198, 2335, 2336, 2346, 2347, 2356, 2357, 2359, 2365, 2367, 2369, 2370, 2476, 2481, 2489, 2491, 2492, 2493, 2497, 2499, 2581, 2582, 2583, 2584, 2604, 2619, 2660)

GQ 2.1.1
Has Ecology complied with the rule-making procedures specified in chapter 34.05 RCW (Administrative Procedure Act) in conducting this rule-making action?

Response:
Ecology has complied with the rule-making procedures specified in chapter 34.05 RCW (Administrative Procedure Act) in conducting this rule-making action. An overview of the history of this rule making process, including a description of the public involvement process, is provided in **Chapter 1** of this document. The Administrative Procedure Act (APA) specifically requires that an agency make several determinations before adopting significant legislative rules. RCW 34.05.328(1). These determinations have been made and are documented in the APA Memorandum. This memorandum relies on documentation in the rule-making file. As required by RCW 34.05.328(2), the rule-making file contains documentation of sufficient quantity and quality so as to persuade a reasonable person that the determinations in RCW 34.05.328(1) are justified. These documents include, but are not limited to, the Rule Authorization Document, the Estimates of the Probable Costs and Benefits, the Least Burdensome Alternative Analysis, and the Rule Implementation Plan.

GQ 2.1.2
Has Ecology appropriately implemented the recommendations of the MTCA Policy Advisory Committee (PAC)?

Response:
Ecology believes that it has appropriately implemented the recommendations of the MTCA Policy Advisory Committee (PAC) in accordance with the statutory rule-making procedures. An overview of the PAC process is provided in **Chapter 1** of this document. The PAC made several recommendations to more effectively implement the goals and objectives of MTCA, including recommendations to the legislature for statutory changes and recommendations to Ecology for regulatory changes. The members of the PAC recognized that adopting any of the proposed amendments to the MTCA Cleanup Regulation would be subject to the rule-making procedures specified in the Administrative Procedure Act (APA) (see Final PAC Report, p. 59). The

members of the PAC further recognized that "the rulemaking process will proceed with broad public input, agency analysis, and legal review" (Final PAC Report, p. 59). Several commentors raised specific issues regarding whether Ecology appropriately implemented specific PAC recommendations. These issues are addressed throughout the remainder of the main text of this document.

GQ 2.1.3
Has Ecology achieved the goals of this rule-making action of making the MTCA Cleanup Regulation fairer, easier to understand, more flexible, less ambiguous, and less expensive?

Response:
The development of the amendments involved the consideration and balancing of a number of issues and interests. The proposed amendments were also developed to satisfy several, sometimes conflicting, regulatory goals, including the following:

- Providing for the selection of cleanup actions that are protect human health and the environment;
- Developing scientifically and legally defensible cleanup standards;
- Providing consistent standards and methodologies for assessing and managing risks;
- Providing flexibility to address site-specific factors;
- Promoting efficient and cost-effective cleanup of contaminated sites;
- Providing enhanced opportunities for public involvement; and
- Improving the clarity and usability of the rule.

Ecology believes that the proposed rule amendments more effectively achieve these goals within the existing framework of the rule. In particular, the amendment reflects the principle of constrained flexibility. Throughout the amendment, Ecology has attempted to balance the preference for flexibility to address site-specific conditions with the need to establish consistent, objective and enforceable requirements and standards that ensure the protection of human health and the environment. This principle of “constrained flexibility” is consistent with regulatory goals previously defined by Ecology for implementing MTCA:

> An important objective of the proposed amendments is to increase the efficiency of site cleanup. In particular, the proposed amendments represent an attempt to reduce the amount of flexibility in the present system which serves to heighten uncertainty rather than predictability by resolving fundamental policy issues. In doing so, Ecology hopes to create a system which focuses available funds on site cleanup and minimizes cleanup standard negotiation or litigation… In developing the proposed amendments, Ecology has tried to balance the goals of regulatory consistency and efficiency with the need to provide some flexibility to address individual site characteristics.

1991 RS, pp. 8-9. Compared to unconstrained flexibility, constrained flexibility increases the certainty that the cleanup achieves the statutory goal of protecting of human health and the environment. By resolving fundamental policy issues through the adoption of regulatory standards, constrained flexibility also increases the efficiency of site cleanup by reducing the

amount of unconstrained flexibility in the present system – such unconstrained flexibility serving to heighten uncertainty rather than predictability. Compared to inflexible standards, the approach of constrained flexibility preserves the flexibility to address individual site conditions.

Examples of rule amendments that implement the principle of constrained flexibility include the requirements and procedures for conducting terrestrial ecological evaluations; the requirements and procedures for evaluating the leaching, dermal, and vapor pathways to establish soil cleanup standards, and the requirement of financial assurances. Note that the complexity also reflects advances in scientific knowledge of how exposure occurs at contaminated sites and how contaminants move in the environment (e.g., dermal (skin) contact, vapor exposure, and leaching of contaminants).

Several amendments were also made specifically to improve the clarity and usability of the rule. Amendments included not only the reorganization of several sections and subsections, but also amendments of particular provisions to improve the clarity and reduce the ambiguity of those provisions. Many amendments were made based on comments received on earlier proposals to further improve the clarity and usability of the rule.

GQ 2.1.4
How do the rule amendments effect specific sites?

(574, 1081, 1084, 1085, 1086)

Response:
A number of site-specific examples were submitted to illustrate the commentor's view of what the amended rule should specifically not allow. The issues raised by the commentors through these illustrations were considered during the rule-making process as appropriate. Some of the issues raised are addressed in this document. See, e.g., GQ 3.2.1 regarding the issue of what constitutes "clean soil." However, please note that the purpose of this Concise Explanatory Statement is not to address site-specific issues.

Chapter 3 Overall Cleanup Process and Definitions (Parts I & II)

3.1 Overall Cleanup Process (Part I)

Several amendments were made to Part I of the regulation to improve the clarity and usability of the regulation and are not intended to change the meaning of the language. More significant amendments were made to WAC 173-340-130. These amendments include revision of the discussion to technical assistance to reflect the amendment of MTCA; revision of and moving the definition of "routine cleanup action" to WAC 173-340-200; and the addition of a new subsection describing compliance with SEPA requirements. No amendments were made to WAC 173-340-110.

GQ 3.1.1
Comments regarding Part I of the regulation are addressed in the following table:

Comment ID	Section	Comment	Response
998, Kluck	100	Requested availability of materials through the internet.	Comment noted.
1243, Gillett	100	Suggested editing change.	Comment addressed in 2000 proposal.
365, Rasmussen	120(2)(a)	Expressed concern regarding deletion of sentence pertaining to reporting current releases.	Comment addressed in 2000 proposal by restoring the current rule language.
366, Rasmussen 2624, Wisness	120(3)(a)	Requested criteria for determining whether a site requires no further action after conducting a site hazard assessment	See Chapter 4 of the CES.
367, Rasmussen 2625, Wisness	120(8)(b)	Requested clarification of when discovered releases should be reported.	See Chapter 4 of the CES.
1018, Kluck	120(9)	Independent remedial actions be should be subject to the public notice and participation requirements specified in WAC 173-340-600 just as any other remedial action.	See Chapter 7 of the CES.
1244, Gillett	130(7)(b)	Suggested editing change.	Comment addressed in 2000 proposal.
182, Gillett	130(8)	Clarify that independent remedial actions, including nonbinding technical opinions, generally do not involve a major action by Ecology triggering SEPA requirements.	The MTCA Cleanup Regulation does not specify whether any particular type of action requires compliance with SEPA. See Chapter 197-11 WAC for the SEPA requirements pertaining to implementation of MTCA.

3.2 Definitions and Usage (Part II)

Several amendments were made to WAC 173-340-200. The majority of these amendments were proposed to clarify the existing definitions and are not intended to change the meaning. Some of

the definitions in the current rule that were determined not to be necessary have been eliminated or combined with other definitions. The amendments include several new definitions to reflect the addition of new terms or to provide additional clarity regarding existing terms.

GQ 3.2.1 Definitions

Ecology received numerous comments that addressed one or more of the definitions in WAC 173-340-200. The comment(s) on each definition are addressed in the following table.

Comment ID	Comment	Response
"Acute Toxicity"		
1143, Kenefick	Definition should specify a time frame.	Comment refers to an existing definition that has not been amended. Ecology believes the current definition appropriately incorporates a wide-range of potential time frames.
"Area Background"		
415, Allen	Definition should include specific discussion of non-localized anthropogenic sources of PCB's and radionuclides.	Comment refers to an existing definition that has not been amended. Ecology believes the current definition appropriately captures the broad range of area background sources.
"Aromatic Hydrocarbons" and "Aliphatic Hydrocarbons"		
81, POG 2241, POG	Suggested technical changes for purpose of clarification.	Comment addressed in 2000 proposal and adopted rule. Comment was withdrawn.
"Carcinogen"		
2564, White	Suggested editing change for purpose of clarification.	The proposed clarification is not required. The current language reflects the intent set forth in the comment.
"Cleanup Action" and "Cleanup Action Alternative"		
185, Gillett	Definition of "Cleanup Action Alternative" should be eliminated and incorporated into definition of "cleanup action."	Comment addressed as appropriate in 2000 proposal.
"Cleanup Level" – See also Chapter 5.		
1159, Herbst 1161, Herbst	Definition should clarify that soil that meets cleanup levels is not "clean soil" to avoid possible misconception.	It is important to note that the definition of cleanup levels includes the concentration of a hazardous substance in the soil that is determined to be protective of human health and the environment under specified exposure conditions. The use of these soil cleanup levels for purposes other than that specified under the cleanup regulation (to identify, investigate and clean up facilities where there has been a release or threatened release of a hazardous substance) may not be appropriate
"Cleanup Standards" – See also Chapter 5.		
594, K. Johnson 1301, McCain	The term should incorporate the concept of remediation levels. Remediation levels are cleanup levels.	Ecology disagrees. Remediation levels are not cleanup levels. See Chapter 5 of the CES for further discussion of this issue.
"Cohen's Method" and "Land's Method"		
416, Allen 418, Allen	Suggests alternate reference source.	The reference cited in the rule is the original source and Ecology believes that this is the appropriate reference to include in the rule.

595, K. Johnson	Definitions related to statistical treatment of analytical data that have been added to the rule should be deleted. The rule should not preclude the use of alternative approaches.	The specification of a standard approach requires the inclusion of definitions. However, the rule does not preclude the use of alternative statistical approaches.
"Conceptual Site Model"		
186, Gillett	The term should not include consideration of potential exposure pathways.	Ecology disagrees. The protection of human health and the environment requires consideration not only of existing exposure pathways (actual exposures), but also potential exposure pathways (potential future exposure) and how such exposure may impact future resource use. The fact that an exposure pathway has not yet been "completed" does not mean that it may not be in the future. It is common practice to include potential exposure pathways in conceptual site models and risk assessments.
"Containment"		
2071, McCain	The term should include "engineered controls."	Comment refers to an existing definition that has not been amended. Ecology believes the current definition is sufficiently broad. See also the definition of "engineered controls."
"Department of Ecology"		
417, Allen	Suggested editing change.	Suggested change not consistent with rules of the code reviser.
"Direct Contact"		
82, POG 2242, POG	Suggested editing change.	Comment addressed in 2000 proposal. Comment withdrawn.
"Drinking Water Fraction"		
1421, Belcher	Requested clarification of how this term can be used in developing surface water cleanup levels.	The default value for drinking water fraction is defined in the rule and cannot be modified on a site-specific basis to establish cleanup levels. See WAC 173-340-708(b). The default value can be modified to establish remediation levels.
"Engineered Controls"		
2072, McCain	Change “treatment and containment” to “treatment and/or containment.	Comment addressed in adopted rule.
"Equivalent Carbon Number"		
83, POG 2243, POG	Suggested editing change.	Comments addressed in 2000 proposal. Comment withdrawn.
1302, McCain	Questioned need for definition.	General definition required to implement POG recommendations throughout regulation for addressing TPH releases.
"Gastrointestinal Absorption Fraction"		
757, Newlon 2432, Newlon 2456, SAB	Supported inclusion and definition of term.	Comments addressed in 2000 proposal. Comment on 1999 proposal withdrawn.
"Henry's Law Constant"		
395, Rasmussen	Supported inclusion of definition of term.	Comment addressed in 2000 proposal.
"LOAEL"		
2565, White	Suggested editing change.	Comment addressed in adopted rule.
"Natural Attenuation"		

420, Allen 1139, Kenefick	The term should include attenuation in all environmental media.	Comments addressed in 2000 proposal.
85, POG 2245, POG	The term should be changed to "monitored natural attenuation"	Ecology disagrees. Although there is an expectation that natural attenuation will be monitored as part of a cleanup action (see WAC 173-340-370(7)), the term "natural attenuation" is also used in some parts of the rule to mean attenuation other than just monitored natural attenuation.
187, Gillett 2073, McCain 2124, Riley	Eliminate last sentence, which stated: "Natural attenuation is not an active remedial measure."	Comment addressed in adopted rule. See Chapter 5 of the CES for further discussion.
85, POG 2245, POG 2387, Newlon 2388, Newlon	Modify last sentence to state the following: "Natural attenuation other than natural biodegradation is not an active remedial measure."	Comment addressed in adopted rule. See Chapter 5 of the CES for further discussion.
368, Rasmussen 2626, Wisness	Suggested adding a sentence to the end of the definition to clarify the last sentence.	Comment addressed in adopted rule. See Chapter 5 of the CES for further discussion.
"Natural Background"		
421, Allen	For purposes of clarification and technical accuracy, we recommend a slight change in the wording. The point of clarification is to ensure that the definition recognizes that inorganic chemicals, as well as some organic chemicals and radionuclides, are naturally occurring and can be found naturally at sites. The point of technical accuracy is to clarify that not all organic compounds whose background levels can be quantified are either persistent or natural products.	Comment partially addressed in 2000 proposal. Other suggested changes were not adopted because they would alter the intent of the definition.
"Natural Biodegradation"		
1306, McCain 1323, McCain	Definition should include chemical degradation of inorganic substances.	"Natural attenuation" includes both biodegradation of organics and chemical degradation of inorganics. "Natural biodegradation" does not include chemical degradation. The amended rule reflects the appropriate use of these terms. See, e.g., WAC 173-340-370(7).
84, POG 2244, POG 422, Allen	Suggested editing change.	Comments addressed in 2000 proposal. Comment on 1999 proposal withdrawn.
"Nonpotable"		
183, Gillett	Suggested eliminating definition.	This term has a specific meaning when used in this regulation and therefore requires a definition to avoid misconceptions.
"Point of Compliance" – See also Chapter 5.		

596, K. Johnson 1301, McCain	The term "point of compliance" should also refer to where remediation levels must be attained. Remediation levels are cleanup levels.	Ecology disagrees. Remediation levels are not cleanup levels. See Chapter 5 of the CES for further discussion of this issue. For the purposes of the rule, the term "point of compliance" means only "the point or points where cleanup levels established in accordance with WAC 173-340-720 through 173-340-760 shall be attained." This does not mean that remediation levels may not also require a point of compliance. However, such points must be determined on a site-specific basis.
2074, McCain 2373, Newlon	Definition should clarify when a conditional point of compliance is available.	Comments addressed in adopted rule. Definition amended to provide the following: "A conditional point of compliance for particular media is only available as provided in WAC 173-340-720 through WAC 173-340-760." Conditional points of compliance are only available for certain media and only if certain conditions are met.
"Probabilistic Risk Assessment"		
184, Gillett 597, K. Johnson 1124, Kenefick 1307, McCain	Definition should be eliminated, or at least the definition (last sentence) should allow for the use of distributions to represent dose-response relationships.	The definition is necessary to implement the proposal in 708(11). See Chapter 9 of the CES for further discussion of probabilistic risk assessment.
"Reference Dose"		
2567, White	Suggested editing change.	Editing change not required to reflect intent.
"Remediation Level" – See also Chapter 5.		
423, Allen	Clarify whether term refers to average concentrations or individual measurements.	Whether the term refers to average concentrations or individual measurements depends on the site and the specific context.
1293, Piecka 1422, Belcher	Definition should be clarified.	Comment addressed in 2000 proposal and further clarified in adopted rule. See Chapter 5 of the CES for further discussion.
"Restoration Time Frame" – See also Chapter 5.		
1309, McCain 1318, McCain	Definition should incorporate concept of remediation levels. Remediation levels are cleanup levels.	Ecology disagrees. Remediation levels are not cleanup levels. See Chapter 5 of the CES for further discussion of this issue.
"Routine Cleanup Actions"		
188, Gillett 1308, McCain 2125, Riley	The term should include those remedial actions where the terrestrial ecological evaluation is ended under WAC 173-340-7492(2) or the values in Table 749-2 are used.	Ecology agrees. Comment addressed in 2000 proposal.
"Soil"		
2075, McCain	The term should not include materials of anthropogenic sources that have been disposed, such as in a landfill, and not used as soil.	Ecology disagrees. Direct contact and leaching can be pathways of concern even at disposal sites. The issue raised is addressed in WAC 173-340-740, which allows for containment of "soil" under certain circumstances.
"Site" and "Facility"		
424, Allen 1311, McCain 2395, Newlon	Suggested editing changes.	Definitions restored in adopted rule to the language in the current rule to address comments. The definitions reflect the statutory definition.
"Terrestrial Ecological Receptors"		

1000, Kluck	The term should include birds.	The definition is sufficiently broad to include birds.
"Unrestricted Site Use Conditions"		
598, K. Johnson	Definition should be eliminated.	Ecology disagrees. This term has a specific meaning when used in this regulation and therefore requires a definition to avoid misconceptions.
"Upper bound on the excess estimated cancer risk…"		
2568, White	Suggested editing change.	Comment addressed in adopted rule.
"Wildlife"		
1000, Kluck	The term should include fish.	The term was intentionally defined to refer only to terrestrial ecological receptors. Thus, aquatic receptors were excluded from the definition. The limited focus of the definition does not mean that aquatic receptors are not important or that they are not protected under the regulation. Rather, protection of aquatic receptors is addressed separately.
599, K. Johnson 1312, McCain	The term should exclude (non-native) species of pest.	Ecology does not expect that protection of a universally recognized pest species will drive cleanup decisions at a site. However, information from pest species may be used to develop cleanup requirements for the protection of other wildlife. In addition, there is no State list of "pest species" available to Ecology.
Requests for Other Definitions		
2456, SAB	Suggested the addition of terms used in the equations.	Comment addressed in adopted rule. Definitions of the following existing terms have been added in response to this comment: "Averaging Time," "Exposure Duration," "Exposure Frequency," "Inhalation Absorption Fraction," and "Oral RfD Conversion Factor."

GQ 3.2.2
How does the nondelegation doctrine relate to the rule and, particularly, federal laws and guidance referenced in the rule?

(189, 230, 262, 263, 277, 419, 987, 1300, 1303, 1304, 2065, 2126, 2172, 2173, 2174, 2180, 2566)

Response:
The nondelegation doctrine, as it has developed in Washington, springs from the state constitution and stands generally for the proposition that the legislature may not delegate its responsibility to make law to another body. In particular, the Washington Supreme Court has held that it is a violation of the nondelegation doctrine for state legislation to attempt to adopt future federal statutes, rules or regulations. *State v. Dougall*, 89 Wn.2d 118 (1977). Because an agency's rule making authority is an extension of the legislature's authority to make law, the nondelegation doctrine also applies to agency rule making. The amendments to the MTCA rule have been crafted to avoid conflict with the nondelegation doctrine. In some cases, such as the

definition of "carcinogen," attention to the nondelegation doctrine has resulted in the striking of language that purported to automatically adopt future amendments to federal statutes and rules.

GQ 3.2.3
How does the nondelegation doctrine apply to relevant and appropriate requirements under WAC 173-340-710?

(230, 263, 2174)

Response:
The nondelegation doctrine generally does not apply to the selection of relevant and appropriate requirements. Ecology does not adopt relevant and appropriate requirements through the rule. Rather, relevant and appropriate requirements are determined on a case-by-case basis by Ecology in the course of carrying out remedial activities at a site, much the same way that remedial technologies are selected on a site-specific, case-by-case basis.

Chapter 4 Site Discovery through Site Listing (Part III)

4.1 Site Discovery and Reporting (WAC 173-340-300)

Several amendments were made to WAC 173-340-300. Most of these amendments were made to improve the clarity and usability of the regulation and are not intended to change the meaning of the provisions. Substantive changes include the following:

- The deletion of the specific requirement for reporting discovered releases by June 1, 1990;
- The addition of guidance regarding when discovered releases should be reported;
- The addition of the requirement that, as resources permit, Ecology review reports that document independent remedial actions at sites on the hazardous sites list to implement a PAC recommendation (Final PAC Report, pp. 42-34); and
- The movement of provisions regarding the reporting of independent remedial actions to WAC 173-340-515 to improve the clarity and usability of the regulation.

Several comments were received regarding the amendments to WAC 173-340-300. These comments are addressed below.

GQ 4.1.1
What is the effect of striking the June 1, 1990, date on the reporting requirement?

(190)

Response:
Striking the date-specific deadline of June 1, 1990 for reporting releases discovered prior to that date does not exempt such releases from the reporting requirement. Releases discovered prior to that date should already have been reported under the current rule. Under the proposed rule amendment, all releases, including those discovered prior to June 1, 1990, must be reported within 90 days of the discovery.

GQ 4.1.2
Should Ecology specify in the rule those situations where discovered releases likely pose a threat or potential threat to human health or the environment and should consequently be reported?

(191, 331, 367, 369, 575, 999, 1313, 2076, 2127, 2625, 2627)

Response:
The proposed rule amendments include the incorporation in WAC 173-340-300(2) of long-standing interpretive and policy statements regarding when discovered releases should be reported. While some commentors expressed approval of this amendment, others expressed disapproval and concern that the incorporation of such guidance into the rule established a

different regulatory standard than under the current rule for reporting releases. Based on the following considerations, Ecology has decided to retain the guidance in the rule.

Under both the current and proposed rules, owners and operators must report discovered releases if they may be a threat or potential threat to human health or the environment. See WAC 173-340-300(2). The inclusion of examples of situations where a release likely poses a threat or potential threat to human health or the environment and should, consequently, be reported does not change this existing regulatory requirement and does not necessarily require the report of a release in every instance where one of the "examples" is encountered. Rather, the inclusion of the examples merely attempts to ensure that those releases that actually pose a threat or potential threat are reported. Determinations of whether a particular release actually poses such a threat or potential threat are based on the best professional judgment of the owner or operator and requires the consideration of site-specific factors. While Ecology has determined that the listed situations are likely to pose a threat or potential threat, Ecology recognizes that some situations may not require the reporting of a release due to site-specific factors.

Since reporting is left to the best professional judgement of property owners, it is appropriate to provide examples of the situations where from our experience reporting has been, or would be, necessary.

The inclusion of examples of situations where releases should be reported also provides useful guidance and, thereby, more effectively ensures that the statutory goals of protecting human health and the environment are achieved. Since the determination of whether a discovered release should be reported is left to the best professional judgement of owners and operators, it is appropriate to provide examples of the situations where, based on Ecology's experience, a release would likely pose a threat or potential threat to human health or the environment and should, consequently, be reported.

The examples specified in the rule are based on long-standing interpretive and policy statements regarding when discovered releases should be reported. Converting such long-standing interpretative and policy statements into the rule is consistent with the statutory objective set forth in the APA (RCW 34.05.230).

GQ 4.1.3
What types of situations are expected to require the reporting of a release?

(192, 194, 331, 369, 425, 1219, 1254, 2129, 2627)

Response:
As discussed above, the proposed rule amendments include the incorporation in WAC 173-340-300(2)(b) of long-standing interpretive and policy statements regarding the types of situations that are expected to require the reporting of a release. The list of situations does not necessarily determine whether a release should or should not be reported. Based on site-specific determinations, situations that correspond with those listed in the rule may not require reporting. Other situations may require the reporting of release. Whether a release must be reported is

based on a determination as to whether the release may be a threat to human health or the environment. Nevertheless, several comments were made regarding the scope of the particular examples specified in the rule. These comments are addressed below.

Subsection (2)(b)(iv)
In response to comment #192, the term "free liquid" was changed to "free product" in the 2000 proposal.

Subsection (2)(b)(v)
Comment #425 requested that the example should be limited in scope to "illegally classified or unpermitted waste materials." Ecology disagrees. The suggested language would inappropriately narrow the intended scope of the example. Ecology intends that the example include contaminated soil, irrespective of the source of the release. Exemptions are specified in WAC 173-340-300(3). In response to comment, however, Ecology modified the example in the 2000 proposal to include unpermitted waste disposal.

Subsection (2)(b)(viii)
Several comments were received regarding the scope and vagueness of the example specified in Section 300(2)(b)(viii). That example includes "sites where hazardous substances have leaked or been dumped on the ground." In response to comment #1254, the term "chemicals" was changed to "hazardous substances" in the 2000 proposal. Some commentors also suggested that the example should be limited to those situations where a specified amount of a hazardous substance has been released. In response, other commentors expressed the concern that such a limitation would presuppose a determination (whether the release poses a threat or potential threat to human health or the environment) that must be made on a site-specific basis. Ecology agrees with the latter concern. Determinations of whether a specific quantity of a hazardous substance poses a threat depends on many site-specific factors, including the nature of the hazardous substance. Furthermore, as explained above, the inclusion of the specified example does not necessarily require the reporting of a release in every instance where that “example” is encountered.

Subsection (2)(b)(ix)
Comment #194 and #2129 requested that the example should be limited in scope to "regulated underground storage tanks." Ecology disagrees. The suggested limitation would inappropriately narrow the intended scope of the example. Ecology intends that the example include all leaking petroleum underground storage tanks, not just those regulated under WAC 173-340-450, and includes leaking home heating oil tanks. If the release is reported under WAC 173-340-450, then the release need not be reported under this provision.

GQ 4.1.4
Should historic contamination be reported once discovered?

(193, 2128)

Response:

Under both the current and proposed rules, all releases that may be a threat or potential threat to human health or the environment must be reported within 90 days of the discovery. The release must be reported irrespective of when the release occurred.

GQ 4.1.5
What is the scope of the exemption for reporting releases in WAC 173-340-300(3)(a)?

(952, 2039)

Response:
The comment refers to an existing regulatory exemption and addresses an issue that is beyond the scope of this rule-making action. Further discussion of this issue would be more appropriate in a guidance document.

GQ 4.1.6
Other comments regarding WAC 173-340-300 are addressed in the following table:

Comment ID	Section	Comment	Response
1001, Kluck	300(5)	Concerned with deleted language	Language moved to Section 515, not deleted.

4.2 Initial Investigation (WAC 173-340-310)

Several amendments were made to WAC 173-340-310. Most of these amendments were made to improve the clarity and usability of the regulation and are not intended to change the meaning of the provisions. Substantive changes include the following:

- The addition of specific authority to require notice of the threat to the potentially affected vicinity for sites requiring emergency remedial action or interim action to implement a PAC recommendation (Final PAC Report, p. 48); and
- The addition of the requirement that Ecology provide the owner or operator, if requested, written notification of that a site requires no further remedial action based on the initial investigation.

Several comments were received regarding the amendments to WAC 173-340-300. These comments are addressed below.

GQ 4.2.1
For sites where an emergency remedial action or interim action is necessary, should notification of the threat to the potentially affected vicinity be required? What is the appropriate method and nature of notification?

(370, 1002, 2628)

Response:

The amendments include the addition of specific authority for Ecology to require public notice for sites where an emergency remedial action or interim action is necessary. This amendment is based on a PAC recommendation (see Final PAC Report, p. 48). Specifically, the amendment provides the following:

> If the department determines that an emergency remedial action or interim action is required, then notification of the threat to the potentially affected vicinity may be required by the department. The method and nature of the notification shall be determined on a case-by-case basis using the methods specified in WAC 173-340-600. Such notification shall be the responsibility of the site owner or operator if required in writing by the department.

WAC 173-340-310(6)(a). One commentor expressed the opinion that such notification (i.e., prior to the remedial action) should always be required. Both commentors objected to the lack of guidance regarding the method and nature of notification. Ecology disagrees. To effectively and reasonably respond to broad range of threats posed by releases requiring emergency or interim actions, it is important to retain flexibility regarding both whether early notice is necessary and the method and nature of that notice. Factors that may influence the decision include, but are not limited to, the nature of the threat, the nature of the remedial action, and the site location. Requiring notification prior to taking remedial actions, for example, could actually threaten human health or the environment by delaying necessary remedial action.

Note that whenever an interim action is conducted, the action must be conducted consistent with the public notice and participation in WAC 173-340-600. WAC 173-340-430(6). The minimum requirements for any required public notice are specified in WAC 173-340-600(4). Ecology may also require additional public notice on a case-by-case basis. See WAC 173-340-600(4).

GQ 4.2.2
For sites requiring further remedial action, should Ecology provide notification of its decision (Early Notice Letter) to anyone other than the owner, operator, and any potentially liable person?

(1003)

Response:
For sites requiring further remedial action, Ecology is required to provide notification of its decision through an "Early Notice Letter" to the owner, operator, and any potentially liable person. Notice to other members of the public is provided through the Site Register. The Site Register is available as a hard copy and is accessible through the Internet at http://www.ecy.wa.gov/programs/tcp/pub_inv/pub_inv2.html. At that site, persons can sign up to receive the Site Register through e-mail (in case they do not always have access to the Internet). Persons can sign up to be on the hard copy mailing list by contacting the Toxics Cleanup Program. Further information regarding a particular site can be obtained by contacting the program's regional offices.

GQ 4.2.3
For sites not requiring further remedial action, should Ecology provide notification of its decision to the owner or operator even if not requested?

(426)

Response:
For sites not requiring further remedial action, Ecology is required to provide notification of its decision to the owner or operator only if requested. Informal or oral requests are sufficient to request notification. Some owners and operators, however, prefer not to be provided with a written notice of Ecology's determination. The notification requirement provides sufficient flexibility to meet the diverse needs of the regulated community.

GQ 4.2.4
Other comments regarding WAC 173-340-310 are addressed in the following table:

Comment ID	Section	Comment	Response
2321, Heaton	310(4)	Supports deferral to another government agency.	Comment noted. Current rule has not changed.

4.3 Site Hazard Assessment (WAC 173-340-320)

Few amendments were made to WAC 173-340-320. These amendments were made to improve the clarity and usability of the regulation and are not intended to change the meaning of the provisions. These amendments include the following:

- The addition of specific authority in subsection (3) to allow another government agency to conduct a site hazard assessment on behalf of Ecology; and
- The addition of a provision in subsection that describes the determinations that must be made based on the site hazard assessment.

The comments received regarding the amendments to WAC 173-340-320 are addressed below.

GQ 4.3.1
Should another government agency be allowed to conduct a site hazard assessment on behalf of Ecology?

(2322, 2328)

Response:
One commentor suggested that another government agency should be allowed to conduct a site hazard assessment on behalf of Ecology. Ecology agrees and has actually deferred the task of conducting site hazard assessments to other government agencies in the past. Section 320(3) has been amended to reflect this practice.

GQ 4.3.2
What are the criteria for determining whether a site requires no further action after conducting a site hazard assessment?

(366, 2624)

Response:
Ecology is not proposing to add criteria for determining whether a site requires no further action after the completion of a site hazard assessment. Under the authority of the Model Toxics Control Act, the department must determine whether there has been a release or threatened release of a hazardous substance and whether it poses a threat or potential threat to human health and the environment. The current rule language describes the information that must be collected as part of a site hazard assessment (see Section 320(4)) and the actions the department needs to take in completing a site hazard assessment (see Section 320(1)) that help in making such a determination.

GQ 4.3.3
Other comments regarding WAC 173-340-320 are addressed in the following table:

Comment ID	Section	Comment	Response
1245, Gillett	320(4)	Suggested editorial change.	Comment addressed in 2000 proposal.
195, Gillett 600, Johnson	320(4)(h)	Concerned with implications of preliminary terrestrial ecological determinations	To address concern, deleted language in 2000 proposal.
1004, Kluck	320(5)	Requested availability of guidance on internet.	Comment noted.

4.4 Hazard Ranking and the Hazardous Sites List (WAC 173-340-330)

Several amendments were made to WAC 173-340-310. Most of these amendments were made to improve the clarity and usability of the regulation and are not intended to change the meaning of the provisions. Substantive changes include the following:

- The addition of a reference to the publications the department currently uses to rank sites, including sediment sites, to bring the rule up to date with current practice ; and
- The addition of criteria for removing sites using containment from the hazardous sites list, including, under certain specified circumstances, municipal solid waste landfills. These criteria are based on a current Ecology policy. This change implements Governor's Executive Order 97-02.
- The addition of a requirement specifying that the record of sites that have been removed from the Hazardous Sites List shall identify which of those sites have institutional controls and which of those are subject to periodic review.

Several comments were received regarding the amendments to WAC 173-340-330. These comments are addressed below.

GQ 4.4.1
What is required to demonstrate the effectiveness of institutional controls for the purpose of removing a site from the hazardous sites list?

(427)

Response:
Ecology will provide guidance for verifying implementation of institutional control requirements and for demonstrating and tracking the effectiveness of these measures.

GQ 4.4.2
Should the regulation provide for the removal of a site from the hazardous sites list even though area background concentrations would result in recontamination of the site to levels that exceed cleanup levels?

(1088, 2012)

Response:
For a site with releases to ground water to be removed from the hazardous sites list, the proposed rule amendment requires a demonstration that "the site meets ground water cleanup levels at the designated points of compliance." WAC 173-340-330(7)(a)(iii)(G). Some commentors thought that this requirement would prevent the removal from the list of a site where upgradient, off-site sources of ground water contamination would result in recontamination of the site to levels that exceed cleanup levels. Ecology disagrees. The amendment requires a demonstration that the site meets ground water cleanup levels at the designated points of compliance. The point of compliance, by definition, includes conditional points of compliance. See WAC 173-340-200. For ground water, conditional points of compliance may be established off-property under certain circumstances. See WAC 173-340-720(8). Consequently, a site can be removed from the hazardous sites list provided it has been demonstrated that the site meets ground water cleanup levels at the designated point of compliance, regardless of whether area background concentrations would result in recontamination of the site.

GQ 4.4.3
Should the regulation provide for the removal of municipal solid waste landfills from the hazardous sites list and, if so, under what circumstances?

(1089, 2240, 2472)

Response:
Several commentors were concerned that the proposed rule amendment would not allow for the removal of municipal solid waste landfills from the hazardous sites list and that the regulation should provide for such removal under certain conditions. Ecology agrees that under the current

criteria it is unlikely a landfill could ever be removed from the hazardous sites list. Accordingly, the rule has been amended to allow landfills to be removed from the list under certain limited circumstances. See WAC 173-340-330(7)(a)(iii)(A). These conditions ensure that for those landfills meeting the requirements of the rule amendment there will be adequate measures to maintain long-term operation, maintenance and monitoring requirements and provide a routine reporting to Ecology.

GQ 4.4.4
Other comments regarding WAC 173-340-330 are addressed in the following table:

Comment ID	Section	Comment	Response
333, Valeriano 576, Wingard	330(7)(a)	Expressed support for amendment clarifying criteria for removing sites from the hazardous sites list.	Comment noted.
332, Valeriano	330(7)(a)(iii)	Requested clarification that all of the listed conditions must be met to be delisted.	Comment addressed in 2000 proposal.
2323, Heaton	330(7)(a)(iii)(A)	Expressed support for keeping sites with active maintenance activities on the hazardous sites list.	Comment addressed in final rule.
1005, Kluck	330(7)(a)(iii)(D)	Requested as a separate requirement that all institutional controls are appropriately recorded in a restrictive covenant.	Removal from the list requires a demonstration that institutional controls are in place and that written documentation is present in Ecology's files. These demonstrations require receipt of a properly recorded deed notice. Determinations of proper filing are based on the recorded numbers stamped on each page by the county.
1006, Kluck	340(2)	Suggested editorial change.	Comment addressed in 2000 proposal.

Chapter 5 Remedy Selection (Part III)

5.1 Remedial Investigation and Feasibility Study (WAC 173-340-350)

WAC 173-340-350 sets forth the requirements and procedures for conducting remedial investigations and feasibility studies. Several amendments were made to this section. Most of these amendments were made to improve the clarity and usability of the regulation and are not intended to change the meaning of the provisions. Substantive changes include the following:

- The reorganization of the provisions in WAC 173-340-350 through 173-340-390 for the purpose of improving the clarity and usability of the rule based on a PAC recommendation (see Final PAC Report, pp. 32-34 and C-46 through C-54);
- The addition of subsection (4) that describes submittal requirements to improve the clarity and usability of the rule;
- The reorganization and amendment of subsection (7) that describes the requirements and procedures for conducting a remedial investigation based on discussions with the PAC and the External Advisory Group;
- The addition of subsection (8) that describes the requirements and procedures for conducting a feasibility study based on discussions with the PAC and the External Advisory Group;

Several comments were received regarding the amendments to WAC 173-340-350. These comments are addressed below.

GQ 5.1.1
What are the submittal requirements for independent remedial actions?

(1007, 1009, 1295)

Response:
The current rule provides in WAC 173-340-515(3) that independent remedial actions must meet the substantive requirements of chapter 173-340 WAC. The commentor requested clarification regarding whether independent remedial actions must meet the substantive requirements of WAC 173-340-350 and the type of documentation that is required where specific documents are required under chapter 173-340 WAC, including documents required under WAC 173-340-350. These comments were addressed in the 2000 proposal. Independent remedial actions must meet the substantive requirements of WAC 173-340-350, including the collection, development and evaluation of sufficient information regarding a site to select a cleanup action. The submittal requirements for independent remedial actions are defined in WAC 173-340-515(4) and require the submission of a report with "enough information to determine if the independent remedial action meets the substantive requirements of this chapter including, the results of all site investigations, cleanup actions and compliance monitoring planned or under-way." WAC 173-340-515(4)(b). Ecology may also require additional reports on the work conducted. Id. These

submittal requirements are specifically references in WAC 173-340-350(4). **See GQ 7.2.5** for further discussion.

GQ 5.1.2
Does the scoping process in WAC 173-340-350(7)(b) include the identification of not only legally applicable requirements, but also relevant and appropriate requirements under WAC 173-340-710?

(1008)

Response:
Yes. WAC 173-340-350(7)(b)(vi) includes the identification of applicable state and federal laws under WAC 173-340-710. "Applicable state and federal laws" is defined in WAC 173-340-200 to mean "all legally applicable requirements and those requirements that the department determines, based on the criteria in WAC 173-340-710(3), are relevant and appropriate requirements."

GQ 5.1.3
What is the purpose of the screening process in WAC 173-340-350(8)(b)? What cleanup action alternatives or components may be eliminated from further evaluation and who should make that decision? Should a discussion of the screening process be included as part of the feasibility study report? Do the procedural requirements of this subsection apply to independent remedial actions?

(953, 1014, 2040)

Response:
The purpose of the screening process set forth in WAC 173-340-830(8)(b) is to reduce the number of cleanup action alternatives and components for further, more detailed evaluation as part of the feasibility study. Cleanup action alternatives and components that may be eliminated from further evaluation are limited to those that clearly do not meet the minimum requirements for cleanup actions specified in WAC 173-340-360 and those that are not technically possible. WAC 173-340-830(8)(b)(i) and (ii). While the person conducting the feasibility study may propose which alternatives or components should be eliminated from further evaluation, Ecology must determine which cleanup action alternatives must be evaluated in the feasibility study. At what point in the process of conducting a feasibility study this determination will be made is dependent on site-specific factors. The screening of alternatives is a discretionary action that can be conducted under the current regulation and the addition of this concept to the rule is simply intended to provide greater clarity regarding the screening process. Although a description of the screening process is not required to be included in the feasibility study, WAC 173-340-350(8)(c)(i)(I) does allow Ecology to require this information as appropriate.

The procedural requirements of this subsection do not apply to independent remedial actions. See WAC 173-340-515(3). Consequently, persons conducting independent remedial actions do

not need to obtain prior approval of which cleanup action alternatives or components are evaluated as part of the feasibility study.

GQ 5.1.4
When may a cleanup action alternative that includes a standard point of compliance be eliminated from further evaluation as part of a feasibility study?

(954, 2041)

Response:
Cleanup action alternatives may be eliminated under WAC 173-340-350(8)(b) from further evaluation if the alternative clearly does not meet the minimum requirements for cleanup actions specified in WAC 173-340-360 or is not technically possible. Comment addressed in the 2000 proposal by including a reference in WAC 173-340-350(8)(c)(i)(F) to the screening process in WAC 173-340-350(8)(b). Determining whether a cleanup action alternative is permanent to the maximum extent practicable requires evaluation of the alternative as part of the feasibility study.

GQ 5.1.5
When does a feasibility study not need to include a permanent cleanup action alternative?

(334, 372, 2629, 2630)

Response:
Except as provided in WAC 173-340-350(8)(c)(ii)(B), the feasibility study must include at least one permanent cleanup action alternative, as defined in WAC 173-340-200, to serve as a baseline against which other alternatives shall be evaluated for the purpose of determining whether the cleanup action selected is permanent to the maximum extent practicable. WAC 173-340-350(8)(c)(ii)(A). Subsection (8)(c)(ii)(B) then sets forth those circumstances when a feasibility study for a site does not need to include a permanent cleanup action alternative. These exceptions from the general requirement in subsection (8)(c)(ii)(A) are based on the selection of a model remedy or determinations that the permanent alternative is not practicable. Ecology is the final arbiter of whether a permanent cleanup action alternative must be included as part of the feasibility study. Several comments were received regarding these exceptions. The comments are addressed in the following table:

Comment ID	Comment	Response
334, Valeriano	Eliminate landfills as a type of site where a permanent cleanup action alternative is not required.	Ecology agrees that landfills should not be excluded per se from the requirement of including a permanent cleanup action alternative. Comment addressed in 2000 proposal. Ecology recognizes that landfills may not need to include a permanent alternative for other reasons.

2629, Wisness	The word "possible" should be changed to "practicable" in subsection (8)(c)(ii)(B)(II)	Ecology disagrees. Determining whether a cleanup action alternative is permanent to the maximum extent practicable requires evaluation of a permanent alternative as part of the feasibility study. The exceptions from the general requirement in subsection (8)(c)(ii)(A) are based on the selection of a model remedy or determinations that the permanent alternative is not practicable. One such circumstance is that the permanent alternative is not "technically possible."
372, Rasmussen 2630, Wisness	Should provide additional criteria for determining whether a permanent alternative is clearly disproportionate.	Ecology recognizes that additional guidance would be appropriate. Ecology is the final arbiter of whether a permanent cleanup action alternative must be included as part of the feasibility study.

GQ 5.1.6
How should information developed as part of a terrestrial ecological evaluation be used in the remedy selection process?

(590, 607, 611, 895, 1110)

Response:
The purpose of the terrestrial ecological procedures set forth in WAC 173-340-7490 though 173-340-7494 is to determine whether a release of hazardous substances to soil may pose a threat to the terrestrial environment; to characterize existing or potential threats to terrestrial plants or animals exposed to hazardous substances in soil; and to establish site-specific cleanup standards for the protection of terrestrial plants and animals. WAC 173-340-7490(1)(a).

In addition, WAC 173-340-7490(1)(b) provides that:

> Information collected during a terrestrial ecological evaluation shall also be used in developing and evaluating cleanup action alternatives and in selecting a cleanup action under WAC 173-340-350 through 173-340-390. WAC 173-340-7490 through 173-340-7494 do not necessarily require a cleanup action for terrestrial ecological protection separate from a human health-based cleanup action. Where appropriate, a terrestrial ecological evaluation may be conducted so as to avoid duplicative studies of soil contamination that will be remediated to address other concerns, as provided in WAC 173-340-350(7)(c)(iii)(F)(II).

Information collected during a terrestrial ecological evaluation should be used in developing and evaluating cleanup action alternatives and in selecting a cleanup action under WAC 173-340-350 through 173-340-390 just as information obtained from any human health risk assessment is used. Further discussion of how information developed as part of a terrestrial ecological evaluation is used in the remedy selection process is provided in the following responses.

GQ 5.1.7
How should information developed as part of a terrestrial ecological evaluation be used in the remedy selection process? Should a terrestrial ecological evaluation be conducted prior to completing a remedial investigation?

(196, 197, 2130, 2131)

Response:
Unless otherwise specified under chapter 173-340 WAC, cleanup levels must be established for hazardous substances in each medium and for each pathway where a release has occurred, using WAC 173-340-700 through 173-340-760. Cleanup levels are typically initially established during the scoping of the remedial investigation and may be further refined during the remedial investigation and/or feasibility study. WAC 173-340-350(9)(a). The establishment of soil cleanup levels requires consideration of the impact or potential impact of hazardous substances on terrestrial ecological receptors under WAC 173-340-7490 through 173-340-7494. See WAC 173-340-740 and 173-340-745. Information that is necessary to determine the impact or potential impact of the hazardous substance on terrestrial ecological receptors, including any information needed to conduct a terrestrial ecological evaluation under WAC 173-340-7492 or 173-340-7493 or to establish an exclusion under WAC 173-340-7491, should be gathered during the remedial investigation. WAC 173-340-350(7)(c)(iii)(F)(I).

Ecology recognizes that under certain circumstances, conducting an ecological evaluation might result in duplicative studies of soil contamination to address other concerns, such as protection of human health. To avoid such duplication, an ecological evaluation may be accomplished by evaluating residual threats to the environment after cleanup action alternatives for human health protection have been developed. See WAC 173-340-350(7)(c)(iii)(F)(II).

GQ 5.1.8
When is it necessary to evaluate in the feasibility study the residual threats that would accompany each alternative and determine if remedies that are protective of human health will also be protective of ecological receptors?

(198, 2132)

Response:
The feasibility study must include cleanup action alternatives that protect human health and the environment (including, as appropriate, aquatic and terrestrial ecological receptors). WAC 173-340-350(8)(c)(i)(A). When the feasibility study only includes alternatives based on protection of human health, the feasibility study must include an evaluation of the residual threats that would accompany each of those alternatives and determine if remedies that are protective of human health will also be protective of ecological receptors. WAC 173-340-350(8)(c)(i)(E). If the alternatives based on protection of human health are not protective of ecological receptors, then the alternatives must be rejected because they do not meet the minimum requirements for cleanup actions in WAC 173-340-360.

Ecology recognizes that under certain circumstances, conducting an ecological evaluation might result in duplicative studies of soil contamination to address other concerns, such as protection of human health. To avoid such duplication, ecological evaluations may be accomplished by evaluating residual threats to the environment after cleanup action alternatives for human health protection have been developed. See WAC 173-340-350(7)(c)(iii)(F)(II).

GQ 5.1.9
Are hazardous substances that are recycled into commercial and domestic products properly regulated?

(1164)

Response:
Hazardous substances that are recycled into commercial and domestic products as part of a cleanup action under MTCA are properly regulated. Any cleanup action conducted under the chapter 173-340 WAC must meet each of the minimum requirements specified in WAC 173-340-360, including the requirement that the cleanup action must comply with applicable state and federal laws. WAC 173-340-360(2)(a)(iii). "Applicable state and federal laws" is defined in WAC 173-340-200 to mean "all legally applicable requirements and those requirements that the department determines, based on the criteria in WAC 173-340-710(3), are relevant and appropriate requirements." These applicable laws include two that regulate solid wastes: (1) chapter 173-304 WAC, Minimum Functional Standards for Solid Waste Handling; and (2) chapter 173-303 WAC, Dangerous Waste Regulations. Chapter 173-303 WAC specifically addresses recycled, reclaimed, and recovered wastes.

GQ 5.1.10
Other comments regarding WAC 173-340-350 are addressed in the following table:

Comment ID	Section	Comment	Response
General			
2590, Morgan	350	An RI/FS should not be required for routine cleanup actions.	The regulation provides adequate flexibility to customize an RI/FS to the specific characteristics of a site, including routine cleanup actions. Also, if an independent remedial action is conducted, the document need not be in the same in title or format. See WAC 173-340-515.
1255, Gillett 1256, Gillett	350(2)	Suggested editing changes.	Comments addressed in 2000 proposal.
Remedial Investigation			
1256, Gillett	350(7)(b)(ii)	Discussion of conceptual site model incomplete. Should refer to WAC 173-340-200.	Comment addressed in 2000 proposal.
1010, Kluck	350(7)(c)(iii)(E)	The subsection should be revised to include an evaluation of likely future development in the area in addition to the present and	An evaluation of likely future development is appropriate to the extent that such development is accounted for as part of any present or

		proposed land use and zoning for the site.	proposed land use or zoning for the site.
1258, Gillett	350(7)(c)(iv)	Suggested editing change.	Comment addressed in 2000 proposal.
Feasibility Study			
1315, McCain	350(8)(a)	Reference to "point of compliance throughout the site" is not correct for all media.	Comment addressed in 1999 proposal.
585, K. Johnson 1072, Aldrich 1117, Kenefick	350(8)(b)(ii)	Use of term "technically possible" is inappropriate. Should replace with the term "practicable."	Ecology believes that the use of the existing term in this context (screening of alternatives) is appropriate. Whether a cleanup action alternative is permanent to the maximum extent practicable requires further analysis.
2077, McCain	350(8)(c)(i)(A)	Delete term "migration route" as redundant with term "exposure pathway."	Ecology disagrees. The term has independent significance.
2077, McCain	350(8)(c)(i)(B)	Suggested editing change.	Comment addressed in adopted rule.
371, Rasmussen	350(8)(c)(ii)(A)	Suggested editing change.	Comment addressed in 2000 proposal.
1247, Gillett	350(8)(c)(ii)(B)	Suggested editing change.	Comment addressed in 2000 proposal.
585, K. Johnson 1072, Aldrich 1117, Kenefick	350(8)(c)(ii)(B)	Use of term "technically possible" is inappropriate. Should replace with the term "practicable."	Ecology believes that the use of the existing term in this context (determining whether a feasibility study requires a permanent alternative) is appropriate. Whether a cleanup action alternative is permanent to the maximum extent practicable requires further analysis.
Integration of Concept of Terrestrial Ecological Evaluations			
1011, Kluck	350(7)(c)(iii)(F)	Concerned that modifications to heading and paragraph weaken provision by excluding impacts to natural resources and aquatic ecological receptors.	Comment addressed in 2000 proposal.
1246, Gillett	350(7)(c)(iii)(F)(I)	Suggested amendment, including example, to clarify intent.	Comment addressed in 1999 proposal.
1314, McCain	350(7)(c)(iii)(F)(II)	Suggested editing change.	Comment addressed in 2000 proposal.
601, K. Johnson	350(7)(c)(iii)(F)(II)	Subsection should be clarified so it is obvious that future site development will be a factor in determining if a terrestrial ecological evaluation should be performed.	Amendment not required to address concern. Remedial investigations require information regarding the current and future land uses at a site and any information needed to conduct an ecological evaluation or to establish an exclusion, including information to establish an exclusion under WAC 173-340-7491(1)(b). See WAC 173-340-350(7)(c)(iii)(E) and (F)(I).
602, K. Johnson	350(7)(c)(iii)(F)(III)	Suggested editing change.	Comment addressed in 2000 proposal.
1257, Gillett	350(7)(c)(iii)(F)(III)	Suggested editing change.	Editing change not required.
2569, White	350(9)(a)	Suggested editing change.	Comment addressed in adopted rule.

5.2 Development of Cleanup Action Alternatives that include Remediation Levels (WAC 173-340-355)

WAC 173-340-355 is a new section that describes the purpose of remediation levels and their relationship to cleanup levels and cleanup standards. This section also sets forth the requirements and procedures for developing a cleanup action alternative, to be evaluated in the feasibility study, that includes remediation levels. Cleanup actions that use remediation levels must meet each of the minimum requirements specified in WAC 173-340-360, just as any other cleanup action. Other sections of the rule have also been amended to incorporate the concept of remediation levels and include the following:

- The addition of a definition of "remediation levels" in WAC 173-340-200.
- The addition in WAC 173-340-357 of a description of how a quantitative risk assessment of a cleanup action alternative that includes remediation levels may be conducted.
- The incorporation of the concept of remediation levels as part of the overview in WAC 173-340-700.
- The addition in WAC 173-340-708 of a description of how various default human health risk assessment assumptions can be modified on a site-specific basis to establish remediation levels.
- The addition in WAC 173-340-720 through 173-340-750 of a description of how various default human health risk assessment assumptions can be modified on a site-specific basis to establish remediation levels.

These amendments are based on a PAC recommendation and were determined by the PAC as necessary to more effectively achieve the goals and objectives of MTCA (Final PAC Report, Sections 3.2.5 and 3.2.7). Comments received regarding WAC 173-340-355 and remediation levels in general are addressed below.

GQ 5.2.1
What is the purpose of remediation levels and their relationship to cleanup levels and cleanup standards?

(211, 258, 339, 373, 458, 588, 609, 613, 614, 620, 621, 622, 623, 728, 733, 874, 1073, 1111, 1159, 1168, 1293, 1301, 1330, 1332, 1344, 2078, 2349, 2419, 2421, 2631)

Response:
Pursuant to MTCA Policy Advisory Committee (PAC) recommendations, Ecology formalized the concept of remediation levels for use in the remedy selection process in the proposed rule amendments. Several commentors, however, expressed confusion regarding the definition and purpose of remediation levels and their relationship to cleanup levels and cleanup standards. Other commentors expressed the opinion that remediation levels should be equated with cleanup levels. To address these issues, Ecology has clarified the definition of remediation levels in WAC 173-340-200 and has created a new section (WAC 173-340-355) that specifically defines the purpose of remediation levels and the requirements and procedures for developing a cleanup

action alternative that includes remediation levels. This new section replaces WAC 173-340-350(11) that was proposed in the 1999 rule amendments. Ecology has further clarified the language in WAC 173-340-355 and provided additional examples based on comments received on the 2000 proposal. Ecology has also reviewed each occurrence of the term throughout the rule to ensure its use is correctly and consistently applied. The following discussion, excerpted from the amendments, provides a brief overview of the purpose of remediation levels and their relationship to cleanup levels and cleanup standards.

Definition of Remediation Level – See WAC 173-340-200

"Remediation level" means a concentration (or other method of identification) of a hazardous substance in soil, water, air, or sediment above which a particular cleanup action component will be required as part of a cleanup action at a site. Other methods of identification include physical appearance or location. A cleanup action selected in accordance with WAC 173-340-350 through 173-340-390 that includes remediation levels constitutes a cleanup action which is protective of human health and the environment.

Purpose of Remediation Levels – See WAC 173-340-355(1)

A cleanup action selected for a site will often involve a combination of cleanup action components, such as treatment of some soil contamination and containment of the remainder. Remediation levels are used to identify the concentrations (or other methods of identification) of hazardous substances at which different cleanup action components will be used. Remediation levels may be used at sites where a combination of cleanup actions components are used to achieve cleanup levels at the point of compliance (see the examples in WAC 173-340-355(3)(a) and (c)). Remediation levels may also be used at sites where the cleanup action involves the containment of soils as provided under WAC 173-340-740(6)(f) and at sites conducting interim actions (see the examples in WAC 173-340-355 (3)(b) and (d)).

Relationship to Cleanup Levels and Cleanup Standards – See WAC 173-340-355(2)

Remediation levels are not the same as cleanup levels. A cleanup level defines the concentration of hazardous substances above which a contaminated medium (e.g., soil) must be remediated in some manner (e.g., treatment, containment, institutional controls). A remediation level, on the other hand, defines the concentration (or other method of identification) of a hazardous substance in a particular medium above or below which a particular cleanup action component (e.g., soil treatment or containment) will be used. Remediation levels, by definition, exceed cleanup levels.

Cleanup levels must be established for every site. Remediation levels, on the other hand, may not be necessary at a site. Whether remediation levels are necessary depends on the cleanup action selected. For example, remediation levels would not be necessary if the selected cleanup action removes for offsite disposal all soil that exceeds the cleanup level at the applicable points of compliance.

A cleanup action that uses remediation levels must meet each of the minimum requirements specified in WAC 173-340-360, including the requirement that all cleanup actions must comply with cleanup standards. Compliance with cleanup standards requires, in part, that cleanup levels are met at the applicable points of compliance. If the remedial action does not comply with

cleanup standards, the remedial action is an interim action, not a cleanup action. Where a cleanup action involves containment of soils with hazardous substance concentrations exceeding cleanup levels at the point of compliance, the cleanup action may be determined to comply with cleanup standards, provided the requirements specified in WAC 173-340-740(6)(f) are met.

GQ 5.2.2
How may potential remediation levels be developed as part of the cleanup action alternatives to be considered during the feasibility study?

(258, 620, 958, 959, 1344, 2043)

Response:
Several commentors requested additional clarification regarding how potential remediation levels may be developed as part of the cleanup action alternatives to be considered during the feasibility study. To address these concerns, the regulatory provision was revised in the 2000 proposal to state the following:

> Potential remediation levels may be developed as part of the cleanup action alternatives to be considered during the feasibility study (see WAC 173-340-350(8)(c)(i)(D)). These potential remediation levels may be defined as either a concentration or other method of identification of a hazardous substance. Other methods of identification include physical appearance or location (e.g., all of the green sludge will be removed from the northern area of the site.) Quantitative or qualitative methods may be used to develop these potential remediation levels. These methods may include a human health risk assessment or an ecological risk assessment. These methods may also consider fate and transport issues. These methods may be simple or complex, as appropriate to the site. Where a quantitative risk assessment is used, see WAC 173-340-357.

WAC 173-340-355(4). Further discussion of this issue would be more appropriate through guidance.

GQ 5.2.3
How are cleanup action alternatives that include remediation levels evaluated as part of the feasibility study?

(210, 211, 958, 959, 2043)

Response:
Several commentors requested additional clarification regarding how cleanup action alternatives that include remediation levels are evaluated as part of the feasibility study. Both WAC 173-340-355(4) and WAC 173-340-360(2)(h) were amended in the 2000 proposal to provide additional clarification. WAC 173-340-355(4) provides that "[a]ll cleanup action alternatives in a feasibility study, including those with proposed remediation levels [see WAC 173-340-350(8)(c)(i)(D)], must … be evaluated to determine whether they meet each of the minimum requirements specified in WAC 173-340-360." The subsection then references WAC 173-340-

360(2)(h), which provides additional clarification regarding how cleanup action alternatives that include remediation levels must be evaluated. That subsection specifically provides that "cleanup actions that use remediation levels shall meet each of the minimum requirements specified in [WAC 173-340-360(2)], just as any other cleanup action." WAC 173-340-360(2)(h).

GQ 5.2.4
Other comments regarding WAC 173-340-355 are addressed in the following table:

Comment ID	Section	Comment	Response
2570, White	355(2)	Suggested editing change.	Comment addressed in adopted rule.

5.3 Quantitative Risk Assessment of Cleanup Action Alternatives (WAC 173-340-357)

WAC 173-340-357 is a new section that describes the purpose of a quantitative risk assessment and its relationship to selecting a cleanup action. This section also sets forth the requirements and procedures for conducting a quantitative risk assessment of cleanup action alternatives. Specifically, a quantitative site-specific risk assessment may be conducted to help determine whether cleanup action alternatives, including those using a remediation level, engineered control and/or institutional control, are protective of human health and the environment. A determination that a cleanup action alternative evaluated is protective of human health and the environment does not mean that the other minimum requirements specified in WAC 173-340-360 have been met. This amendment implements a PAC recommendation (see Final PAC Report, Section 3.2.1).

This section also defines in subsection (3)(f) a default exposure scenario for establishing remediation levels that address the direct contact pathway for sites that are commercial gasoline stations. The amendment is based on a PAC recommendation and was determined by the PAC as necessary to more effectively achieve the goals and objectives of MTCA (Final PAC Report, pp. 28-30).

GQ 5.3.1
If a quantitative site-specific risk assessment is used to help determine whether a cleanup action alternative is protective of human health and the environment, what other considerations may be needed in evaluating the protectiveness of the overall cleanup action?

(212)

Response:
WAC 173-340-357(1) provides the following:

> A quantitative site-specific risk assessment may be conducted to help determine whether cleanup action alternatives, including those using a remediation level, engineered control

> and/or institutional control, are protective of human health and the environment. If a quantitative site-specific risk assessment is used, then other considerations may also be needed in evaluating the protectiveness of the overall cleanup action. Methods other than a quantitative site-specific risk assessment may also be used to determine if a cleanup action alternative is protective of human health and the environment.

The other considerations that may be needed in evaluating the protectiveness of the overall cleanup action include each of the minimum requirements for selecting a cleanup action in WAC 173-340-360. Note that WAC 173-340-357(2) specifically provides the following:

> Selecting a cleanup action requires a determination that each of the requirements specified in WAC 173-340-360 is met, including the requirement that the cleanup action is protective of human health and the environment. A quantitative risk assessment conducted under this section may be used to **help** determine whether a particular cleanup action alternative meets this requirement. A determination that a cleanup action alternative evaluated is protective of human health and the environment does not mean that the other minimum requirements specified in WAC 173-340-360 have been met.

WAC 173-340-357(2) (emphasis added).

GQ 5.3.2
When may remediation levels be established under Method C?

(2201)

Response:
Remediation levels may be established under Method C "only if the particular medium the remediation level is being established for qualifies for a Method C cleanup level." See WAC 173-340-357(3). This clarification was added in the 2000 proposal to address the concern of the commentor.

GQ 5.3.3
What are the acceptable risk levels for remediation levels when conducting a quantitative site-specific human health risk assessment?

(610, 1118, 1321, 2201)

Response:
When conducting a quantitative site-specific human health risk assessment, "[t]he acceptable risk level for remediation levels shall be the same as that used for the cleanup level." WAC 173-340-357(3)(c). The acceptable levels of risk specified in the current rule have not been modified as part of this rule-making action and cannot be modified on a site-specific basis.

The PAC specifically addressed the issue of acceptable levels of risk in response to the legislature. Specifically, the legislature in HB 1810 required the PAC to review, provide advice,

and develop recommendations on "clean-up standards and clean-up levels, including the use of site-specific risk assessment." In response, the PAC established the following priority issue for analysis:

> Do allowable risk values in the MTCA cleanup regulations appropriately balance the public's desire for protecting individuals with the need for cleanups to proceed at a reasonable cost? Should the allowable risk values for carcinogens in the MTCA cleanup regulations be amended, for example, to match federal risk range values under CERCLA (the federal superfund program) in the National Contingency Plan?

Final PAC Report, pp. 4-5. At the PAC's request, the MTCA Science Advisory Board (SAB) conducted a review of the target risk levels defined in the MTCA Cleanup Regulation. The SAB, however, did not recommend changing those levels (Final PAC Report, p. 28). The PAC also did not recommend changing the target risk levels (Final PAC Report, pp. 19, 28 and C-16 through C-17). Based on the lack of a recommendation from the PAC, amendment of the target risk levels was not included within the scope of this rule-making action.

GQ 5.3.4
What methods in WAC 173-340-747 may be used to develop soil concentrations that are protective of ground water beneficial uses during remedy selection to help assess the protectiveness to human health of a cleanup action alternative that uses a remediation level, engineered control and/or institutional control?

(213)

Response:
Any of the methods specified in WAC 173-340-747 to develop soil concentrations that are protective of ground water beneficial uses may also be used during remedy selection to help assess the protectiveness to human health of a cleanup action alternative that uses a remediation level, engineered control and/or institutional control. See WAC 173-340-357(3)(d). This provision was amended in the 2000 proposal to address the concern of the commentor.

GQ 5.3.5
What is the purpose of the commercial gas station scenario in WAC 173-340-357(3)(f)?

(214, 215, 216, 2133, 2134)

Response:
The purpose of the commercial gas station scenario is to define a default exposure scenario for establishing remediation levels that address the direct contact pathway for sites that are commercial gasoline stations. The amendment is based on a PAC recommendation and was determined by the PAC as necessary to more effectively achieve the goals and objectives of MTCA (Final PAC Report, pp. 28-30). This scenario is intended to be a conservative estimate of a child trespasser scenario at a commercial gas station where contaminated soil has been excavated and stockpiled or soil is otherwise accessible. The establishment of this default

scenario does not limit a person from proposing a different scenario. The provision also specifically provides that Equations 740-3 and 740-5 may be modified on a site-specific basis as described in WAC 173-340-740(3)(c). Sites using remediation levels must also assess the protectiveness of the remedy for other exposure pathways (e.g., soil vapors and soil to ground water). Ecology intends to develop guidance regarding the evaluation of these other pathways. A person may use other quantitative and qualitative methods to help in demonstrating the protectiveness of a remedy.

Sites using remediation levels must also use institutional controls to prevent uses that could result in a higher level of exposure. This requirement is also based on the PAC recommendation (Final PAC Report, p. 29).

GQ 5.3.6
What types of sites does the commercial gas station scenario apply to?

(214, 960, 2044, 2133)

Response:
The prescribed default exposure scenario in WAC 173-340-357(3)(f) applies only to "active commercial gas stations where there are retail sales of gasoline and/or diesel." For the purposes of this section, the term is intended to apply only to those gas stations that are currently operating as commercial gas stations and those gas stations that are only temporarily closed for business. The term is intended to exclude those sites where a gas station is no longer in the business of selling gas. The prescribed default exposure scenario is based on exposure assumptions that consistently apply to active commercial gas stations where there are retail sales of gasoline and/or diesel. Those assumptions may not apply at other types of sites. The limited applicability of the prescribed default exposure scenario is based on the PAC recommendation (Final PAC Report, pp. 28-30). The precondition set forth in the 1999 proposal that the site be covered with asphalt or concrete pavement was eliminated in the 2000 proposal.

GQ 5.3.7
What is the basis for the default exposure frequency of 0.25?

(878)

Response:
The default exposure frequency of 0.25 is based on a PAC recommendation and is explained in the Final PAC Report (pp. 28-30 and C-23).

GQ 5.3.8
Other comments regarding WAC 173-340-357 are addressed in the following table:

Comment ID	Section	Comment	Response
1322, McCain	357	"Soil cleanup level" should be "soil remediation level."	Comment addressed in 1999 and 2000 proposals.

86, POG 2246, POG	357(3)	Suggests editing change regarding use of the terms "exposure parameters" and "input parameters."	Comment addressed in 2000 proposal.
729, Newlon 2397, Newlon 1269, POG	357(3)(f)	Direct contact equations for commercial gas stations in 1998 draft were incorrect because they did not include dermal exposure. Comment addressed.	Comment addressed in 1999 proposal.
978, Graves 2058, Graves	357	How does one evaluate the protectiveness of a containment system?	See WAC 173-340-357 for a description of how risk assessments can be used in evaluating the protectiveness of a remedy.

5.4 Selection of Cleanup Actions (WAC 173-340-360)

WAC 173-340-360 describes the minimum requirements and procedures for selecting cleanup actions. Specifically, all cleanup actions must meet each of the minimum requirements specified in WAC 173-340-360(2). WAC 173-340-360(3) describes the specific requirements and procedures for determining whether a cleanup action uses permanent solutions to the maximum extent practicable, as required under subsection (2)(b)(i). WAC 173-340-360(4) describes the specific requirements and procedures for determining whether a cleanup action provides for a reasonable restoration time frame, as required under subsection (2)(b)(ii).

Several amendments were made to this section. Most of these amendments were made to improve the clarity and usability of the regulation and are not intended to change the meaning of the provisions. Substantive changes include the following:

- The reorganization of the provisions formerly in WAC 173-340-350 and 173-340-360 for the purpose of improving the clarity and usability of the rule based on a PAC recommendation (see Final PAC Report, pp. 32-34 and C-46 through C-54);
- The modification of the purpose of the hierarchy of cleanup technologies based on a PAC recommendation (see Final PAC Report, pp. 32-34 and C-46 through C-54). The amendment includes the removal of the hierarchy as a stand-alone criteria for remedy selection and the inclusion of the hierarchy as a guide to long-term effectiveness of cleanup action alternatives and as a list of remedial options to evaluate, as appropriate, at a site;
- The clarification of the requirement for use of institutional controls in WAC 173-340-360(2)(e) based on a PAC recommendation (see Final PAC Report, pp. 32-34 and C-45 through C-54);
- The modification of the requirement for use of dilution and dispersion in WAC 173-340-360(2)(g) based on discussions with the MTCA External Advisory Group;
- The addition of the requirement for use of remediation levels in WAC 173-340-360(2)(h) based on a PAC recommendation (see Final PAC Report, pp. 35-36); and
- The modification of the requirements and procedures for determining whether a cleanup action uses permanent solutions to the maximum extent practicable in WAC 173-340-360(3) based on a PAC recommendation (see Final PAC Report, pp. 32-34 and C-45 through C-54).

Several comments were received regarding the amendments to WAC 173-340-360. These comments are addressed below.

GQ 5.4.1
What is the purpose of the minimum requirements for cleanup actions and the relationship among those requirements?

(199, 219, 428, 712, 2117, 2204)

Response:
WAC 173-340-360 describes the minimum requirements and procedures for selecting cleanup actions. All cleanup actions must meet each of the minimum requirements specified in WAC 173-340-360(2). These minimum requirements are the same requirements listed in the current rule and serve the same purpose and have the same relationship as under the current rule. WAC 173-340-360(3) describes the specific requirements and procedures for determining whether a cleanup action uses permanent solutions to the maximum extent practicable, as required under subsection (2)(b)(i). WAC 173-340-360(4) describes the specific requirements and procedures for determining whether a cleanup action provides for a reasonable restoration time frame, as required under subsection (2)(b)(ii).

Determining whether a cleanup action meets each of the minimum requirements requires a separate, independent determination for each requirement. A determination that a cleanup action meets one requirement does not mean that the other minimum requirements specified in WAC 173-340-360(2) have been met. For example, a determination that a cleanup action uses permanent solutions to the maximum extent practicable, as required under subsection (2)(b)(i), does not mean that the other minimum requirements specified in WAC 173-340-360(2) have been met. The cost or practicability of cleanup cannot be used to justify the selection of a cleanup action that is not protective of human health and the environment. See 1991 RS, pp. 102-103.

GQ 5.4.2
How should public concerns be considered as part of the remedy selection process?

(209, 338, 2206, 2326)

Response:
Cleanup actions must meet each of the requirements in WAC 173-340-360, including the requirement that the cleanup action must consider public concerns. WAC 173-340-360(2)(b)(iii). The degree to which public concerns are considered and addressed is also a factor when conducting a disproportionate cost analysis to determine whether a cleanup action is permanent to the maximum extent practicable. WAC 173-340-360(3)(f)(vii). Note that WAC 173-340-600 sets forth specific public notice and participation requirements that are applicable as part of conducting a remedial investigation/feasibility study and selecting a cleanup action. See WAC 173-340-600(13) and (14). Note further that the criteria in WAC 173-340-360(3)(f)(vii)

was amended to provide specific direction on seeking public comment regarding the evaluation of cleanup action alternatives.

GQ 5.4.3
For non-permanent ground water cleanup actions under WAC 173-340-360(2)(c)(ii), to what extent is the removal of free product required?

(431, 559)

Response:
Free product, including both LNAPL and DNAPL, should be removed to the maximum extent practicable, in accordance with the statutory preference for permanent solutions.

GQ 5.4.4
For current or potential future residential areas and for schools and child care centers, what type of cleanup actions are required?

(201, 336, 577, 604, 2135, 2202, 2203)

Response:
For current or potential future residential areas and for schools and child care centers, "soils with hazardous substance concentrations that exceed soil cleanup levels must be treated, removed, or contained." WAC 173-340-360(2)(d). This requirement is self-explanatory and reflects an existing regulatory requirement found in WAC 173-340-740(1)(a) of the current rule. Institutional controls may also be required under certain circumstances to assure both the continued protection of human health and the environment and the integrity of a cleanup action. For example, if the cleanup action resulted in hazardous substances remaining at the site at concentrations that exceeded the applicable cleanup level, then institutional controls would be required. See WAC 173-340-440(4).

GQ 5.4.5
Should the requirement for soil cleanup actions in WAC 173-340-360(2)(d) apply to other types of properties (land uses) than those specified in the regulation, such as parks?

(336, 577, 2203)

Response:
The requirement for soil cleanup actions in WAC 173-340-360(2)(d) reflects an existing regulatory requirement found in WAC 173-340-740(1)(a) of the current rule, including the types of properties (land uses) subject to this requirement. The exposure assumptions that apply to the specified properties (land uses) may not always uniformly apply to other properties (land uses), such as parks. The requirement in WAC 173-340-360(2)(d) does not mean that other types of properties may not in fact require treatment, removal, or containment of all soils that exceed the cleanup levels. Such determinations, however, must be made on a site-specific basis.

GQ 5.4.6
When may a cleanup action primarily rely on dilution and dispersion?

(206, 1012, 2140, 2208)

Response:
The rule amendments include in WAC 173-340-360(2)(g) a modification of the requirement pertaining to dilution and dispersion. The amendment is based on discussions with the External Advisory Workgroup. The amendment provides that:

> Cleanup actions shall not rely primarily on dilution and dispersion unless the incremental costs of any active remedial measures over the costs of dilution and dispersion grossly exceed the incremental degree of benefits of active remedial measures over the benefits of dilution and dispersion.

WAC 173-340-360(2)(g). A cleanup action must meet this requirement in addition to every other minimum requirement in WAC 173-340-360(2). This requirement is less stringent than the requirement in the current rule, which provided that "[t]he cleanup action shall not rely primarily on dilution and dispersion of the hazardous substance if active remedial measures are technically possible." See current rule, WAC 173-340-350(5)(e)(iii). Under the current rule, if active remedial measures were technically possible, then a cleanup action could never rely on dilution and dispersion, irrespective of cost. Under the amendment, if active remedial measures are technically possible, then a cleanup action may primarily rely on dilution and dispersion, but only under certain circumstances. Those circumstances are based on consideration of cost.

Determining whether the incremental costs of any active remedial measures over the costs of dilution and dispersion grossly exceed the incremental degree of benefits of active remedial measures over the benefits of dilution and dispersion requires consideration of site-specific factors. The marginal cost must not merely exceed, but grossly exceed the marginal benefit. The "grossly exceeds" cost test requires a greater "exceedance" than the disproportionate cost test specified in WAC 173-340-360(3)(e)(i). Further guidance on this issue will be developed.

Note that the requirement in WAC 173-340-360(2)(g) refers only to cleanup actions that "primarily" rely on dilution and dispersion. The applicability of this requirement reflects the current rule language and has not been amended. Issues pertaining to dilution and dispersion were previously discussed in the 1991 Responsiveness Summary (see e.g., Issue #11, pp. 134-38, and Issue #20, pp. 146-48).

GQ 5.4.7
Does Ecology consider natural attenuation as an active remedial measure?

(85, 187, 206, 368, 957, 974, 2073, 2124, 2140, 2245, 2388, 2626)

Response:

The term "natural attenuation" is defined in WAC 173-340-200 and means "a variety of physical, chemical or biological processes that, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of hazardous substances in the environment." As noted in the definition, these in situ processes include not only dilution and dispersion, but also natural biodegradation; sorption; volatilization; and chemical or biological stabilization, transformation, or destruction of hazardous substances. In response to the concerns expressed by several commentors, Ecology has amended the definition to clarify that a cleanup action that includes natural attenuation and conforms to the expectation in WAC 173-340-370(7) can be considered an active remedial measure. See WAC 173-340-370(7) for a description of the expected role of natural attenuation in site cleanup. Natural attenuation, alone, cannot be considered an active remedial measure.

GQ 5.4.8
How does one determine whether a cleanup action is permanent to maximum extent practicable, as required under WAC 173-340-260(2)(b)(i)? What is the purpose of the disproportionate cost analysis?

(199, 220, 612, 586, 1112, 1296, 2143, 2205, 2562)

Response:
The requirements and procedures for determining whether a cleanup action uses permanent solutions to the maximum extent practicable, as required under WAC 173-340-360(2)(b)(i), have been amended in accordance with the PAC recommendations to more effectively achieve the goals and objectives of MTCA. See Final PAC Report, pp. 30-32 and C-45 through C-56). The amendments are primarily intended to improve the clarity and usability of the rule.

WAC 173-340-360(3) describes the requirements and procedures for determining whether a cleanup action uses permanent solutions to the maximum extent practicable, as required under WAC 173-340-360(2)(b)(i). A determination that a cleanup action meets this one requirement does not mean that the other minimum requirements specified in WAC 173-340-360(2) have been met. To select a cleanup action for a site, a cleanup action must meet each of the minimum requirements specified in WAC 173-340-360(2). For example, the cost or practicability of cleanup cannot be used to justify the selection of a cleanup action that is not protective of human health and the environment. See 1991 RS, pp. 102-103.

When selecting a cleanup action, preference shall be given to permanent solutions to the maximum extent practicable. To determine whether a cleanup action uses permanent solutions to the maximum extent practicable, the disproportionate cost analysis specified in WAC 173-340-360(3)(e) shall be used. The analysis shall compare the costs and benefits of the cleanup action alternatives evaluated in the feasibility study. The costs and benefits to be compared are the evaluation criteria identified in WAC 173-340-360(3)(f).

GQ 5.4.9
When is a disproportionate cost analysis not required?

(223, 961)

Response:
As provided in WAC 173-340-360(3)(d), "[a] disproportionate cost analysis shall not be required if the department and the potentially liable persons agree to a permanent cleanup action that will be identified by the department as the proposed cleanup action in the draft cleanup action plan." The provision was amended in 2000 proposal to improve the clarity of the rule and to address the issues raised by commentors regarding the 1999 proposal.

GQ 5.4.10
What does the word "disproportionate" mean in the context of the disproportionate cost analysis? Is the word "substantial" subsumed within the word "disproportionate"?

(338, 578, 2206, 2320, 2324, 2325)

Response:
To determine whether a cleanup action uses permanent solutions to the maximum extent practicable, the disproportionate cost analysis specified in WAC 173-340-360(3)(e) shall be used. The test for determining whether costs are disproportionate to benefits was defined by the PAC (see Final PAC Report, p. C-48). The test is set forth in WAC 173-340-360(3)(e)(i) as follows:

> Costs are **disproportionate** to benefits if the incremental costs of the alternative over that of a lower cost alternative exceed the incremental degree of benefits achieved by the alternative over that of the other lower cost alternative.

(emphasis added). The comparable disproportionate cost analysis in the current rule provided that:

> A cleanup cost shall not be considered practicable if the incremental cost of the cleanup action is **substantial and disproportionate** to the incremental degree of protection it would achieve over a lower preference cleanup action.

WAC 173-340-360(5)(d)(iv) (emphasis added). Note that while the revised analysis defines what is meant by the term "substantial and disproportionate," the term no longer includes the word "substantial." As explained in the Final PAC Report (p. C-48), **"[t]he meaning of the word 'substantial' as originally defined in the rule is subsumed in the word 'disproportionate.'"** In other words, the PAC did not intend to change the regulatory standard of "substantial and disproportionate."

One of the purposes of maintaining the concept of "substantiality," as originally defined in the rule, as part of the concept of "disproportionality" is to allow for a margin of safety when the benefits are not easily quantifiable. The necessary discretion to provide for such a margin of safety was formulated by the PAC as part of its recommendation (Final PAC Report, p. C-48) and has been explicitly incorporated into the rule in WAC 173-340-360(3)(e)(ii)(C), which provides the following:

> The comparison of benefits and costs may be quantitative, but will often be qualitative and require the use of best professional judgment. In particular, the department has the discretion to favor or disfavor qualitative benefits and use that information in selecting a cleanup action.

GQ 5.4.11
What are the procedures for conducting a disproportionate cost analysis?

(221, 224, 879, 955, 1178, 1319, 1320, 2144, 2146, 2362)

Response:
The basic framework for conducting a disproportionate cost analysis is set forth in WAC 173-340-360(3)(e)(ii). The procedures set forth how the cleanup action alternatives should be ranked, how to select an alternative as the baseline for the analysis, how to assess the costs and benefits, and how to determine if the costs are disproportionate to the benefits. Some commentors requested further guidance. Other commentors considered the procedures too inflexible. WAC 173-340-360(3)(e)(ii) sets forth the basic framework and guidance for conducting the analysis while providing sufficient flexibility to account for site-specific factors. The costs and benefits to be compared are the evaluation criteria in WAC 173-340-360(3)(f), each of which allows for consideration of site-specific information. Further discussion of implementation issues is more appropriately addressed through guidance.

The assessment of costs and benefits is described in WAC 173-340-360(3)(e)(ii)(C) and reflects the recommendations made by the PAC (Final PAC Report, p. C-48). The amendment specifically provides the following:

> The comparison of benefits and costs may be quantitative, but will often be qualitative and require the use of best professional judgment. In particular, the department has the discretion to favor or disfavor qualitative benefits and use that information in selecting a cleanup action. Where two or more alternatives are equal in benefits, the department shall select the less costly alternative provided the requirements of [WAC 173-340-360(2)] are met.

WAC 173-340-360(3)(e)(ii)(C).

GQ 5.4.12
For the purposes of the disproportionate cost analysis, which of the evaluation criteria in WAC 173-340-360(3)(f) are considered costs and which are considered benefits?

(222, 2145)

Response:
The evaluation criteria in WAC 173-340-360(3)(f) define the categories of costs and benefits and the factors must be considered when determining the costs and benefits of a cleanup action

alternative. These criteria are the same criteria listed in the current rule. Further discussion of implementation issues is more appropriately addressed through guidance.

GQ 5.4.13
Are the evaluation criteria in WAC 173-340-360(3)(f) listed in order of importance?

(429)

Response:
These evaluation criteria in WAC 173-340-360(3)(f) are the same criteria listed in the current rule. They are not listed in order of importance.

GQ 5.4.14
How should the short-term risks resulting from implementation of a cleanup action alternative be considered as part of the disproportionate cost analysis?

(337)

Response:
The short-term risks resulting from implementation of a cleanup action alternative are considered as part of the disproportionate cost analysis. The evaluation criteria in WAC 173-340-360(3)(f) define the categories of costs and benefits and the factors must be considered when determining the costs and benefits of a cleanup action alternative. These criteria are the same criteria listed in the current rule. The comment refers to an existing criteria and addresses an issue that is beyond the scope of this rule-making action. Further discussion of implementation issues is more appropriately addressed through guidance.

GQ 5.4.15
What does the phrase "improvement of the overall environmental quality" mean in WAC 173-340-360(3)(f)(i)?

(207, 2141)

Response:
The comment refers to existing regulatory language. The evaluation criteria in WAC 173-340-360(3)(f) are the same criteria listed in the current rule. Further discussion of this issue is more appropriately addressed through guidance.

GQ 5.4.16
Should the hierarchy of cleanup technologies be removed as a stand-alone criteria for remedy selection? Should the hierarchy of cleanup technologies be used as a guide to long-term effectiveness of various alternatives and as a list of remedial options to evaluate?

(586, 608, 715, 1013, 1074, 1115, 2119)

Response:
The rule amendments include the removal of the hierarchy of cleanup technologies as a stand-alone criteria for remedy selection and the addition of that hierarchy as a guide to long-term effectiveness of various alternatives and as a list of remedial options to evaluate. See WAC 173-340-360(3)(f)(iv). This rule amendment is based on a PAC recommendation and was determined by the PAC as necessary to more effectively achieve the goals and objectives of MTCA (Final PAC Report, pp. 32-35 and C-46 through C-47. The rule, as amended, still requires that the feasibility study includes a permanent cleanup action alternative except under certain circumstances (see WAC 173-340-350(8)(c)(ii)) and that the cleanup action alternatives in the feasibility study be ranked based on permanence (see WAC 173-340-360(3)(e)(ii)(A)) and evaluated based on long-term effectiveness (see WAC 173-340-360(3)(f)(iv)), among other factors.

GQ 5.4.17
Should natural attenuation be included in the list of cleanup technologies to be considered when evaluating long-term effectiveness?

(693)

Response:
The term "natural attenuation" includes several biological and chemical processes (see definition in WAC 173-340-200), many of which are found in the list of cleanup technologies to be considered when evaluating long-term effectiveness.

GQ 5.4.18
Should the provision in WAC 173-340-360(4)(c) be stricken as inconsistent with the removal of the hierarchy of cleanup technologies?

(217, 2147)

Response:
The comment refers to an existing regulatory provision (WAC 173-340-360(4)(c)) that has not been amended. The provision is not inconsistent with the removal of the hierarchy of cleanup technologies as a stand-alone criteria for remedy selection. The rule still requires use of the hierarchy as a guide to long-term effectiveness of various alternatives and as a list of remedial options to evaluate. Furthermore, the provision reflects the statutory preference for permanent solutions.

GQ 5.4.19
Other comments regarding WAC 173-340-360 are addressed in the following table:

Comment ID	Section	Comment	Response
199, Gillett 428, Allen	360	To improve the clarity and usability of the rule, move the minimum requirements back into WAC 173-	Comment addressed in 2000 proposal.

		340-360.	
564, Wingard	360(2)	Permanent cleanups are important.	Comment noted.
335, Valeriano 1316, McCain	360(2)	Delete proposed sentence stating, "These requirements are not subject to qualifications or waivers."	Comment addressed in 1999 proposal by deleting relevant language.
200, Gillett	360(2)(a)(iii)	Delete requirement as redundant with requirement in section 360(2)(a)(ii).	Comment refers to existing rule language and an issue that is beyond the scope of this rule-making action. The requirement is necessary for emphasis.
689, Burden	360(2)(b)(ii)	Modify requirement to allow for consideration of natural attenuation and technical and economic feasibility.	Comment refers to existing rule language and an issue that is beyond the scope of this rule-making action. See WAC 173-340-370(7) for Ecology's expectations regarding when natural attenuation may be appropriate as part of a cleanup action.
335, Valeriano	360(2)(b)(iii)	Modify requirement. Community concerns should be addressed, not merely considered.	Comment refers to existing rule language and an issue that is beyond the scope of this rule-making action. Community concerns should be considered and addressed, as appropriate, as part of the development and selection of a cleanup action.
202, Gillett 2136, Riley	360(2)(d)	Provide criteria for determining whether a property is a current or potential school or day care center.	Comment addressed in 2000 proposal. The requirement applies to "schools and child care centers."
205, Gillett 2139, Riley	360(2)(f)	Modify requirement to provide that releases and migration shall be prevented or minimized to the maximum extent practicable.	Comment refers to an existing regulatory requirement that is beyond the scope of this rule-making action. See former WAC 173-340-360(5)(e)(i) in the current rule.
603, K. Johnson	360(3)(c)(i)	Permanent cleanup actions should only be required where a permanent cleanup action is both practicable and in the public interest.	Comment refers to existing rule language and an issue that is beyond the scope of this rule-making action. Issues pertaining to the selection of cleanup actions were previously discussed in the 1991 Responsiveness Summary (see, e.g., Chapter X, pp. 123-50).
1248, Gillett	360(3)(d)	Suggested editing change.	Comment addressed in 2000 proposal.
1235, Gillett 1249, Gillett	360(3)(e)(ii)(A)	Suggested editing change.	Comments addressed in 2000 proposal.
1320, McCain	360(3)(e)(ii)(C)	Include requirement that where two or more alternatives are equal in benefits, the department shall select the less costly alternative.	Comment addressed in 1999 proposal.
208, Gillett 2142, Riley	360(3)(f)(iv)	Modify the parenthetical definition of "long-term reliability" for purposes of clarity.	Comment addressed in adopted rule.
608, K. Johnson	360(3)(f)(iv)	Modify criteria to exclude consideration of the risks posed by failure of a cleanup action alternative.	Comment refers to an existing regulatory requirement and addresses an issue that is beyond the scope of this rule-making action.
697, Burden	360(3)(f)(vi)	Modify criteria to include	Comment refers to an existing regulatory

2633, Wisness		consideration of practicability.	requirement and addresses an issue that is beyond the scope of this rule-making action. Note that the cost of an alternative is considered under the criteria in WAC 173-340-360(3)(f)(iii).
2636, Wisness	360(3)(f)	Based on the definition of "permanent cleanup action" in WAC 173-340-200, how does Ecology compare containment in an on-site disposal unit with containment of cleanup waste (with no treatment) in an off-site disposal unit?	The comment refers to an existing definition and addresses an issue that is beyond the scope of the rule-making action.
2634, Wisness	360(4)(b)(iv)	Modify factor to require consideration of only "potential reasonable future use."	Comment refers to an existing regulatory requirement and addresses an issue that is beyond the scope of this rule-making action.
320, Warden 1091, Hapke 2394, Newlon	360(4)(d)	Provision is too restrictive. The provision should be modified to allow for a remedial action to be "final" if it is demonstrated that it is technically impossible meet a cleanup level.	Comment refers to an existing regulatory requirement and addresses an issue that is beyond the scope of this rule-making action. See 1991 RS, Issue #21, p. 148 for further discussion. Note that cleanup actions must comply with cleanup standards and that the rule has been amended to include an area-wide conditional point of compliance. See WAC 173-340-720(8).
2080, McCain	360(4)(d)	Suggested editing change to reflect the effect of the new provision for a conditional point of compliance for area-wide groundwater contamination.	Suggested editing change not required. If a remedial action is able to achieve cleanup levels at the conditional point of compliance, then the action would not be considered an interim action for the purposes of this subsection.
376, Rasmussen 2635, Wisness	360(4)(e)	Provision is too restrictive. The provision should be modified to allow for a remedial action to be "final" if it is demonstrated that it is technically impossible to meet a cleanup level.	Comment refers to an existing regulatory requirement and addresses an issue that is beyond the scope of this rule-making action. See 1991 RS, Issue #22, p. 148 for further discussion.
2394, Newlon	360(4)(e)	The requirement that concentrations that are technically possible to achieve shall be met within a reasonable restoration timeframe is too restrictive.	Comment refers to an existing regulatory requirement and addresses an issue that is beyond the scope of this rule-making action. See 1991 RS, Issue #22, pp. 148-49 for further discussion.
218, Gillett 698, Burden 2148, Riley	360(4)(f)	Does Ecology consider natural attenuation as an active remedial measure?	See the definition of "natural attenuation" and **GQ 5.4.7** above.

5.5 Expectations for Cleanup Action Alternatives (WAC 173-340-370)

WAC 173-340-370 is a new section consisting of provisions that were moved from WAC 173-340-360(9) and reformatted to improve the clarity and usability of the rule. No change in meaning is intended. For discussion of the current rule, see 1991 RS, Issue #5, pp. 129-130. The only substantive change is the inclusion in subsection (7) of an expectation regarding when natural attenuation of hazardous substances may be appropriate at a site. The purpose of this amendment is to provide additional guidance regarding the use of natural attenuation as a cleanup action component. Comments received regarding the amendments to WAC 173-340-545 are addressed below.

GQ 5.5.1
What is the purpose of the expectations set forth in WAC 173-340-370?

(340, 1031, 2207)

Response:
The purpose of the expectations set forth in WAC 173-340-370 is explained in the rule, which provides the following:

> These expectations represent the types of cleanup actions the department considers likely results of the remedy selection process described in WAC 173-340-350 through 173-340-360; however, the department recognizes that there may be some sites where cleanup actions conforming to these expectations are not appropriate. Also, selecting a cleanup action that meets these expectations shall not be used as a substitute for selecting a cleanup action under the remedy selection process described in WAC 173-340-350 through WAC 173-340-360.

WAC 173-340-370. This provision reflects changes made as part of the adopted rule in response to comments requesting further clarification of the purpose of the expectations.

GQ 5.5.2
When does Ecology expect that natural attenuation of hazardous substances may be appropriate at a site? Can a cleanup action that includes natural attenuation and conforms to the expectations in WAC 173-340-370(7) be considered an active remedial measure?

(85, 187, 368, 559, 685, 730, 974, 1270, 2073, 2124, 2209, 2245, 2387, 2388, 2420, 2626)

Response:
WAC 173-340-370(7) sets forth when Ecology expects that natural attenuation of hazardous substances may be appropriate at a site. The purpose of this amendment is to provide additional guidance regarding the appropriate use of natural attenuation as a cleanup action component. As noted in the definition of "natural attenuation" in WAC 173-340-200, a cleanup action that includes natural attenuation and conforms to the expectations in WAC 173-340-370(7) can be considered an active remedial measure. Specific comments regarding the rule language are addressed in the following table.

Comment ID	Section	Comment	Response
730, Newlon 2420, Newlon	370(7)	Expectation should refer to "natural attenuation," not just "natural biodegradation." Comment addressed.	Comment addressed in 1999 proposal.
1270, POG	370(7)(c), (d)	Expectation should include additional elements.	Comment addressed in 1999 proposal.
2209, Valeriano	370(7)(c)	Provision should exclude dilution and dispersion.	Comment addressed in adopted rule.
1306, McCain 1323, McCain	370(7)(c)	Provision should be expanded to include evidence of both biodegradation of organics and chemical degradation of inorganics.	Comment addressed in adopted rule.
685, Burden	370(7)(c)	Provision should be less restrictive and allow for evidence that natural attenuation can reasonably be expected to occur.	Natural attenuation is not always appropriate for a site. Favorable conditions are necessary for the physical chemical or biological processes to reduce the mass, toxicity, mobility, volume, or concentration of hazardous substances in the environment. That is why it is necessary for persons to demonstrate that natural biodegradation or chemical degradation is occurring and will continue to occur at a reasonable rate at the site.
685, Burden	370(7)	Add another provision that allows for natural attenuation when active remedial measure are not technically or economically feasible.	A cleanup action that includes natural attenuation and conforms to the expectations in WAC 173-340-370(7) can be considered an active remedial measure. All cleanup actions must meet the minimum requirements in WAC 173-340-360(2). Technical feasibility and cleanup cost are factors considered when determining whether a cleanup action is permanent to the maximum extent practicable, one of those minimum requirements. The cost or practicability of cleanup cannot be used to justify the selection of a cleanup action that is not protective of human health and the environment or that does not comply with cleanup standards.

GQ 5.5.3
Other comments regarding WAC 173-340-370 are addressed in the following table:

Comment ID	Section	Comment	Response
340, Valeriano 2210, Valeriano	370	Suggests adding new expectation: "The result of the cleanup should be that the site is cleaned up permanently so that future generations are not left with the legacy of pollution."	MTCA provides that Ecology shall give preference to permanent solutions to the maximum extent practicable." RCW 70.015D.030(1)(b).
87, POG 2247, POG	370(6)	The meaning of the language in 173-340-370(6) needs to be clarified as to whether it conflicts with the language in 173-340-720 and -730. It is not clear whether the use of the term "dilution" means the same as "mixing zone" or something different.	Comment refers to an existing regulatory requirement. Note that "mixing zones" are only allowed in the context of point discharges. The provisions are not inconsistent.
731, Newlon 2389, Newlon	370(6)	Modify expectation to clarify that natural attenuation processes may be	Comment refers to an existing regulatory requirement. Note that the definition of

		appropriate.	natural attenuation in WAC 173-340-200 has been amended to clarify that a cleanup action that includes natural attenuation and conforms to the expectation in WAC 173-340-370(7) can be considered an active remedial measure. See WAC 173-340-370(7) for a description of the expected role of natural attenuation in site cleanup.
2208, Valeriano	370(6)	Modify expectation to address persistent bioaccumulative toxins (PBTs).	Comment refers to an existing regulatory requirement and addresses an issue that is beyond the scope of this rule-making action. Note that Ecology recently issued a PBT strategy. See Ecology, *Proposed Strategy to Continually Reduce Persistent, Bioaccumulative Toxins (PBTs) in Washington State*, Pub. #00-03-054, Dec. 2000.

5.6 Cleanup Action Plan (WAC 173-340-380)

WAC 173-340-380 is a new section consisting of provisions that were moved from WAC 173-340-360(10) through (12) and reformatted to improve the clarity and usability of the rule. No change in meaning is intended. Comments received regarding WAC 173-340-380 are addressed below.

GQ 5.6.1
Comments regarding WAC 173-340-380 are addressed in the following table:

Comment ID	Section	Comment	Response
613, K. Johnson	380(1)(a)(iv)	Cleanup standard should incorporate the concept of remediation levels. Remediation levels are cleanup levels.	Ecology disagrees. Remediation levels are not cleanup levels. See Section 5.2 of the CES for further discussion of this issue.

5.7 Model Remedies (WAC 173-340-390)

WAC 173-340-390 is a new section that describes Ecology's authority to identify model remedies for common categories of facilities, types of contamination, types of media, and geographic areas. In identifying a model remedy, Ecology must identify the circumstances for which application of the model remedy meets the requirements in WAC 173-340-360. This amendment is based on a PAC recommendation and was determined by the PAC as necessary to more effectively achieve the goals and objectives of MTCA. Comments received regarding WAC 173-340-390 are addressed below.

GQ 5.7.1
How may a model remedy be developed and identified?

(226, 341, 377, 1015, 2150, 2211)

Response:
A model remedy may be developed and identified either through guidance or through a rule-making action.

GQ 5.7.2
What are the requirements that a model remedy must meet to be selected as a cleanup action or as a portion of the cleanup action?

(377, 962, 2045, 2638)

Response:
All cleanup actions must meet each of the requirements specified in WAC 173-340-360. As provided in WAC 173-340-390(2), Ecology must identify the circumstances for which application of a model remedy meets the requirements in WAC 173-340-360.

GQ 5.7.3
Will Ecology provide the public an opportunity to review and comment on any proposed model remedy?

(341, 377, 962, 1015, 2045, 2211, 2638)

Response:
Yes. Ecology will provide the public an opportunity to review and comment on any proposed model remedy. WAC 173-340-390(2) has been added to clarify this fact and address the commentors' concerns.

GQ 5.7.4
How is the applicability of a model remedy determined? If a model remedy is applicable, must it be selected as the cleanup action?

(227, 2151)

Response:
When Ecology identifies a model remedy, Ecology must also identify the circumstances for which application of a model remedy meets the requirements in WAC 173-340-360. WAC 173-340-390(2). If a site meets the circumstances identified by Ecology, then the components of the model remedy may be selected as the cleanup action, or as a portion of the cleanup action. WAC 173-340-390(3). A person is not presumptively required to select the components of the model remedy as the cleanup action, or as a portion of the cleanup action. However, the cleanup action that is selected must still meet each of the requirements specified in WAC 173-340-360.

GQ 5.7.5
Where a model remedy is proposed as the cleanup action or as a portion of the cleanup action, is the cleanup action still subject to the same public notice and participation requirements in this chapter as any other cleanup action?

(341, 377, 1015, 2211, 2638)

Response:
Yes. Where a model remedy is proposed as the cleanup action or as a portion of the cleanup action, the cleanup action is still subject to the same public notice and participation requirements in this chapter 173-340 WAC as any other cleanup action. WAC 173-340-390(4) has been added to clarify this fact and address the commentors' concerns.

GQ 5.7.6
Other comments regarding WAC 173-340-390 are addressed in the following table:

Comment ID	Section	Comment	Response
70, POG 225, Gillett 794, Brown 2149, Riley	390	Encourage development of model remedies and guidance for commercial gas stations and other petroleum contaminated sites.	Comment noted. Ecology is committed to the development of model remedies for commercial gas stations and other petroleum contaminated sites.
321, Warden	390	Encourage development of model remedies.	Comment noted.
1016, Kluck	390	Ecology should identify model remedies that establish a high standard of environmental and human health protection and a greater emphasis on permanence.	Comment noted. The purpose of model remedies is to streamline and accelerate the selection of cleanup actions that protect human health and the environment, with a preference for permanent solutions to the maximum extent practicable. Model remedies must meet each of the requirements for cleanup actions specified in WAC 173-340-360.
2348, Martin	390	How will the amendment facilitate cleanup, redevelopment and reuse of brownfields, agricultural properties and areas of widespread contamination?	Based on the PAC recommendation, the rule amendments will facilitate cleanups in the situations noted by using the authority granted by the amendments to develop model remedies and to use area-wide points of compliance.

5.8 Institutional Controls (WAC 173-340-440 and 173-340-360(2)(e))

Several amendments were made to this section. Most of these amendments were made to improve the clarity and usability of the regulation and are not intended to change the meaning of the provisions. Substantive changes include the following:

- The reorganization and amendment of subsections (1) and (2) to provide a better description of institutional controls and their relationship to engineered controls. These amendments were made to improve the clarity and usability of the rule;
- The addition of subsection (3) which clarifies that this section is applicable to any remedial action conducted under this chapter. This amendment was made to improve the clarity and usability of the rule;
- The amendment of the list of circumstances in subsection (4) specifying when institutional controls are required as part of a remedial action to ensure the continued protection of human health and the environment and the integrity of the remedial action. The purpose of this amendment is to clarify existing regulatory requirements and to reflect other amendments made throughout the remainder of the rule, including amendments regarding site-specific risk assessment and conducting terrestrial ecological evaluations based on PAC recommendations (see Final PAC Report, pp. 32-35);
- The addition in subsection (5) of the minimum requirements that cleanup actions that use institutional controls must meet, including criteria for evaluating the protectiveness and long-term effectiveness of institutional controls. The purpose of this amendment is to clarify existing regulatory requirements and to implement a PAC recommendation (see Final PAC Report, pp. 32-35);
- The inclusion in subsection (6) of the existing regulatory requirement in WAC 173-340-360 regarding the use of institutional controls to improve the clarity and usability of the rule;
- The addition in subsection (7) of the requirement that Ecology review compliance with institutional controls requirements as part of periodic reviews under WAC 173-340-420. This amendment is based on a PAC recommendation (see Final PAC Report, pp. 32-35);
- The amendment of subsection (8) to provide specific format requirements for properties owned by a local, state, or federal government entity. This amendment is necessary to avoid conflicts with federal requirements.
- The amendment of subsection (9) to require that a notice of a restrictive covenant be provided in any instrument conveying an interest in the property. This amendment is based on a PAC recommendation (see Final PAC Report, pp. 32-35); and
- The amendment of subsection (11) to clarify when financial assurance are required and the acceptable methods for providing such financial assurances. This amendment is based on a PAC recommendation (see Final PAC Report, pp. 32-35).

Several comments were received regarding the amendments to WAC 173-340-440. These comments are addressed below.

GQ 5.8.1
What are the minimum requirements for cleanup actions that use institutional controls? Should the effectiveness of institutional controls be demonstrated? What is required to make such a demonstration?

(343, 560, 564, 964, 2047, 2137, 2213)

Response:

The rule amendments specify in WAC 173-340-440(5) and 173-340-360(2)(e)(i) the minimum requirements that cleanup actions that use institutional controls must meet, including criteria for evaluating the protectiveness and long-term effectiveness of institutional controls. The amendment specifically provides the following:

> Cleanup actions that use institutional controls shall meet each of the minimum requirements specified in WAC 173-340-360, just as any other cleanup action. Institutional controls should demonstrably reduce risks to ensure a protective remedy. This demonstration should be based on a quantitative, scientific analysis where appropriate.

WAC 173-340-440(5) and 173-340-360(2)(e)(i). The purpose of this amendment is to clarify existing regulatory requirements and to implement a PAC recommendation (see Final PAC Report, pp. 32-35 and C-49 through C-53).

The inadequacies of the current system of institutional controls were identified during the PAC process. Throughout its deliberations, the PAC reaffirmed the need for the effective use of institutional controls. After considering several options, the PAC decided to recommend the adjustment of the statutory and regulatory language to strengthen institutional controls where they are appropriately used. See Final PAC Report, C-49 through C-53.

This amendment is one of several amendments based on PAC recommendations that were made to strengthen institutional controls where they are appropriately used. The amendment emphasizes the existing regulatory requirement that cleanup actions that use institutional controls must meet the minimum requirements in WAC 173-340-360, just as any other cleanup action. The amendment further emphasizes that to make such a determination, the effectiveness of institutional controls should be demonstrated. Such demonstrations are necessary to ensure that cleanup actions that use institutional controls actually meet the minimum requirements in WAC 173-340-360 and that the institutional controls themselves are effective in reducing risks to ensure that the remedy is protective over the long-term. Without such a demonstration, cleanup actions that use institutional controls (just as any other cleanup action) cannot be said to meet the minimum requirements in WAC 173-340-360.

The amendment further provides that the demonstration should be based on a quantitative, scientific analysis where appropriate. Some commentors were concerned that such analyses might not always be appropriate or cost-effective. Ecology recognizes that it may be difficult to demonstrate the effectiveness of institutional controls through the use of a quantitative, scientific analysis or to otherwise quantify the benefits associated with a cleanup action alternative. That recognition is incorporated into the requirement by requiring such quantitative analyses only "where appropriate." Note that this language also directly reflects the language of the PAC recommendation (see Final PAC Report, p. 33).

GQ 5.8.2
May cleanup actions primarily rely institutional controls and monitoring where it is technically possible to implement a more permanent cleanup action for all or a portion of the site?

(39, 203, 233, 343, 374, 375, 430, 432, 560, 564, 585, 605, 606, 617, 681, 690, 691, 713, 714, 881, 956, 964, 1072, 1076, 1090, 1116, 1117, 1120, 1127, 1128, 1129, 1185, 1188, 1326, 2042, 2079, 2083, 2118, 2138, 2156, 2213, 2480, 2632, 2639)

Response:
No. The comments refer to the existing regulatory requirement regarding the use of institutional controls in WAC 173-340-360 established in 1991 that has not been substantively changed as part of this rule-making action. The amendments included the reorganization of WAC 173-340-350 through 173-340-390 and the duplication of the requirements in WAC 173-340-360 applicable to institutional controls in WAC 173-340-440 to improve the clarity and usability of the rule. The existing regulatory requirement, as stated in the amended rule, provides that:

> In addition to meeting each of the minimum requirements specified in [WAC 173-340-360], cleanup actions shall not rely primarily on institutional controls and monitoring where it is technically possible to implement a more permanent cleanup action for all or a portion of the site.

WAC 173-340-360(2)(e)(iii) and 173-340-440(6).

Several commentors suggested that the existing regulatory requirement should be deleted or otherwise amended to change the intent of the requirement. Some of these commentors expressed concern that the requirement might preclude the use of institutional controls and, consequently, the use of natural attenuation as a remedy. Some of these commentors also expressed the opinion that the requirement conflicted with the intent of the PAC recommendations. Several other commentors objected to any consideration of eliminating the existing regulatory requirement and continued to express concern regarding the inappropriate use of institutional controls and the lack of protectiveness, effectiveness, and permanence of such controls.

The PAC did not recommend the elimination of any existing regulatory requirement applicable to institutional controls. On the contrary, the purpose of the PAC deliberations was to address recognized concerns regarding the inappropriate use of institutional controls and the potential ineffectiveness of such controls. After considering several options, including no action and the elimination of institutional controls as a method of site remediation, the PAC decided to address the concerns by recommending the adjustment of the statutory and regulatory language to strengthen institutional controls where they are appropriately used. See Final PAC Report, C-49 through C-53.

The language of the existing regulatory requirement was modified as part of the rule amendments to reflect other PAC recommendations. Specifically, the PAC recommended the removal of the hierarchy of cleanup technologies as a stand-alone criteria for remedy selection and the use of that hierarchy as a guide to long-term effectiveness and as a list of remedial options to evaluate (see Final PAC Report, pp. C-46 through C-47). Based on that recommendation, the hierarchy of cleanup technologies (as found in WAC 173-340-360(4)(a) of the current rule) was removed as a

stand-alone criteria for remedy selection. Any reference to that provision was also removed. This included the removal of the phrase "cleanup action alternative that utilizes a higher preference cleanup technology" in WAC 173-340-360(5)(e)(iv) of the current rule – the requirement at issue here. That phrase was replaced with the phrase "more permanent cleanup action," a phrase that is consistent with MTCA and the original intent of the regulatory requirement.

The requirement at issue was one of several requirements that existed as part of the current rule (see WAC 173-340-360(5)(e)) to ensure that statutory preference for permanent solutions would be realized. Most of those requirements have been retained or modified, as appropriate, in the amended rule. The basis for these requirements, independent of the hierarchy of cleanup technologies, remains valid. Issues pertaining to institutional controls were previously discussed in the 1991 Responsiveness Summary (see e.g., Issue #16, pp. 142-43). With respect to institutional controls, the concerns expressed during PAC deliberations and recognized by the PAC only validated the basis for retaining the existing requirement.

Retaining the existing regulatory requirement, as amended, will not preclude the use of institutional controls as a component of a cleanup action. Ecology records show that approximately 85% of the sites cleaned up under an order or consent decree use institutional controls. At these sites, the remedy incorporates permanent and non-permanent cleanup action components that together are protective of human health and the environment.

Retaining the existing regulatory requirement, as amended, will also not preclude the use of natural attenuation as a component of a cleanup action. Under the authority of the current rule, Ecology has approved several cleanup actions that included natural attenuation as a component. The regulation has also been amended to further describe the expected role of natural attenuation as part of a cleanup action. See WAC 173-340-370(7). As further noted as part of the definition of "natural attenuation" in WAC 173-340-200, a cleanup action that includes natural attenuation and conforms to the expectation in WAC 173-340-370(7) can be considered an active remedial measure.

GQ 5.8.3
Should deed restrictions be required under MTCA even if an ordinance or other law restricted the same activity?

(616, 2015)

Response:
Two commentors suggested that there was no need for a person to put a deed restriction on property they owned if a local ordinance or other law restricted the same resource use or activity that required a deed restriction under the rule. The comments refer to an existing regulatory requirement and address an issue that is beyond the scope of the rule-making action. Note that the only way under property law to place notice of restrictions on property is to file a restrictive covenant on the title of the property. This provides subsequent purchasers with direct knowledge about limitations on use of the property. Also note that zoning and land uses can change over

time. Note further that whether a cleanup action that includes such property restrictions meets the minimum requirements for cleanup actions is dependent on determinations regarding the effectiveness and permanence of those restrictions. To ensure the long-term effectiveness of any cleanup action that includes property restrictions that limit exposure and reduce risk, Ecology is dependent on the statutory authority provided by the legislature to enforce the restrictive covenant that includes such property restrictions.

GQ 5.8.4
What is the authority for requiring financial assurances? What are the differences between the current rule and the rule as amended? When are financial assurances required?

(965, 1130, 1131, 2048)

Response:
Under the current rule, Ecology could require the potentially liable person to provide financial assurances under certain circumstances and using specified or approved mechanisms. See WAC 173-340-440(7) under the current rule. The financial assurance rule amendments revise the current rule in the following ways:

- First, the amendments modify Ecology's authority and duty to require the potentially liable person to provide financial assurances. Specifically, the amendment provides that "Ecology shall, as appropriate, require financial assurance mechanisms at sites where the cleanup action selected includes engineered and/or institutional controls." WAC 173-340-440(11). Based on this amendment, Ecology expects that financial assurances will be required in practice under the proposed rule where they may not have been required under the current rule.
- Second, the amendments provide potentially liable persons increased flexibility in the selection of financial assurance mechanisms that meet the requirements of the rule. See WAC 173-340-440(11)(a).
- Third, the amendments provide a specific exemption for certain types of financial hardship. See WAC 173-340-440(11)(b).
- Fourth, the amendments provide a specific exemption for potentially liable persons that can demonstrate that sufficient financial resources are available and in place to provide for the long-term effectiveness of engineered and institutional controls adopted. See WAC 173-340-440(11).

These rule amendments are based on a PAC recommendation (see Final PAC Report, pp. 32-34). The amendments are required to more effectively achieve the general goals and specific objectives of the statute, including the following:

- To protect human health and the environment (see RCW 70.105D.010 and .030);
- To require potentially liable persons to conduct remedial actions (including investigations) to remedy releases or threatened releases of hazardous substances (see RCW 70.105D.030(1)(b));

- To give preference to permanent solutions to the maximum extent practicable (see RCW 70.105D.030(1)(b));
- To require adequate monitoring to ensure the effectiveness of the remedial action (see RCW 70.105D.030(1)(b)); and
- To enforce the application of permanent and effective institutional controls that are necessary for a remedial action to be protective of human health and the environment (see RCW 70.105D.030(1)(g)).

Financial assurances are safeguards (an "insurance" policy) to ensure the long-term protectiveness of a less permanent cleanup action that includes engineered and/or institutional controls. Financial assurances may be required to cover one or more of the following: operation and maintenance, compliance monitoring, and corrective measures.

As discussed more thoroughly in the LBA Analysis, the proposed amendment is the least burdensome alternative that will achieve the general goals and specific objectives of MTCA. Several alternatives were considered and evaluated as part of that analysis

As discussed more thoroughly in the Estimates of the Probable Costs and Benefits, the probable benefits of this amendment exceed the probable costs. The amendment is not expected to impact most sites. The impact depends on several factors. Most notably, the impact depends on whether, and to what extent, financial assurances will be required in practice under the proposed rule where they may not have been required under the current rule. Even if financial assurances will be required in practice under the proposed rule where they may not have been required under the current rule, other factors may mitigate the impact on costs. First, the proposed rule amendment provides potentially liable persons increased flexibility in the selection of financial assurance mechanisms that meet the requirements of the rule. See WAC 173-340-440(11)(a). Second, the proposed rule provides a specific exemption for financial hardship. See WAC 173-340-440(11)(b). Third, the proposed rule provides a specific exemption for potentially liable persons that can demonstrate that sufficient financial resources are available and in place to provide for the long-term effectiveness of engineered and institutional controls adopted. See WAC 173-340-440(11). The Estimates of Probable Costs and Benefits provides a more extensive discussion of the potential adverse impact of the amendment on potentially liable persons.

Several commentors requested further clarification of when financial assurances would be required. Ecology recognizes that guidance will need to be developed for the purpose of providing more detail on when financial assurance will be required.

GQ 5.8.5
Does a potentially liable person's obligation to provide financial assurance extend only to its portion of liability at a site?

(619)

Response:

The cost associated with providing financial assurances is a remedial action cost. Under the MTCA, potentially liable persons are strictly liable, jointly and severally, for those costs (see RCW 70.105D.010(5) and .040(2)).

GQ 5.8.6
May financial assurances be required as part of an independent remedial action?

(2327)

Response:
Financial assurances may be required as part of an independent remedial action, depending on the action taken. WAC 173-340-515 sets forth the standards and requirements for independent cleanup actions. WAC 173-340-515(3) specifically provides that independent remedial actions must meet the substantive requirements of chapter 173-340 WAC. WAC 173-340-440(3) specifically provides section 440 applies to remedial actions being conducted under WAC 173-340-515. The requirement of financial assurances is a substantive requirement.

GQ 5.8.7
Can cleanup actions for petroleum contaminated sites be completed under the rule as amended without the requirement of a deed restriction or financial assurances?

(41, 581, 675, 828, 2553, 2579)

Response:
Yes. The majority of petroleum-only cleanup actions are conducted as voluntary, independent remedial actions rather than as formal oversight sites under decree or order. Historically, petroleum-only cleanups have achieved cleanup levels with the exception of approximately 10% of the independent cleanups. This estimate is based on a review of nearly 300 cleanups conducted under the voluntary cleanup program (VCP). The instances where a deed restriction was requested by a PLP for an independent petroleum-only remedial action occurred because a building or structure was located on top of contamination.

GQ 5.8.8
Other comments regarding WAC 173-340-440 are addressed in the following table:

Comment ID	Section	Comment	Response
Purpose			
2385, Newlon	360(2)(e)(i)	Clarify that financial assurances are only required as needed on a site-by-site basis. The "and" in this sentence should be changed to "or".	Comment addressed in adopted rule. Determinations of whether financial assurances are required are made on a site-specific basis.
2300, POG 2381, Newlon 2383, Newlon	440(1)	Clarify that section does not require the use of every type of institutional control listed in subsection (1) when institutional controls are used or required as part of a remedial action.	Comment addressed in adopted rule. Ecology does not intend that every type of institutional control listed in subsection (1) is necessarily required when institutional controls are used or

			required as part of a remedial action.
2301, POG 2384, Newlon	440(1)(e)	Financial assurances should not be included on the list of what are institutional controls.	To the extent that financial assurances provide for the long-term operation and maintenance of the cleanup action, they are an institutional control as defined in WAC 173-340-440(1).
Applicability			
1261, Gillett	440(3)	Clarify that subsection (3) does not require the use of institutional controls as part of every remedial action.	Suggested change is not required to clarify the intent of subsection (3). The provision does not require the use of institutional controls as part of every remedial action. The circumstances requiring the use of institutional controls are specified in subsection (4).
Circumstances Required			
2302, POG	440(4)	Suggested editorial change.	Suggested change is not appropriate.
88, POG 2248, POG 616, K. Johnson	440(4)(b, c)	Suggested corrections to 1999 proposal.	Comment addressed, as appropriate, in 2000 proposal.
2303, POG	440(4)(d)	This provision creates unnecessary requirements for institutional controls.	Comment addressed in adopted rule. See revised language in WAC 173-340-440(4)(d) and 173-340-720(6)(c)(iii).
2302, POG 2304, POG 2382, Newlon	440(4) and 440(4)(e)	Change "site" to "property." Otherwise, the requirement would impose a deed restriction on every property participating in an area-wide point of compliance or every property deemed to be within a site.	Ecology disagrees that the requirement for institutional controls should be limited to properties. Institutional controls are applicable to a "site," which by definition is anyplace where contamination has come to be located.
1294, Piecka	440(4)	Should institutional controls be required whenever site-specific risk assessment is used to establish cleanup levels?	Comment refers to an existing general regulatory requirement that has not been amended.
Requirement for Primary Reliance			
204, Gillett	440(6)	Noted inconsistency. Institutional controls "should" demonstrably reduce risks to ensure a protective remedy, not "shall".	Inconsistency corrected, as appropriate, in 2000 proposal. The comment refers to an existing regulatory requirement.
Format			
433, Allen	440(8)(b)(ii)	Recommend that an acceptable alternative to a restrictive covenant is an Institutional Controls Management Plan.	Subsection (8)(b) requires that the entity will implement an effective alternative system to meet the requirements of subsection (9). The amendment does not mandate or preclude the use of any particular system.
618, K. Johnson	440(8)(c)	Commenting on the 1999 proposal, suggested different criteria for determining when other legal or administrative means may be used. Suggested replacing the phrase "it is not possible" with the phrase "it is not practicable."	Comment addressed, as appropriate, in the 2000 proposal.
2386, Newlon	440(8)(c)	Commenting on the 2000 proposal and referring to who must obtain a	There is no conflict. Subsection (8)(a) refers to property where the PLP is the

		restrictive covenant or use other legal or administrative means, expressed concern that the third sentence might conflict with the requirements in subsection (8)(a). Suggested deleting the third sentence.	owner. Subsection (8)(c) refers to property where the PLP is not the owner. Under such circumstances, the PLP must make a good faith effort obtain a restrictive covenant for the property that the it does not own. If the PLP is unable to obtain a restrictive covenant after a good faith effort, then other legal or administrative means may be used.
Restrictive Covenants			
234, Gillett 2157, Riley	440(9)(c)	Clarify that this provision does not require the owner to notify Ecology of each individual conveyance.	Comment refers to an existing regulatory requirement that has not been amended. Ecology believes the issue raised is better addressed through guidance.
Local Government Notification			
2305, POG	440(10)	Add the phrase "and permit issuance authority" after the phrase in the first sentence "…with land use planning authority…"	Ecology disagrees. The language in the first sentence is consistent with RCW 70.105D.030(1)(f).
Financial Assurances			
2306, POG	440(11)	When must financial assurances be put in place to cover the costs associated with the operation and maintenance of the cleanup action?	Under WAC 173-340-400(6)(c), documentation of financial assurance must be provided with the as-built documentation for the site cleanup.
2585, Wilson	440(11)	With the exception of the "financial test" mechanism, all of the mechanisms provided are unavailable to the federal government.	Ecology recognizes that the examples of financial mechanisms listed in subsection (11) may not all be applicable to the federal government. Through the development of guidance, Ecology can provide further information on acceptable financial mechanisms.
2307, POG	440(11)(b)	Delete the word "similar" that appears before the words "financial hardship" at the end of this sentence.	Defining what type of financial hardship must be demonstrated to obtain an exemption under subsection (11)(b) would be more appropriately conveyed through guidance. Not every "financial hardship" justifies an exemption.
Removal of Restrictions			
560, Wingard 2212, Valeriano	440(12)	How long will institutional controls and financial assurances be required to be in place?	As provided in subsection WAC 173-340-440(12), institutional controls and financial assurances would need to stay in place until the conditions in subsection (4) that required them no longer exist and the public has had an opportunity to comment.
General Comments			
675, A. Johnson 828, Sims 2553, Sims 921, Crell	440	Does Ecology understand that institutional controls are a deterrent to redevelopment and may raise complicated property issues?	Ecology recognizes that there are complicated issues associated with the presence of contamination on properties. Institutional controls are measures undertaken to limit or prohibit activities that may interfere with the integrity of an interim action or cleanup action or that

			may result in exposure to the hazardous substances left on site after a cleanup action. Ecology's experience is that buyers and lenders are interested in being provided with assurance that a site with hazardous substance is protective of human health and the environment. Institutional controls can provide this assurance.
1032, Kluck	440	Suggests that the listing of a site on the Hazardous Sites List, studies, remedies and independent remedial actions should be placed on deed restrictions.	Ecology believes that the public notice requirements and the other methods used to provide information to the public fulfills the department's responsibilities under MTCA.

Chapter 6 Site Cleanup and Monitoring (Part IV)

6.1 Cleanup Actions (WAC 173-340-400)

A few amendments were made to WAC 173-340-400. Most of these amendments were made to improve the clarity and usability of the regulation and are not intended to change the meaning of the provisions. Substantive changes include the following:

- The addition of requirements to provide information regarding exempted permits and the substantive requirements of those permits to reflect amendments to MTCA;
- The addition of requirements to provide information pertaining to financial assurances and institutional controls. Ecology believes this information is necessary to implement PAC recommendations regarding the use of these mechanisms (see Final PAC Report, pp. 32-33);
- The revision of the requirement for construction oversight by a profession engineer registered or a qualified technician to allow for oversight by military engineers under RCW 18.43.130, making the provision consistent with current licensing practices; and
- The revision of the requirement for construction oversight by a profession engineer registered or a qualified technician to allow for oversight by others for LUST sites and comparable types of cleanups.

Several comments were received regarding the amendments to WAC 173-340-400. These comments are addressed below.

GQ 6.1.1
Comments regarding WAC 173-340-400 are addressed in the following table:

Comment ID	Section	Comment	Response
1324, McCain	400(4)	Requiring draft institutional control and financial assurance documentation at the engineering design phase appears to require too much too early.	Ecology disagrees that requiring draft institutional control and financial assurance documentation at the engineering design phase is too early. This is a major review step in the cleanup process and an appropriate point to make sure steps are being taken to get these documents in place. Ecology agrees that final copies of these documents are not needed at the operational plan stage. The amendment was changed to require final copies with the as-builts.
1325, McCain	400(6)(b)(iii)	UST and non-LUST provisions should be in separate provisions.	Ecology believes these two provisions should stay in this subsection because they relate to the third statement that Ecology may depart from these requirement in other appropriate cases.

1019, Kluck	400(6)(c)	Documentation of institutional controls should require certified copies of the recorded documents, not just copies.	Comment addressed in 2000 proposal. Copies of recorded deed restrictions are sufficient. Determinations of proper filing are based on the recorded numbers stamped on each page by the county.
1020, Kluck	400(7)	Request criteria for determining when differences in the cleanup action plan are substantial enough to require public notice and comment.	Ecology does not have any written program policy for implementing this existing regulatory requirement. These determinations are made on a site-specific basis.
228, Gillett 2152, Riley	400(8)	Clarify the submittal requirements for independent remedial actions.	Independent remedial actions must comply with the substantive requirements of section 400 and submit reports as required by WAC 173-340-515. The reports submitted must contain sufficient information to determine if the independent remedial action meets the substantive requirements of this chapter, including those in section 400. The requested clarification does not require an amendment.

6.2 Compliance Monitoring (WAC 173-340-410)

A few amendments were made to WAC 173-340-410. Most of these amendments were made to improve the clarity and usability of the regulation and are not intended to change the meaning of the provisions. Substantive changes include the following:

- The addition of a more specific description of the types of performance standards that must be attained under an interim action or cleanup action and confirmed through performance monitoring to reflect existing requirements and other amendments; and
- The addition of a more specific description of the types of monitoring that may be required as part of a compliance monitoring plan for a site. This amendment more effectively implements existing statutory and regulatory requirements and is necessary to implement PAC recommendations regarding the ensuring the long-term effectiveness of institutional controls.

Several comments were received regarding the amendments to WAC 173-340-410. These comments are addressed below.

GQ 6.2.1
Comments regarding WAC 173-340-410 are addressed in the following table:

Comment ID	Section	Comment	Response
880, Goold 963, Graves 2046, Graves	410	Ecology should provide further guidance regarding compliance monitoring requirements.	The requested information is more appropriately provided in guidance. Ecology has published such information

			in the document "Guidance on Sampling and Data Analysis Methods," Jan. 1995, Pub. #94-49. Further guidance will be developed and provided as appropriate.
614, K. Johnson	410(1)(b)	Redefine concept of remediation levels and incorporate into this section.	Remediation levels are defined in WAC 173-340-200 and further explained in WAC 173-340-355. Additional clarification was provided in the 2000 proposal. The concept is incorporated as appropriate throughout the chapter.
1021, Kluck	410(2)	What is the justification for allowing an exemption from the requirement for a monitoring plan for compliance monitoring?	The comment refers to an existing regulatory requirement. The amended language in section 410(2) was moved there from section 410(3) of the current rule.
229, Gillett 2153, Riley	410(3)	Strike "no longer exceed cleanup levels" and insert "comply with cleanup standards"	Ecology does not agree. Compliance monitoring should continue as long as cleanup levels exceed applicable points of compliance at the site. The term "point of compliance" is defined in WAC 173-340-200.

6.3 Periodic Review (WAC 173-340-420)

Several amendments were made to WAC 173-340-420. Many of these amendments were made to improve the clarity and usability of the regulation and are not intended to change the meaning of the provisions. In addition, several substantive changes were made to this section, including the following:

- Amendment of the provision regarding the applicability of periodic reviews to distinguish between cleanup actions conducted under and order or decree and independent cleanup actions to reflect the distinction established in MTCA;
- Amendment of the provision regarding the applicability of periodic reviews to require such review when an institutional control and/or financial assurance is required as part of the cleanup action, when site-specific risk assessments result in a significant increase in the residual concentrations at the site, or when uncertainty in the ecological evaluation or reliability of the cleanup action demands that additional review to assure long-term protection. This amendment is necessary to implement the PAC recommendations regarding remedy selection (see Final PAC Report, pp. 32-34);
- Amendment of the review criteria to include an assessment of the effectiveness of engineered and institutional controls to implement the PAC recommendations regarding remedy selection (see Final PAC Report, pp. 32-34);
- The addition of the requirement that Ecology notify potentially liable persons of the results on the periodic review to reflect current practice. This change is required by Governor's Executive Order 97-02; and
- The addition of a requirement that Ecology determine whether additional reviews are necessary as part of a review.

Several comments were received regarding the amendments to WAC 173-340-420. These comments are addressed below.

GQ 6.3.1
Under what circumstances should Ecology conduct a periodic review of a site?

(342, 1156, 2081)

Response:
The current rule specifies in WAC 173-340-400 those circumstances that require Ecology to conduct a periodic review of a site. The proposed rule amended that provision to provide greater clarity as to when a periodic review is required. See WAC 173-340-400(2). Several comments were received regarding this amendment. These comments are addressed in the following table.

Comment ID	Section	Comment	Response
2081, McCain	420(2)	Clarify intent of provision.	Comment addressed in final rule.
342, Valeriano	420(2)(c)	Supports the adoption of criteria for determining when a periodic review is required, including subsection (2)(c) in particular.	Comment noted.
1156, Herbst	420(2)(c)	Can a cleanup action meet the minimum requirements specified in WAC 173-340-360 if the conditions specified in subsection (2)(c) require a periodic review of the cleanup action?	All cleanup actions must meet each of the minimum requirements in WAC 173-340-360, including that the cleanup action is protective of human health and the environment. The purpose of the periodic review is to ensure that the cleanup action that was expected to be protective in the long-term actually is protective. If the cleanup action is determined to not be protective, changes to the cleanup action plan may be required.

GQ 6.3.2
To determine whether human health and the environment are being protected, what factors should Ecology consider?

(230, 615, 1022, 1023)

Response:
The regulation sets forth several factors in WAC 173-340-400(4) that must be considered during a periodic review when evaluating whether a cleanup action is protective of human health and the environment. Some of these factors were subject to amendment. Several comments were received regarding the scope of some of these factors. These comments are addressed in the following table.

Comment ID	Section	Comment	Response

1023, Kluck	420(4)(d)	Review criteria regarding site and resource use should not be limited to the effectiveness of institutional and engineered controls.	Requested clarification reflects intent. Clarification made in 2000 proposal.
1022, Kluck	420(4)(e)	Review criteria should include the availability of more effective remedies or technologies.	Consideration of the availability and practicability of more permanent remedies includes the consideration of several factors, including both permanence and long-term effectiveness. The review criteria also include an evaluation of the effectiveness of cleanup actions.
615, K. Johnson	420(4)(c,f)	Review criteria should be limited to substantial changes.	Ecology disagrees. To determine whether human health and the environment are being protected, any change in state and federal law or the availability of any improved analytical techniques must be considered in the context of a particular site and the remedial actions conducted at that site. The fact that applicable state and federal laws have changed or that improved analytical techniques are available does not necessarily mean that a remedial action is not protective.
231, Gillett 2154, Riley	420(6)	Clarify that sites with institutional controls shall remain subject to periodic reviews only as long as the conditions giving rise under MTCA to the need for the institutional controls continue to exist.	Requested clarification reflects intent. Clarification made in the final rule.

6.4 Interim Actions (WAC 173-340-430)

A few amendments were made to WAC 173-340-430. These amendments were made to improve the clarity and usability of the regulation and are not intended to change the meaning of the provisions. Comments received regarding the amendments to WAC 173-340-430 are addressed below.

GQ 6.4.1
Comments regarding WAC 173-340-430 are addressed in the following table:

Comment ID	Section	Comment	Response
732, Newlon 2391, Newlon	430(1)	Clarify that an interim action may constitute the cleanup action for a site if the interim action is subsequently shown to comply with WAC 173-340-350 through 173-340-390.	Requested clarification reflects intent. Clarification made in the final rule.
1260, Gillett	430(4)(b)	Redefine concept of remediation levels and incorporate into this section.	Remediation levels are defined in WAC 173-340-200 and further explained in WAC 173-340-355. Additional

			clarification was provided in the 2000 proposal. The concept is incorporated as appropriate throughout the chapter.
232, Gillett 2082, McCain 2155, Riley	430(8)	Clarify the submittal requirements for independent remedial actions	Independent remedial actions must comply with the substantive requirements of section 430 and submit reports as required by WAC 173-340-515. Reports must be submitted to Ecology within 90 days of the completion of the action. The reports submitted must contain sufficient information to determine if the independent remedial action meets the substantive requirements of this chapter, including those in section 430. See WAC 173-340-515(3) and (4). To clarify this intent, changes were made in the final rule.

6.5 Releases from Underground Storage Tanks (WAC 173-340-450)

A few amendments were made to WAC 173-340-450. Most of these amendments were made to improve the clarity and usability of the regulation and are not intended to change the meaning of the provisions. The amendments include one substantive change – the revision of the analytical testing requirements in Table 830-1 for petroleum releases. Comments received regarding the amendments to WAC 173-340-450 are addressed below.

GQ 6.5.1
Comments regarding WAC 173-340-450 are addressed in the following table:

Comment ID	Section	Comment	Response
1262, Gillett	450(2)	Clarify that the actions required under subsection (2) must be performed within 24 hours of confirmation (as opposed to discovery) of the release.	Requested clarification reflects intent. Clarification made in the 2000 proposal.
89, POG 2249, POG	450(6)	An RI/FS should not be required just because free product is found; rather, an RI/FS should only be required if free product removal is not achieved.	Ecology disagrees. If there is free product at the site, there is a potential for a serious problem that must be investigated. For example, removal of free product does not address contaminated soils or dissolved plumes. NOTE: Comment withdrawn based on 2000 proposal.

Chapter 7 Administrative Procedures for Remedial Actions (Part V)

7.1 Administrative Options (WAC 173-340-510)

A few amendments were made to WAC 173-340-510. Most of these amendments were made to improve the clarity and usability of the regulation and are not intended to change the meaning of the provisions. The amendments include the movement of provisions regarding independent remedial actions to WAC 173-340-515 to improve the clarity and usability of the regulation. Comments received regarding the amendments to WAC 173-340-510 are addressed below.

GQ 7.1.1
Comments regarding WAC 173-340-510 are addressed in the following table:

Comment ID	Section	Comment	Response
344, Valeriano 2214, Valeriano	510	Expressed support for additional overview provided in 1998 draft.	Comment noted. The comment refers to the 1998 draft that contained a more detailed overview. That overview was eliminated in the 1999 proposal. Ecology determined that such information would be more appropriate as guidance.

7.2 Independent Remedial Actions (WAC 173-340-515)

WAC 173-340-515 is a new section that is intended to implement PAC recommendations and statutory changes regarding independent remedial actions. This section includes several provisions that have been reformatted and consolidated here from other parts of the rule to improve the clarity and usability of the rule.

GQ 7.2.1
Should a person be allowed to conduct an independent remedial action as long as the person has not commenced discussions or negotiations for an agreed order or consent decree or the site is not under and order or decree? Should a person be required to provide notification to or obtain approval from Ecology prior to conducting independent remedial actions?

(347, 1025, 1157, 2216)

Response:
The comments refer to existing regulatory language that has been consolidated in WAC 173-340-515(2) and addresses an issue that is beyond the scope of this rule-making action – whether a person may conduct independent remedial actions. This section provides that "[n]othing in this chapter shall preclude potentially liable persons from conducting independent remedial actions at sites not in discussion or negotiations for, or under, an order or decree." WAC 173-340-515(2).

Therefore, as long as the person is not proposing to conduct an independent remedial action at a site in discussion or negotiations for, or under, an order or decree, the person may conduct such action without prior notification of or prior approval by Ecology. Some commentors suggested that a person should not be allowed to conduct an independent remedial action under certain conditions, such as when the community has expressed concerns or where there are bioaccumulative chemicals of concern at the site. The commentors also suggested that a person should be required to provide notification to or obtain approval from Ecology prior to conducting independent remedial actions. Ecology recognizes the concerns raised by citizens regarding the efficacy of independent remedial actions. However, given the nature and limited purpose of independent remedial actions and the fact that Ecology retains the authority to issue an enforcement order at any time or to require additional remedial actions following completion of an independent remedial action (see WAC 173-340-515(3) and 173-340-310(7)), the proposed changes to this provision have not been adopted. Citizens are encouraged to contact the Department of Ecology about their concerns regarding a site.

GQ 7.2.2
Should a potentially liable person be allowed to conduct an independent remedial action on a part of a site if another part of the site is under an order or decree?

(347, 2216)

Response:
The comments refer to existing regulatory language that has been consolidated in WAC 173-340-515(2) and addresses an issue that is beyond the scope of this rule-making action – whether a person may conduct independent remedial actions. This section provides that "a potentially liable person may not conduct independent remedial actions after commencing discussions or negotiations for an agreed order or consent decree unless" certain conditions are met. WAC 173-340-515(2). One commentor suggested that a potentially liable person should never be allowed to conduct an independent remedial action on a part of a site if another part of the site is under an order or decree. Ecology recognizes the concern raised. However, Ecology believes the rule already provides sufficient safeguards to address that concern and prevent inappropriate independent remedial actions at sites under an order or decree.

GQ 7.2.3
Should independent remedial actions be subject to the public notice and participation requirements specified in WAC 173-340-600 just as any other remedial action?

(348, 996, 1018, 1026, 2010, 2218)

Response:
Under the current rule, independent remedial actions must meet the substantive requirements of chapter 173-340 WAC. The public notice and participation requirements specified in WAC 173-340-600 are not interpreted as constituting substantive requirements. The issue of whether independent remedial actions should be subject to the public notice and participation requirements specified in WAC 173-340-600 just as any other remedial action was not addressed

by the PAC. Considering the lack of consensus on this issue, Ecology determined that it would not be appropriate to address this issue as part of this rule-making action. Several commentors expressed the opinion that independent remedial actions should nonetheless be subject to the public notice and participation requirements specified in WAC 173-340-600 just as any other remedial action. These comments refer to existing regulatory requirements and address an issue that is beyond the scope of this rule-making action.

Public notice is provided through the Site Register. Additions to the hazardous sites list, changes in site status, and removal form list must be published in the Site Register. The Site Register, which is updated bimonthly, is available through hard copy, e-mail, or the Internet. The Internet address is http://www.ecy.wa.gov/programs/tcp/pub_inv/pub_inv2.html. At that site, citizens can sign up to receive the Site Register through e-mail (in case they do not always have access to the Internet). They can sign up to be on the hard copy mailing list by contacting the Department of Ecology.

Public notice is required as part of an independent remedial action when a person intends to pursue a private right of action against a potentially liable person to recover cleanup costs. MTCA limits recovery of remedial action costs "to those remedial actions that … are the substantially equivalent of a department-conducted or department-supervised remedial action." RCW 70.105D.080. Ecology considers independent remedial actions to be substantially equivalent only if "before conducting an interim action or cleanup action, reasonable steps have been taken to provide advance public notice." WAC 173-340-545(2)(c)(iii). What constitutes adequate public notice is defined in WAC 173-340-545(3).

Ecology also reaffirms its authority under the current rule to require persons conducting independent remedial actions to take additional remedial actions if Ecology determines such actions are necessary to protect human health and the environment (see WAC 173-340-515(3)). If such actions are required by Ecology, then the public notice and participation requirements in WAC 173-340-600 are applicable.

GQ 7.2.4
What is the standard for reviewing independent remedial actions? Does Ecology have the authority to require further remedial action?

(346)

Response:
The comment refers to existing regulatory language that has been consolidated in WAC 173-340-515 and addresses an issue that is beyond the scope of this rule-making action. The regulation sets forth both the standard of review and Ecology's authority to require further remedial action:

> In reviewing independent remedial actions, the department shall determine whether the remedial actions meet the substantive requirements of this chapter and/or whether further remedial action is necessary at the site. Persons conducting independent remedial actions do so at their own risk, and may be required to take additional remedial actions if the

> department determines such actions are necessary. In such circumstances, the department reserves all of its rights to take actions authorized by law.

WAC 173-340-515(3)(a). This regulatory authority is based on statutory authority (see, e.g., RCW 70.105D.030(1)(i)).

GQ 7.2.5
What are the substantive requirements of chapter 173-340 WAC? What documentation must be submitted for independent remedial actions where specific documents are required under chapter 173-340 WAC?

(235, 236, 238, 947, 1007, 1009, 1327, 2034, 2084, 2158, 2159, 2160)

Response:
The comments refer to existing regulatory language that has been consolidated in WAC 173-340-515. The regulation provides that independent remedial actions must meet the substantive requirements of chapter 173-340 WAC. WAC 173-340-515(3). Several commentors suggested that Ecology should provide guidance as to what constitutes a substantive requirement. Providing such guidance in the rule is not practical. To assist those persons conducting independent remedial actions, Ecology may provide "informal advice and assistance (technical consultations) on the administrative and technical requirements of this chapter." WAC 173-340-515(5). This advice may include written opinions as to "whether the independent remedial actions or proposals for those actions meet the substantive requirements of this chapter and/or whether the department believes further remedial action is necessary at the facility." WAC 173-340-515(5).

Several commentors also requested clarification regarding the type of documentation that is required for independent remedial actions where specific documents are required under chapter 173-340 WAC. To further clarify the intent of the regulation, WAC 173-340-515(3)(c) has been revised to state the following:

> Except for the requirement of a restrictive covenant under WAC 173-340-440, where documents are required under this chapter, the documents prepared need not be the same in title or format; however, the documents must still contain sufficient information to serve the same purpose. The scope and level of detail in these documents may vary from site to site depending on the site-specific conditions and the complexity of the remedial action.

WAC 173-340-515(3)(c). Restrictive covenants must be in the same title and format because they are required to effectively implement institutional controls that are required to assure the continued protection of human health and the environment and the integrity of the cleanup action. For properties owned by a local, state, or federal government entity, a restrictive covenant may not be required if the entity meets the requirements found in WAC 173-340-440(8)(b).

The regulation also requires in WAC 173-340-515(4)(a) that:

> Any person who conducts an independent interim action or cleanup action for a release that is required to be reported under WAC 173-340-300 shall submit a written report to the department within ninety days of the completion of the action.

The regulation then specifies in WAC 173-340-515(4)(b) what information that report must include. To further clarify the intent of the regulation regarding the type of information that is required, WAC 173-340-515(3)(c) has been revised to state the following:

> The report shall include the information in WAC 173-340-300(2) if not already reported, and enough information to determine if the independent remedial action meets the substantive requirements of this chapter including, the results of all site investigations, cleanup actions and compliance monitoring planned or under-way. If a restrictive covenant is used, it must be included in the report and it must meet the requirements specified in WAC 173-340-440(9). The department may require additional reports on the work conducted.

GQ 7.2.6
Should any person who conducts an independent remedial action submit a written report to Ecology within 90 days of the completion of the action?

(378, 2625, 2640)

Response:
The comments refer to existing regulatory language that has been consolidated in WAC 173-340-515. The commentor requested clarification as to the circumstances that would require a person who conducts an independent remedial action to submit a written report to Ecology. The regulation specifically provides that only those persons who conduct an independent remedial action "for a release that is required to be reported under WAC 173-340-300" are required to submit a written report. WAC 173-340-515(4)(a). Accordingly, if a person is not required to report a release under WAC 173-340-300, then the person is not required to submit a written report after completing an independent remedial action. However, Ecology expects that if a release required remedial action, then the release addressed by that action presumably posed a threat or potential threat to human health or the environment and should probably have been reported.

GQ 7.2.7
Does Ecology have the authority under the Voluntary Cleanup Program to require further remedial action?

(1158)

Response:

Ecology has the statutory and regulatory authority to require further remedial action under the Voluntary Cleanup Program. Specification of that authority in WAC 173-340-515(5) is not necessary. MTCA specifically provides that Ecology may "require potentially liable persons to conduct remedial actions (including investigations…) to remedy releases or threatened releases of hazardous substances" and may "[i]ssue orders … where necessary to protect human health and the environment from a release or threatened release of a hazardous substance." RCW 70.105D.030(1)(b), (f). The MTCA Cleanup Regulation specifically provides that "[p]ersons conducting independent remedial actions do so at their own risk, and may be required to take additional remedial actions if the department determines such actions are necessary. In such circumstances, the department reserves all of its rights to take actions authorized by law." WAC 173-340-515(3)(a).

GQ 7.2.8
Has Ecology completed an audit of independent remedial actions as required by the PAC?

(2215)

Response:
The PAC established the following priority issue for analysis:

> Should we institute a program of random Ecology audits or spot-checks of independent cleanups on an ongoing basis?

Final PAC Report, p. 6. As discussed more thoroughly in the report, members of the PAC expressed some concern about the large numbers of sites undergoing independent cleanups with no Ecology oversight, except for Ecology's ultimate review of final cleanup action reports. Final PAC Report, p. 42. To provide additional information on this issue, the PAC recommended that most independent cleanup sites on the Hazardous Sites List be reviewed to see whether they could be removed from the list. The PAC also recommended that the procedures for site hazard assessment (SHA) and site investigations be reviewed to ensure that both delegated counties and Ecology are properly reviewing the adequacy of independent cleanups. Final PAC Report, pp. 42-43.

In response to the recommendations of the PAC, Ecology performed an evaluation of the procedures for site hazard assessment (SHA) and site investigations to ensure that both delegated counties and Ecology are properly reviewing the adequacy of independent cleanups. Based on that evaluation, Ecology determined that the existing procedures ensure that Ecology and the delegated counties are properly reviewing the adequacy of independent cleanups. See Ecology, *Audit/Quality Control of Independent (Voluntary) Cleanups – Review of Site Hazard Assessment (SHA)/Site Investigation Procedures*, Nov. 1997.

In response to the recommendations of the PAC, Ecology also performed a pilot audit of ranked sites that had conducted independent cleanup actions and submitted final reports. Based on that audit, the following facts were determined:

(1) Only a few ranked sites submitted final reports after undergoing a site hazard assessment and ranking.
(2) For those ranked sites where final reports were submitted before undergoing a site hazard assessment and ranking, one of the following is true:
- The final report was used in the ranking;
- The cleanup action was ongoing or not proceeding;
- The cleanup action was not an independent cleanup action (the database was either not accurate or updated);
- Ecology had already reviewed the site and determined that no further remedial action was required; or,
- Most often, the site had already been entered into the Voluntary Cleanup Program for agency oversight.

Based on that audit, Ecology determined that it could implement the PAC recommendation within the existing structure of the Voluntary Cleanup Program and without approaching the legislature for additional funding or establishing a separate review program. Ecology, *Audit/Quality Control of Independent (Voluntary) Cleanups – Review of Site Hazard Assessment (SHA)/Site Investigation Procedures*, Nov. 1997.

GQ 7.2.9
Other comments regarding WAC 173-340-515 are addressed in the following table:

Comment ID	Section	Comment	Response
322, Warden	515	Expressed support for continued staffing for independent remedial actions.	Comment noted.
434, Allen	515	Guidance regarding the benefits and procedures of the Voluntary Cleanup Program should be included in this section.	Independent cleanup actions include those actions conducted under the Voluntary Cleanup Program (VCP). Information regarding the VCP is provided in the Ecology FOCUS publication titled *Voluntary Cleanup Program.*
1017, Kluck 1024, Kluck	515(2)(b)	The term "reasonable notice" is too vague. Should require specific time period or prior notice.	The comments refer to existing regulatory language that has been moved to WAC 173-340-515(2) regarding whether a person may conduct independent remedial actions at a site under an order or decree. Amendment is not required. Prior notice is required by implication. The "reasonableness" of the notice refers to the amount of time before beginning the independent remedial action.

7.3 Consent Decrees (WAC 173-340-520)

A few amendments were made to WAC 173-340-520. These amendments were made to improve the clarity and usability of the regulation and are not intended to change the meaning of the

provisions. The amendments include descriptions of the information that must be submitted when requesting a prospective purchaser consent decree. RCW 70.105D.040(5) contains specific statutory requirements for this type of decree. Comments received regarding the amendments to WAC 173-340-520 are addressed below.

GQ 7.3.1
Should prospective purchasers be required to enter into a consent decree?

(1160)

Response:
Prospective purchasers are not required to enter into a consent decree. As explained in WAC 173-340-520(1)(c), "[a] prospective purchaser consent decree is a particular type of consent decree entered into with a person not currently liable for remedial action at the site who proposes to purchase, redevelop, or reuse the site." If a prospective purchaser wants to enter into a consent decree, then the purchaser must submit a request prior to purchasing the property. Otherwise, the provisions pertaining to prospective purchasers, by definition, would not apply to the purchaser. In other words, if a prospective purchaser actually purchases the property before requesting and entering into a consent decree, then the purchaser is not a prospective purchaser, but rather an owner. As an owner, the purchaser might then be determined to be a potentially liable person under MTCA.

GQ 7.3.2
Other comments regarding WAC 173-340-520 are addressed in the following table:

Comment ID	Section	Comment	Response
323, Warden 867, Goold	520	Support and encourage flexible use of prospective purchase consent decrees to encourage the cleanup and redevelopment of contaminated property.	Comment noted.
345, Valeriano 2217, Valeriano	520	Mandatory penalties should be required in orders or decrees as an incentive to meet timelines.	The comment addresses an issue that is beyond the scope of this rule-making action. Note that RCW 70.105D.050(1) provides that "[a]ny liable person who refuses, without sufficient cause, to comply with an order or agreed order…is liable in action brought by the attorney general." RCW 70.105D.050(1).

7.4 Agreed Orders (WAC 173-340-530)

A few amendments were made to WAC 173-340-530. These amendments were made to improve the clarity and usability of the regulation and are not intended to change the meaning of the provisions. Comments received regarding the amendments to WAC 173-340-530 are addressed below.

GQ 7.4.1
Comments regarding WAC 173-340-520 are addressed in the following table:

Comment ID	Section	Comment	Response
1027, Kluck	530(1)	Supports clear statement that agreed orders are not a settlement.	The comment refers to existing regulatory language in WAC 173-340-530(1). No change was made or contemplated. Regulatory language is a reflection of the statute.
345, Valeriano 2217, Valeriano	530	Mandatory penalties should be required in orders or decrees as an incentive to meet timelines.	The comment addresses an issue that is beyond the scope of this rule-making action. Note that RCW 70.105D.050(1) provides that "[a]ny liable person who refuses, without sufficient cause, to comply with an order or agreed order…is liable in action brought by the attorney general." RCW 70.105D.050(1).

7.5 Private Right of Action (WAC 173-340-545)

WAC 173-340-545 is a new section whose provisions were moved from WAC 173-340-550(5) and reformatted to improve the clarity and usability of the rule. No change in meaning is intended. Subsection (4) of this section includes additional guidance regarding determinations of whether remedial actions have been conducted substantially equivalent with the technical standards and evaluation criteria. Comments received regarding the amendments to WAC 173-340-545 are addressed below.

GQ 7.5.1
What remedial actions does Ecology consider the substantial equivalent of a department-conducted or department-supervised remedial action?

(947, 948, 2034)

Response:
The comments refer to existing regulatory language that was moved to WAC 173-340-545 from WAC 173-340-550(5). MTCA provides the following:

> Recovery of remedial action costs shall be limited to those remedial actions that, when evaluated as a whole, are the substantial equivalent of a department-conducted or department-supervised remedial action. Substantial equivalence shall be determined by the court with reference to the rules adopted by the department under this chapter.

RCW 70.105D.080. The regulation provides the following:

> The purpose of [WAC 173-340-545] is to facilitate private rights of action and minimize department staff involvement in these actions by providing guidance to potentially liable persons and the court on what remedial actions the department would consider the substantial equivalent of a department-conducted or department-supervised remedial action. In determining substantial equivalence, the department anticipates the requirements in this section will be evaluated as a whole and that a claim would not be disallowed due to omissions that do not diminish the overall effectiveness of the remedial action.

WAC 173-340-545(1). Guidance to potentially liable persons and the court on what remedial actions the department would consider the substantial equivalent of a department-conducted or department-supervised remedial action is provided in subsections (2) through (4) of this section.

GQ 7.5.2
What constitutes adequate public notice for the purposes of determining substantial equivalence?

(1028)

Response:
WAC 173-340-545(3) specifically provides that:

> For the purposes of this section only, unless a court determines other notice procedures are adequate, the [notice required under WAC 173-340-545(3)(a) through (c)] constitutes adequate public notice for independent remedial actions and supersedes the requirements in WAC 173-340-600.

The commentor expressed concern that the requirements set forth in subsection (3) are not adequate because concerned or effected citizens are not provided adequate prior notification or opportunity to comment and suggests that the substantial equivalence of independent remedial actions should be measured against the requirements in WAC 173-340-600. The comment refers to an existing regulatory requirements that was moved to WAC 173-340-545 from WAC 173-340-550(5) and addresses an issue that is beyond the scope of this rule-making action – what should constitute adequate public notice for the purposes of determining substantial equivalence. The requirements set forth in WAC 173-340-545(3) were adopted as part of the MTCA Cleanup Regulation in 1993.

GQ 7.5.3
What constitutes compliance with technical standards and evaluation criteria for the purposes of determining substantial equivalence? What are the substantive requirements of chapter 173-340 WAC? What documentation must be submitted for independent remedial actions where specific documents are required under chapter 173-340 WAC?

(237, 238, 948, 1328, 2034, 2160, 2161)

Response:

The comment refers to existing regulatory language that was moved to WAC 173-340-545 from WAC 173-340-550(5). The regulation provides that independent remedial actions to be the substantial equivalent of department-conducted or department-supervised remedial actions if, among other things, "[t]he remedial actions have been conducted substantially equivalent with the technical standards and evaluation criteria described in subsection (4) of this section." WAC 173-340-545(2)(c)(iv). The regulation then provides in subsection (4) that remedial actions comply with the requirement in subsection (2) if it is conducted substantially equivalent with the substantive requirements of several specified sections. Several commentors suggested that Ecology should provide guidance as to what constitutes a substantive requirement. Providing such guidance in the rule is not practical. To assist those persons conducting independent remedial actions, Ecology may provide "informal advice and assistance (technical consultations) on the administrative and technical requirements of this chapter." WAC 173-340-515(5). This advice may include written opinions as to "whether the independent remedial actions or proposals for those actions meet the substantive requirements of this chapter and/or whether the department believes further remedial action is necessary at the facility." WAC 173-340-515(5).

One commentor also requested clarification as to the type of documentation or evaluation that is required for independent remedial actions where specific documents are required under chapter 173-340 WAC. Subsection (4) provides the following:

> Except for a restrictive covenant under WAC 173-340-440, where documents are required by the following sections, the documents prepared need not be the same in title or format. Other documents can be used in place of the documents specified in these sections as long as sufficient information is included in the record to serve the same purpose.

WAC 173-340-545(4). In other words, even though the documents need not be in the same title or format, comparable evaluations must nonetheless be conducted and documented. Restrictive covenants must be in the same title and format because they are required to effectively implement institutional controls that are required to assure the continued protection of human health and the environment and the integrity of the cleanup action. For properties owned by a local, state, or federal government entity, a restrictive covenant may not be required if the entity meets the requirements found in WAC 173-340-440(8)(b).

GQ 7.5.4
Should independent remedial actions be conducted substantially equivalent with the substantive requirements of WAC 173-340-380?

(239, 2162)

Response:
The comment refers to existing regulatory language that was moved to WAC 173-340-545 from WAC 173-340-550(5) and addresses an issue that is beyond the scope of the rule-making action. Independent remedial actions should be conducted substantially equivalent with the substantive

requirements of WAC 173-340-380 because documentation of the basis for the selection of the remedial action conducted at a site is necessary to determine substantial equivalence.

GQ 7.5.5
Other comments regarding WAC 173-340-545 are addressed in the following table:

Comment ID	Section	Comment	Response
1250, Gillett	545(3)	Editorial.	Comment addressed in 2000 proposal.

7.6 Payment of Remedial Action Costs (WAC 173-340-550)

Several amendments were made to WAC 173-340-550. Most of these amendments were made to improve the clarity and usability of the regulation and are not intended to change the meaning of the provisions. These amendments include the removal of subsection (5) to establish a new section WAC 173-340-545. Substantive changes include the establishment a cost recovery mechanism for use of the office of the citizen technical advisor and for processing technical assistance requests. These amendments implement PAC recommendations (see Final PAC Report, pp. 47-48 and 40-42). Additional language describing prepayment agreements and their relationship to an order or decree is provided. This amendment is based on current department policy and implements the Governor's Executive Order 97-02.

The only comments received regarding the amendments to WAC 173-340-550 pertained to the citizen technical advisor office. These comments are addressed in **Chapter 8** of the CES.

Chapter 8 Public Participation (Part VI)

8.1 Public Notice and Participation (WAC 173-340-600)

Several amendments were made to this section. Most of these amendments were made to improve the clarity and usability of the regulation and are not intended to change the meaning of the provisions. Substantive changes include the following:

- The addition in WAC 173-340-600(2) of a provision that references other sections in chapter 173-340 WAC that contain specific notice requirements. This amendment was made to improve the clarity and usability of the rule;
- The addition in WAC 173-340-600(4)(g) of the requirement providing for what a public notice describing cleanup plans that use site-specific risk assessment or would restrict future site or resource use must contain. This amendment is based on a PAC recommendation (see Final PAC Report, pp. 47-48);
- The addition in WAC 173-340-600(8) and (9)(e) of the requirement that, for sites where site-specific risk assessment is used, Ecology determine whether that risk assessment may affect significant public concerns regarding exposure scenarios or future land uses and, if so, assure that appropriate public involvement and comment opportunities will occur as identified in the public participation plan. This amendment is based on a PAC recommendation (see Final PAC Report, pp. 47-48);
- The amendment of WAC 173-340-600(7) to require that the Site Register provide notice of several additional items. This amendment was made to reflect existing requirements and to implement a PAC recommendation (see Final PAC Report, p. 52);
- The amendment of the requirement in WAC 173-340-600(10) regarding when public hearings must be held for remedial actions conducted under a consent decree. This amendment was made to implement recent statutory amendments to MTCA (see RCW 70.105D.040(4)(a)) and a PAC recommendation (see Final PAC Report, pp. 47-48);
- The addition in WAC 173-340-600(14)(c) of the requirement that whenever the cleanup action proposes a restrictive covenant as part of the draft cleanup action plan, Ecology provide notice to and seek comments from the city or county department with land use planning authority for real property subject to the restrictive covenant. This amendment was made to implement recent statutory amendments to MTCA (see RCW 70.105D.030(1)(f));
- The addition in WAC 173-340-600(17) of a provision that provides notice of the availability of public participation grants under chapter 173-321 WAC. This amendment was made to improve the clarity and usability of the rule.
- The establishment in WAC 173-340-600(18) of the citizen technical advisor office and a process for recovering costs for use of that office. This amendment is based on a PAC recommendation (see Final PAC Report, pp. 47-48).

Several comments were received regarding the amendments to WAC 173-340-600. These comments are addressed below.

GQ 8.1.1
How does the rule ensure that the public will have a meaningful opportunity to participate in the establishment of cleanup levels and selection of cleanup actions when site-specific risk assessments are used?

(1163, 1217, 2006, 2008, 2010, 2610, 2612)

Response:
The rule amendments include the addition of several public notice and participation requirements to ensure that the public has a meaningful opportunity to participate whenever site-specific risk assessment is used. These amendments are based on PAC recommendations and were determined by the PAC as necessary to achieve the statutory goals and objectives of the statute (see Final PAC Report, pp. 47-48). These recommendations reflect the concern expressed during the PAC process by citizen groups about the increased use of site-specific risk assessment in setting cleanup levels and selecting cleanup actions and the communities' ability to understand and influence risk assessment and cleanup decisions. The amendments reflecting these recommendations include the following:

The requirement in WAC 173-340-600(4)(g) pertaining to public notice:

> For public notices describing cleanup plans that use site-specific risk assessment or would restrict future site or resource use, the public notice shall specifically identify the restrictions and invite comments on these elements of the cleanup plan. This notice shall also include a statement indicating the availability of public participation grants and of the department's Citizen Technical Advisor for providing technical assistance to citizens on site-specific risk assessment and other issues related to site remediation.

The requirement in WAC 173-340-600(8) that:

> For sites where site-specific risk assessment is used, the department shall … evaluate public interest in the site, significant public concerns regarding future site use, and public values to be addressed through the public participation plan.

The requirement in WAC 173-340-600(9)(e) that:

> If the variables proposed to be modified in a site-specific risk assessment or alternative reasonable maximum exposure scenario may affect the significant public concerns regarding future land uses and exposure scenarios, then the department shall assure appropriate public involvement and comment opportunities will occur as identified in the public participation plan.

Several commentors expressed support for these amendments. Some commentors expressed the opinion that independent remedial actions should comply with the public notice and participation requirements in WAC 173-340-600, including the requirements relating to site-specific risk

assessments, just as any other cleanup action. The applicability of public notice and participation requirements to independent remedial actions is discussed in **Chapter 7** of the CES.

One commentor expressed the opinion that Ecology should not have the authority to determine whether additional public notice and involvement is required (see WAC 173-340-600(8) and (9)(e)). Ecology believes the commentor has misconstrued the amendments. Irrespective of any Ecology determination, additional public notice is required at sites where a site-specific risk assessment is being considered, including identification of the restrictions to future site or resource use and notice of the availability of the citizen technical advisor and public participation grants (see WAC 173-340-600(4)(g)). Moreover, the purpose of the other amendments is not to preclude public involvement, but rather to establish an affirmative duty to ensure that there is in fact adequate public involvement (see WAC 173-340-600(8) and (9)(e)).

Some commentors expressed the opinion that site-specific risk assessment should not be permitted at sites without full compliance with the public notice and participation requirements and without appropriate access to the office of the community technical advisor office and public participation grants. Ecology believes that the lack of appropriate access to either the office of the community technical advisor or public participation grants should be considered when determining whether there is adequate public involvement under WAC 173-340-600(9)(e). Ecology, however, cannot prohibit future amendments of the rule that may impact access to the citizen technical advisor office or to public participation grants.

GQ 8.1.2
Does Ecology have the authority to establish citizen advisory boards for individual sites?

(351, 2220)

Response:
Under WAC 173-340-600(9)(g)(iii), Ecology has the authority to establish citizen advisory boards on a site-specific basis. The decision not to provide further discussion of citizen advisory boards in the rule does not mean that the existing authority was removed. Ecology places a high priority on providing the public with meaningful opportunities for public involvement and considers the use of citizen advisory boards as one such opportunity.

GQ 8.1.3
When conducting a cleanup action under a consent decree, when must a public hearing be held?

(572)

Response:
The rule amendments include the amendment of the requirement in WAC 173-340-600(10) regarding when public hearings must be held for cleanup actions conducted under a consent decree. This amendment was made to implement recent statutory amendments to MTCA (see RCW 70.105D.040(4)(a)) and a PAC recommendation (see Final PAC Report, pp. 47-48). The amended requirement provides the following:

> The department shall hold a public hearing on the proposed consent decree for the purpose of providing the public with an opportunity to comment whenever ten or more persons request a public hearing or whenever the department determines a public hearing is necessary.

WAC 173-340-600(10)(d). Ecology places a high priority on providing the public with meaningful opportunities for public involvement. Ecology intends to hold hearings when interest by the public is evident. Also see response to comment 994.

GQ 8.1.4
What is the purpose of the citizen technical advisor? Are the costs associated with the citizen technical advisor remedial action costs recoverable from a potentially liable person?

(1043, 1080, 1137, 1218)

Response:
The amendments include a funding mechanism for the addition of a citizen technical advisor position at the Department of Ecology. WAC 173-340-550. This amendment is based on a PAC recommendation and was determined by the PAC as necessary to more effectively achieve the goals and objectives of MTCA (Final PAC Report, pp. 47-48). The amendment is required to achieve the general goals and specific objectives of the statute, including the following:

- To protect human health and the environment (See RCW 70.105D.010 and .030);
- To provide for public participation (See RCW 70.105D.030(2)(a)); and
- To recover remedial action costs from potentially liable persons (See RCW 70.105D.050(3)).

The citizen technical advisor will increase the resources available to citizens, enabling citizens to more effectively participate in the cleanup process. The citizen technical advisor is intended to augment, not replace, resources available to citizens now provided by Ecology site staff. Effective citizen participation contributes to efficient and protective cleanups by helping decision-makers develop remedies that consider community values. Effective citizen participation also enhances the protectiveness of a remedy by increasing the knowledge and understanding of citizens of the cleanup and the risks associated with any residual contamination.

The costs associated with the citizen technical advisor are remedial action costs recoverable from a potentially liable person. The amendment includes the cost as an overhead program support cost, not as a direct cost. MTCA requires that the state seek to recover the amounts spent by the department for investigative and remedial actions. MTCA defines "remedial action" to include "any action or expenditure consistent with the purposes of this chapter to identify, eliminate, or minimize any threat or potential threat posed by hazardous substances to human health or the environment." RCW 70.105D.020(20). The MTCA Cleanup Regulation defines remedial action costs as "costs reasonably attributable to the site and may include costs of direct activities, support costs of direct activities, and interest charges for delayed payments." WAC 173-340-550(2). The activities of a citizen technical advisor are necessary to reduce the threat or potential

threat posed by hazardous substances to human health or the environment and to adequately address community concerns as part of the cleanup action process.

As discussed more thoroughly in the LBA Analysis, the proposed amendment is the least burdensome alternative that will achieve the general goals and specific objectives of MTCA. Several alternatives were considered and evaluated as part of that analysis.

As discussed more thoroughly in the Estimates of the Probable Costs and Benefits, the probable benefits of this amendment exceed the probable costs. The impact of the amendment on costs is based on whether additional program support costs, including those attributable to the citizen technical advisor, can be recovered under the regulation. Because the MTCA Cleanup Regulation places a limit on the amount of program support costs that are recoverable and because those costs currently exceed that limit, additional program support costs cannot be recovered. Consequently, the amendment, which makes the costs of a citizen technical advisor recoverable as a program support cost, is not expected to result in any additional costs for potentially liable persons.

GQ 8.1.5
Other comments regarding WAC 173-340-600 are addressed in the following table:

Comment ID	Section	Comment	Response
563, Wingard	600	Social and environmental justice must be addressed through public participation.	The current rule provides sufficient authority for Ecology to assure that such concerns are solicited and addressed as appropriate at a site.
994, Kluck 996, Kluck	600	Expressed concern regarding perception that there is a diminishing role for public involvement under MTCA.	The rule amendments do not decrease public involvement opportunities. In fact, the rule amendments include several amendments that help ensure that the public has a meaningful opportunity to participate. See the description of substantive changes at the beginning of **Section 8.1** of the CES.
436, Allen	600(3)(b)	Change this subsection to "Addressing anticipated public concerns…"	Suggested change is not required to clarify the rule.
437, Allen	600(4)(e)	Add a provision to extend for an additional 15 days if requested by the public.	Comment addressed in 2000 proposal by clarifying that the comment period may be extended as appropriate.
1029, Kluck	600(4)(g)	Public notice should also include notice of the availability of public participation grants.	Comment addressed in 2000 proposal.
438, Allen	600(7)	Insert a reference to electronic availability and a web site address.	Comment addressed in 2000 proposal.
882, Goold	600(9)	Suggested the development of a prototype public participation plan as guidance.	Comment noted. Ecology will take this suggestion into consideration as future guidance is developed. WAC 173-340-600(9) outlines plan development.
435, Allen	600(9)	Public participation plan should include development of mailing list of	WAC 173-340-600(4) of the current rule describes who must receive public notice

		interested parties.	and includes interested parties who request mailing.
439, Allen	600(9)(a)	Suggested editing change.	Suggested change is not required to clarify the rule.
440, Allen	600(9)(g)(iii)	Concerned that the "questionnaires" might fall under the federal paper reduction law for those government agencies involved.	Comment noted.
440, Allen	600(9)(g)(iii)	Suggested including a reference to discussion of regional citizen advisory committees in WAC 173-340-610.	Suggested change is not required to clarify the rule.
441, Allen	600(9)(g)(iv)	Suggested editing change.	Comment addressed in 2000 proposal.
442, Allen	600(9)(g)(vii)	Suggested editing change.	Suggested change is not appropriate.
443, Allen	600(10)(c)(iv)	Provide procedures for requesting a public hearing.	Comment addressed in 2000 proposal.
444, Allen	600(12)	Clarify to whom the mailing goes.	Suggested change is not necessary. See WAC 173-340-600(4) for the applicable requirements.
445, Allen	600(13)(c)(ii)	Change "selected" to "proposed."	Comment addressed in 2000 proposal.
446, Allen	600(14)	Suggested editing change.	Suggested change is not required to clarify the rule.
447, Allen	600(14)(b)(iii)	Suggested editing change.	Comment addressed in 2000 proposal.
448, Allen	600(15)(b)	Include how far in advance of a cleanup action the public notice should be run.	Suggested change is not necessary. WAC 173-340-600(4)(e) provides for a minimum 30-day comment period.
449, Allen	600(16)(a)	Identify area of potential impact and the kind of impact.	Comment refers to an existing regulatory requirement. Public notice requirements are set forth in WAC 173-340-600(4).
2085, McCain	600(16)(b)	Delete “proposed permit exemptions and institutional controls” and replace it with “any institutional controls and any substantive requirements that are proposed for applicability to cleanup actions exempt from permitting under RCW 70.105D.090.”	Comment addressed in adopted rule as appropriate throughout the regulation.
349, Valeriano	600(17)	Specify the availability of public participation grants non-profit public interest groups.	Comment addressed in 2000 proposal by referencing chapter 173-321 WAC where qualifying requirements are described.
1042, Jakubiak	600(17)	Suggested several editing changes.	Comment addressed as appropriate in 2000 proposal. Reference has been added to chapter 173-321.
450, Allen	600(18)	Suggested editing change.	Comment addressed in 2000 proposal.
350, Valeriano	600(18)	Would use of the citizen technical advisor preclude hiring an advisor with public participation grants?	No.
1043, Jakubiak	600(18)	Should provide more detail in rule regarding the functions of the citizen technical advisor.	Specific operating guidelines will be developed and communicated when the position is established.
1043, Jakubiak	600(18)	The business community should not be part of the committee reviewing the program.	A three-year review of the program will be conducted as proposed by the PAC, including a committee representing Ecology, environmental interests and the business community.

8.2 Regional Citizens' Advisory Committees (WAC 173-340-610)

Only one amendment was made to this section. The amendment modifies the requirement in WAC 173-340-610(6)(d) regarding the responsibility of the regional citizens' advisory committees to advise Ecology. The amendment is based on a PAC recommendation (see Final PAC Report, pp. 47-48). Comments received on this amendment are addressed below.

GQ 8.2.1
Can the regional citizens' advisory committees provide input on specific sites?

(352, 2220)

Response:
The rule amendments include the amendment of the requirement in WAC 173-340-610(6)(d) regarding the responsibility of the regional citizens' advisory committees to advise Ecology. The amendment is based on a PAC recommendation (see Final PAC Report, pp. 47-48). The amendments specifically provides that the committees' responsibilities include the following:

> Advise the department of community concerns about the cleanup program's activities and develop proposals for addressing these concerns. Committees may use issues at specific sites as a foundation for understanding regional issues.

WAC 173-340-610(6)(d). The amendment is not meant to preclude regional citizens' advisory committees from providing input on specific sites.

Chapter 9 Cleanup Standards – General

9.1 Overview of Cleanup Standards (WAC 173-340-700) and General Comments

Several amendments to WAC 173-340-700 were made for clarification purposes and to reflect changes made to other chapters, including updating several cross-references. Substantive and other changes, listed by subsection, include the following:

(1) Purpose
No changes.

(2) Explanation of term "cleanup level"
Added explanation of the term "cleanup level".

(3) Explanation of term "cleanup standards"
Moved explanation of the term "cleanup standards" from (4).

(4) Relationship between cleanup standards and remediation levels
(b) Added brief explanation of the term "remediation levels". See Section 355 for additional explanation of remediation levels.
(c) Clarified that containment discussion only applies to soil containment.

(5) Methods for setting cleanup levels
(Intro) Added general discussion of method for setting cleanup levels, including use of a conceptual site model.
(a) (b) & (c) Added discussion of need to include an evaluation of terrestrial ecological receptors when setting cleanup levels under Methods A, B and C.
(b) & (c) Added description of division of Methods B and C into standard and modified methods.
(c) Added a statement that Method C cleanup levels require institutional controls.

(6) Requirements for setting cleanup levels
(a) Added statement reflecting permit exemptions. Also, in former (5), deleted language discussing remedy selection (cross-references to appropriate Sections were added to 700(4).)

(7) Procedures for demonstrating compliance with cleanup standards
(former (7)) Deleted policy statements (moved to Section 702).

(8) Specific procedures for setting cleanup levels at petroleum contaminated sites
Added overview discussion for setting cleanup levels at petroleum contaminated sites.

Several comments were received regarding the specific language in this Section. These are discussed below, along with general comments that pertain to several of the cleanup standards chapters.

GQ 9.1.1
What is the difference between cleanup levels, cleanup standards, and remediation levels?

(458, 620, 621, 622, 623, 628, 733, 1293, 1330, 1332, 1344, 2421)

Numerous comments were received on the 1999 proposal expressing concern that did not adequately explain the difference between cleanup levels, cleanup standards and remediation levels. Some persons advocated language that would equate remediation levels with cleanup standards.

Response:
See discussion of the relationship between cleanup levels, cleanup standards, and remediation levels in Chapter 5 of the CES.

GQ 9.1.2
What is the appropriate role of a conceptual site model in establishing cleanup levels and remediation levels?

(186, 735, 869, 871, 2399)

Three persons provided comments regarding the use of conceptual site models in site cleanup. For example, Newlon stated:

> The Port recognizes that a conceptual model may be needed for Method A to the extent that one must determine which media to evaluate (soil, ground water, etc.) However, it still needs to be made clear that a detailed CSM is not needed for Method A.

Goold added:

> The concept of site conceptual exposure model (SCEM) has been mentioned in several sections (WAC 173-340 (7), WAC 173-340-700(5&8), however it has not been sufficiently emphasized. The SCEM should be developed as a part of the Remedial Investigation. The SCEM should consider the current and likely future land-use to identify all the complete routes of exposure for human as well as ecological receptors and identify the point(s) of exposure, point(s) of compliance, and the chemicals of concern. Those implementing the process should be encouraged to present the SCEM in a graphical or a tabular form….

And Gillett:

> Ecology proposes to add a definition of "conceptual site model". In that definition, the reference to "actual and potential exposure pathways" is unnecessary since the definition of "exposure pathway" includes "the path a hazardous substance takes or could take …."

> Recommendation: Strike "actual and potential". Alternatively, conform the terminology in the two definitions so that it is clear they refer to the same thing. In particular, "potential" exposure pathways should not be construed to refer to a theoretical pathway that could not actually be complete at a given site.

Response:
As noted earlier, the following language was added to WAC 173-340-700(5) discussing the role of conceptual site models in setting cleanup levels:

> The first step in setting cleanup levels is to identify the nature of the contamination, the potentially contaminated media, the current and potential pathways of exposure, the current and potential receptors, and the current and potential land and resource uses. A conceptual site model may be developed as part of this scoping process. Cleanup levels may then be established for each media. Both the conceptual site model and cleanup levels may be refined as additional information is collected during the remedial investigation/feasibility study.

In addition, in WAC 173-340-700(8) the following language has been added:

> The first step in setting Method B or C cleanup levels for TPH is to identify the nature of the contamination, the potentially contaminated media, the current and potential pathways of exposure, the current and potential receptors, and the current and potential land and resource uses. A conceptual site model should be developed as part of this scoping process.

While additional detailed explanation of conceptual site models could be added to the rule, given the non-regulatory nature of this discussion and the ready availability of EPA publications (U.S. EPA, 1987; U.S. EPA, 1991a) discussing the use of conceptual site models, Ecology believes that the above discussion is adequate for the purpose of the rule language.

As for the level of detail that should be used for sites establishing cleanup levels under Method A vs. other methods, Ecology does not believe it is appropriate to make such a distinction in the rule. Some Method A sites can be quite complex and a detailed conceptual site model can help sort out which exposure pathways need to be emphasized in site investigation and cleanup. Please note that the above rule language does not require the use of conceptual site models, it is only intended to alert the reader to a useful tool for establishing cleanup levels.

Ecology disagrees with the statement that a conceptual site model should only address “complete”, not potential, exposure pathways. Remedial actions are required to eliminate threats or potential threats to human health and the environment.

At many sites actual exposure is not occurring at the time of the remedial investigation/feasibility study because the site is abandoned or occupants are aware of the contamination and take precautions to avoid exposure. However, when setting cleanup levels and evaluating the protectiveness of a remedy, it is not sufficient to assume that current exposure conditions will prevail over the long term. In fact, it has been the department’s experience at contaminated sites

that once the persons involved in the cleanup move on, new tenants or employees (and sometimes even new owners) are unaware of contamination and fail to take similar precautions. This is especially true because of rapidly changing land use patterns and activities, and pressures on the use of natural resources such as ground water or surface waters. Thus, it is very important that potential exposure pathways be taken into consideration when establishing cleanup levels and assessing the protectiveness of a remedy.

GQ 9.1.3
Do PLPs have a choice with what Method they can use to establish cleanup levels?

(632)

Response:
At sites where the PLP is conducting the cleanup as an independent remedial action, Ecology agrees that PLPs can choose what method they use to establish cleanup levels. This is also often initially true at sites being done under Ecology oversight. However, once a PLP and Ecology agree on the method for setting cleanup levels, and that agreement becomes part of a consent decree or agreed order, PLPs do not have the option of switching methods unless Ecology concurs. Also, there may be instances, for example, where an order is issued directing that a cleanup be done, where the PLP does not have an option to choose how they will establish cleanup levels.

GQ 9.1.4
Under what circumstances can Method A cleanup levels be mixed with Method B or C cleanup levels at a site?

(90, 324, 422, 966, 2035, 2049, 2250, 2350)

Several persons requested that additional clarification be provided on the mixing of Method A, B and C cleanup levels. The MTCA SAB has also discussed the need for additional guidance on this issue. For example, Graves offered the following comment:

> The revised regulation does not provide any information regarding the ability for a PLP to use Method A and/or Method B cleanup levels together on a particular site. Currently in Ecology Guidance (CLARC II Tables, page 5), Ecology allows for use of Method A default values when Method B cleanup levels are being evaluated for a particular site. It would be helpful to state Ecology's current policy in the Regulation.

Response:
Historically, Method A table values have been used when a reference dose or cancer potency factor does not exist for a contaminant (e.g. lead). As noted by Graves, Ecology has provided guidance on the mixing of cleanup levels through it's Cleanup Levels and Risk Calculations (CLARC) guidance (Publication #94-145). Specifically, that guidance states the following general rules for mixing methods:

1. When using Method A, no Method mixing is permitted;

2. When using Method B, Method A cleanup levels may be used but not Method C cleanup levels.
3. When using Method C, Method A or B cleanup levels may be used.

The logic behind this approach is that, in general, Method A cleanup levels are equal to or more stringent than Method B cleanup levels, which are in turn, more stringent than Method C cleanup levels. There are, however, a number of limitations to mixing Methods that are not captured by these general guidelines:

- This mixing of methods generally only applies within a given medium. For example, Method A ground water cleanup levels can be mixed with Method B ground water cleanup levels. This is not meant to prohibit the use of Method A cleanup levels for one medium and Method B or C for another medium.
- When using Method B or C to develop a soil cleanup level using TPH fractions, the Method A TPH ground water cleanup levels cannot be used as the ground water cleanup level. This is because the ground water TPH cleanup levels were developed based on an assumed composition that may be different from the composition of TPH at the site. Instead, equations 720-3 must be used to develop a ground water cleanup level.
- The Method A industrial soil cleanup levels can only be used at eligible industrial sites using Method C soil cleanup levels.
- The Method A cleanup levels do not take into account additive risk, while an adjustment for additive risk is required under Methods B and C. Thus, if a Method A cleanup level is being used under Methods B or C, the Method A value may need to be adjusted downward for additive risk.
- The Method A table values for soil cleanup levels do not address terrestrial ecological risk, and thus cannot be used without taking this pathway into account.
- Method A values based on background or PQLs need to be examined for applicability at a specific site based on site-specific information.

Because of the myriad of issues associated with mixing of Methods, many of which are site-specific considerations, Ecology believes it would be inappropriate to propose specific rule language at this time. Ecology does intend to continue to include a discussion of this option in future editions of the CLARC database.

GQ 9.1.5
Why are Methods B and C now subdivided into "Standard" and "Modified" Methods? Is there any significance to changing the title of Method B from "standard" to "universal" method?

(242, 463)

One person questioned the appropriateness of subdividing Method B into "Standard" and "Modified" methods, indicating that there was not much "value added" by this since both methods can be used at a site. A second questioned the intent of changing the title of Method B from "standard" to "universal" method.

Response:
The division of Method B into "standard" and "modified" Method B was done in response to comments on earlier drafts of the rule that Ecology needed to be clearer on what parameters could be modified in the equations when using site-specific risk assessments. "Standard" Methods B and C use generic default assumptions to calculate cleanup levels and can be thought of as comparable to ASTM RBCA's "tier I" (ASTM, 1995). "Modified" Methods B and C provide for the use of chemical-specific or site-specific information to change selected default assumptions and can be thought of as comparable to ASTM RBCA's "tier II". Ecology agrees that either method can be used to establish cleanup levels at a site and no preference is implied by this distinction.

The change in the title for Method B, is not intended to change the applicability of Method B. This change was made to avoid confusion with the above described division of Methods B and C into "standard" and "modified" methods.

GQ 9.1.6
How do terrestrial ecological impacts need to be considered when establishing cleanup levels?

(240, 244, 247, 736, 2086, 2310, 2422)

Three persons expressed concern with the description of how terrestrial ecological impacts are to be considered when establishing cleanup levels. For example, McCain stated the following:

> In proposed subsections 700(5)(a) and 700(8)(a), it states "If the Method A cleanup level is not protective of terrestrial ecological receptors, then a Method B or Method C soil cleanup level, as appropriate for the site, must be established." This language is very likely to have unintended consequences, since the concentrations and points of compliance for Method A are largely based on human health protection.
>
> To illustrate the problem, consider a site where soil is contaminated with lead at levels that comply with the Method A soil value (250ppm). The simplified terrestrial ecological evaluation procedures at proposed section WAC 173-340-7492(1)(d) indicate that soil concentrations in Table 749-2 may be used as cleanup levels. Table 749-2 indicates that lead values greater than 220ppm may not be protective of terrestrial ecological receptors. Proposed section WAC 173-340-7492(2)(b) would then allow use of a physical barrier and institutional controls to satisfy ecological protection requirements. This would suggest that it should be appropriate to deal with lead under Method A for human exposures, and use controls allowed under WAC 173-340-7492(2)(b) to address potential terrestrial ecological exposures. Instead, the language proposed for subsection 700(5)(a) would require that cleanup levels be based on Method B or C rather than on Method A. This is a ridiculous result, since Method A was protective for other purposes and the ecological evaluation procedures identified a method for managing eco risks. Similar results and analyses apply to other chemicals for which lower eco-risk numbers in Table 749-2 are lower than Method A numbers, such as PCBs at industrial properties, chromium III, diesel, etc.
>
> As another example, the proposed conditional point of compliance for protection of terrestrial ecological receptors is 6 feet, which the department considers to be the "biologically active zone" under WAC 173-340-7490(4)(a). Under that provision, nothing more may be necessary than an institutional control preventing deeper excavation. Again, what would then be the reason to require that cleanup levels be based on Method B or C, rather than on Method A, if the only exceedance of the ecological standard is deeper than 6 feet?

> The basic problem appears to arise because Method A and proposed WAC 173-340-7490 to 7493 provide very different methods for deriving cleanup levels and points of compliance. Further, Ecology has not accounted for the fact that the terrestrial ecological evaluation procedures include a number of "offramps" intended to avoid complex analysis when it isn't necessary. This poor "fit" shouldn't force complexity into the process. Rather, Ecology should simply state that Method A numbers must be used in tandem with terrestrial ecological analyses.

Similar concerns were expressed from the POG with regard to language in the TPH overview.

Response:
The proposed language in the 2000 proposal was added in an attempt to address comments received on earlier drafts of the rule on this issue. Ecology concurs that the proposed language is potentially inconsistent with the process for determining whether a site poses a threat to terrestrial ecological receptors and establishing cleanup levels or selecting a remedy to address those concerns. Part of the problem arises out of trying to summarize a multi-stepped process in a few words in an overview discussion. To address these concerns, in the final rule the language in WAC 173-340-700(5)(a) will be modified to state the following. Similar modifications will be made to (5)(b), (5)(c) and (8)(a).

> ~~For soil contamination, the soil cleanup level must not result in any significant adverse effects on the protection and propagation of terrestrial ecological receptors. This determination must be made in accordance with the requirements and procedures specified in WAC 173-340-7490 through 173-340-7494.~~ For soil contamination, the potential impact of hazardous substances on terrestrial ecological receptors must be evaluated under WAC 173-340-7490 through WAC 173-340-7494. Specifically, either an exclusion must be established for the site under WAC 173-340-7491 or a terrestrial ecological evaluation must be conducted under WAC 173-340-7492 or 173-340-7493. ~~If the Method A cleanup level is not protective of terrestrial ecological receptors, then a Method B or Method C soil cleanup level, as appropriate for the site, must be established.~~ The terrestrial ecological evaluation may result in a more stringent Method A soil cleanup level than is required to protect human health.

GQ 9.1.7
How is natural background and the practical quantitation limit taken into account when establishing cleanup levels?

(255, 261, 280, 383, 454, 695)

Several comments were received requesting changes to the proposed language describing how natural background and PQLs were to be considered when establishing cleanup levels. For example, Burden, expressed the following concern:

> NATURAL BACKGROUND LEVELS. Under the current WAC 173-340-700 (4)(d) cleanup levels shall be established at a concentration equal to the natural background concentration. The proposed regulations change this as follows:

> "... In some cases, cleanup levels calculated using the methods specified in this chapter are less than natural background levels or levels that can be reliably measured. In those situations, the cleanup level shall be established at a concentration equal to the practical quantitation limit or natural background concentration.
>
> Comment: We believe the department intends that this regulation is to be interpreted to mean that the cleanup level will be to the practical quantitation limit where background levels are less than can be reliably measured and that the cleanup level will be to the background level when it exceeds the reliably measured levels.

And Gillett:

> [These subsections state] that cleanup levels "are not required to be set at levels below the practical quantitation limit or natural background." This could be read to imply that Ecology may, but is not required to, set cleanup levels below the PQL or natural background, which would be inconsistent with the proposed WAC 173-340-700(6)(d), which states that "the cleanup level shall be established at a concentration equal to the practical quantitation limit or natural background concentration."

Response:
Ecology concurs with the commentors that the intent of this provision is that the cleanup level cannot be more stringent than the practical quantitation limit or natural background, whichever is higher. This adjustment is not intended to be optional. To address these concerns, the following changes were proposed to WAC 173-340-700(6)(d) in the 2000 proposal:

> **(d) Natural background and analytical considerations.** In some cases, cleanup levels calculated using the methods specified in this chapter are less than natural background levels or levels that can be reliably measured. In those situations, the cleanup level shall be established at a concentration equal to the practical quantitation limit or natural background concentration, whichever is higher. See WAC 173-340-707 and 173-340-709 for additional information.

In the final rule, parallel changes have been made to other Sections of the rule with similar language.

GQ 9.1.8
Does an adjustment for total site risk need to be made when one of the cleanup levels is based on natural background?

(2341, 2344)

Newlands expressed the following concern regarding rule provisions requiring adjustment of cleanup levels for total site risk:

> 173-340-730(5)(a) pertains to total site risk adjustments to cleanup levels for surface waters. It says:
>
> (a) Total site risk adjustments. Surface water cleanup levels for individual hazardous substances developed in accordance with subsections (3) and (4) of this section, including those based on applicable state and federal laws, shall be adjusted downward to take into account exposure to multiple hazardous substances and/or exposure resulting from more than one pathway of exposure. These adjustments need to be made

only if, without these adjustments, the hazard index would exceed one (1) and the total excess cancer risk would exceed one in one hundred thousand (1 x 10-5). These adjustments shall be made in accordance with the procedures specified in WAC 173-340-708 (5) and (6). In making these adjustments, the hazard index shall not exceed one (1) and the total excess cancer risk shall not exceed one in one hundred thousand (1 x 10-5).

The problem with the above approach arises when a single naturally-occurring substance, such as arsenic, already exists at a level with a greater hypothetical risk level than one in one hundred thousand (1 x 10-5). In that case, there can be no theoretical cancer risk increase allowed from any other substance. This may be partly remedied by modifying the second sentence in the section to read:

These adjustments need to be made only if, without these adjustments, the hazard index would exceed one (1) solely from human causes and the total excess cancer risk solely from human causes would exceed one in one hundred thousand (1 x 10-5).

Absent the above qualifier, surface water, or groundwater flowing to surface water, must meet impossibly high cleanup standards, which will produce little or no significant benefit.

Response:
Ecology acknowledges that this adjustment can be problematic when there are multiple hazardous substances at a site and the natural background concentration is at or above the acceptable health risk. This is most likely to be a concern at sites with naturally occurring carcinogens such as arsenic and radionuclides. This concern was expressed by others earlier in the rule-making process and was addressed by adding WAC 173-340-730 (5)(c), which states:

> **(c) Natural background and PQL considerations.** Cleanup levels determined under subsections (2), (3) and (4) of this section, including cleanup levels adjusted under subsection (5)(a) and (b) of this subsection, shall not be set at levels below the practical quantitation limit or natural background concentration, whichever is higher. See WAC 173-340-707 and 173-340-709 for additional requirements pertaining to practical quantitation limits and natural background concentrations.

For example, at a site where arsenic and one or more other carcinogens are present, the arsenic cleanup level would be set at natural background and the cleanup level for the other carcinogens would be set at the practical quantitation limit. Ecology acknowledges that at sites where arsenic is an indicator hazardous substance, this language could result in the cleanup level for other carcinogens being set at natural background or the PQL. However, we do not believe it is appropriate to make the suggested change to the rule at this stage in the rule amendment process without engaging in additional public dialogue on the implications of making this change. Such a change would be a significant policy shift from what is currently in the MTCA rule and what has been subject to public review to date.

GQ 9.1.9
What analytical methods are used for defining the Practical Quantitation Limit (PQL)?

(967, 2050)

One person requested clarification on if Ecology is still using implementation memo #3, published by Ecology in 1993 as the basis for establishing PQLs.

Response:
In 1993, Ecology issued "Implementation Memo No. 3" (Ecology, 1993a). This memo provided a summary of the PQLs that were able to be achieved by labs surveyed at that time. Because that memo is nearly seven years old, when calculating the new Method A values, Toxics Cleanup Program staff consulted with EPA's Manchester lab and some private labs for the latest information on PQLs and analytical methods. These PQLs are summarized in Appendix D to the CES.

Ecology intends to update Implementation Memo No. 3 after adoption of the rule amendments. In the interim, users should contact the lab they normally use for sample analyses to obtain the latest information on analytical methods and PQLs for contaminants of concern at their site.

GQ 9.1.10
What is the role of land use in establishing petroleum cleanup levels?

(92, 249, 2166, 2252, 2392)

Three persons expressed concern about the sentence in WAC 173-340-700(8)(b)(ii)(B)(II) and (iii) stating "Consideration of current and future site uses may be considered in establishing remediation levels". The essence of the concern appears to be that this statement could be misleading because land use can be considered in some instances when setting cleanup levels.

Response:
Ecology agrees that this statement is an incomplete description of how land and resource use is to be considered when setting remediation levels and cleanup levels. Since the focus of this section is to provide an overview of establishing cleanup levels and standards, not remediation levels, we concur that it is appropriate to delete this statement. Instead, a cross-reference has been added to 173-340-700(8)(b)(ii)(A) alerting the reader that to WAC 173-340-708(3) describes how land and resource uses can be considered when establishing remediation levels. See the discussion under Section 706 of this Chapter for a further discussion of how land and resource uses are to be considered when establishing cleanup levels and remediation levels.

GQ 9.1.11
Can the process described here for establishing cleanup levels also be used for establishing remediation levels?

(91, 2251, 2392)

Two commentors suggested broadening the discussion in 700(8) to incorporated remediation levels.

Response:

Because the emphasis of this subsection is on the discussion of the process for establishing cleanup levels, not remediation levels, the suggested revision has not been made. Ecology does agree that many of the procedures used for establishing cleanup levels can also be used to assess the protectiveness of a remedy. Rather than attempting to add a duplicative and abbreviated discussion here, we believe this aspect of cleanup is adequately addressed in subsection (4) of the overview and with the descriptions provided in WAC 173-340-355 and 173-340-708, and in the Sections for each medium.

GQ 9.1.12
Why hasn't Ecology adopted the approach taken in ASTM's Risk Base Corrective Action (RBCA) Standard for petroleum contamination?

(40, 708, 711, 868, 883, 914, 2116, 2477, 2498)

Several commentors questioned the approach used in MTCA to establish petroleum cleanup standards, objecting to Ecology's characterization of this process in fact sheets accompanying the rule as "…similar to the nationally recognized ASTM Risk-Based Corrective Action (RBCA) model." For example, WSPA made the following comment:

> …A fundamental problem in the proposed amendments is the very limited ability to evaluate and use realistic exposure scenarios in establishing cleanup levels. MTCA (and the ASTM RBCA) provides for the use of reasonable maximum exposure (RME) scenarios based on estimates of current and future resource uses. MTCA defines RME as "the reasonable maximum exposures for ground water, surface water, soil, and air." It establishes default RMEs for each pathway, but provides for the use of alternate RMEs where the PLP demonstrates that default RMEs "are not appropriate for a particular site." However, the proposed amendments constrain PLPs' ability to use alternate RMEs even if the default RME is not appropriate. Under the proposed amendments, an alternate RME may be used only if specifically authorized in the medium-specific provisions. A review of these provisions reveals that the only alternate RMEs allowed for cleanup levels are non-potable ground water, industrial soil and industrial air.
>
> For example, the proposed amendments establish that ground water use as drinking water will be the RME at most sites, allowing for only very limited exceptions. The criteria for demonstrating that ground water is not a reasonable current or future source of drinking water are very narrowly defined and result in the over-classification of a number of ground water resources. This stipulation of almost all ground water as drinking water is over-conservative and is inconsistent with the RME definition of "reasonably expected to occur at a site under current and potential future site use". This is particularly true given the current understanding of attenuation processes and the natural degradation of petroleum compounds over time.
>
> Under the ASTM RBCA process, it is fully anticipated that cleanup levels at many, if not most, sites will be based on RMEs other that ground water ingestion. However, the proposed MTCA amendments contain only a very limited ability to establish cleanup levels based on non-drinking water RMEs. Further, establishing cleanup levels based on non-drinking water use is technically complex. For example, the establishment of cleanup levels for non-potable ground water requires the use of a site-specific risk assessment . By comparison, the ASTM RBCA provides for Tier 1 cleanup levels for both soil and ground water based on a variety of exposure pathways including ingestion, direct contact, and transport to other media. This results in a system that is more useable for all sites.

Response:

The overall approach under MTCA and the ASTM-RBCA process (ASTM, 1995) are very similar. Both emphasize identifying sources and concentrations of contaminants, migration pathways, and potential exposure routes. Both MTCA and the RBCA process require evaluation of a variety of exposure pathways and both use very similar equations to calculate cleanup levels for these various exposure pathways.

While the RBCA guidance uses examples where ground water ingestion is not evaluated, it does not establish a policy that ground water ingestion is not required to be evaluated. The examples in the guidance do not purport to establish policy. In fact, RBCA instructors emphasize that there are many policy choices involved in the cleanup of contaminated sites and RBCA does not establish these policies; it is up to the individual State to establish the appropriate policies. What RBCA does do is provide the technical tools for evaluating various potential exposure pathways, once the policy framework has been established. In Washington State, MTCA provides that policy framework.

When comparing the RBCA process to the policy framework established under MTCA, however, there is one major difference. The MTCA Statute requires the use of permanent remedies to the maximum extent practical; RBCA does not.

The RBCA process takes the approach that any method of risk reduction is appropriate, no matter how reliable or permanent. This could, for example, result in little actual cleanup and cleanups relying instead on property and resource use restrictions to minimize potential exposure. In contrast, by requiring remedies that are "permanent to the maximum extent practicable", MTCA emphasizes actual cleanup.

In addition, the RBCA process makes changing the points of exposure an acceptable means of developing a site-specific cleanup level. This approach is inconsistent with the MTCA statutory preference for permanent remedies. Because of this preference for permanent remedies and the potential lack of reliability in institutional controls, MTCA does not allow persons doing cleanup to simply move the point of compliance to get a more favorable cleanup level or to show the absence of risk at a site.

Furthermore, Ecology believes it is entirely appropriate and consistent with State law and public values to ensure that cleanups emphasize protection of ground water. This is especially true given the current difficulty of securing water rights in Washington State. See Chapter 10 for additional discussion of this issue.

GQ 9.1.13
Will it be possible to establish site-specific petroleum cleanup levels that are substantially different than the Method A values?

(65, 248, 720, 2165)

Three comments were received expressing concern that using Method B or C to establish site-specific petroleum cleanup levels may require a lot of additional site investigation and may not result in substantially different petroleum cleanup levels than under Method A.

Response:
Ecology acknowledges that using Methods B or C to establish soil cleanup levels will require additional site investigation than would be required to use Method A. While limiting MTCA to Method A petroleum cleanup levels would be a simple approach, it would not necessarily always be less costly, and would not fulfill the PAC and POG recommendations. While the additional investigative work under Methods B or C may cost more initially, it could result in a substantial savings in cleanup costs at some sites. How much site-specific petroleum cleanup levels will vary from the Method A cleanup levels will depend on how much the petroleum composition and soil and ground water conditions at a site differ from the assumptions used to derive the Method A values. We believe experienced consultants will be able to tell with limited testing whether it will be worthwhile to pursue deriving Method B or C petroleum cleanup levels for a site, just as they now do for other hazardous substances. Ecology intends to supplement the rule with guidance on emerging issues and procedures to minimize the cost of developing cleanup levels under Methods B and C.

GQ 9.1.14
Other comments regarding WAC 173-340-700 are addressed in the following table:

Comment ID	Section	Comment	Response
69, POG	700(8)	POG believes the TPH additions will put WA in the forefront.	Comment acknowledged.
86, POG	700(6)(c)	The term "input parameters" is not defined.	Replaced "factors" with "default assumptions" to be consistent with language in other Sections changed as a result of this earlier comment.
71, POG 118, POG 2279, POG	700(8)	Retrofitting of older TPH data should not be allowed.	Addressed in 700(8)(b)(D)(II).
118, POG 2279, POG	700(8)	Correlation of older TPH data with new methods should be allowed	Addressed in 700(8)(b)(D)(I).
737, POG	700(8)	Replace TPH overview with POG's version	Several suggested revisions were incorporated.
1336, McCain	700(8)	Rewrite as per Gillett's November, 1998 draft	Several of the suggested revisions were incorporated.
2011, Holmes	700(8)	References to Section 830 and Method 7 wrong	References changed in final rule.
2308, POG	700(5)(a)	Concerned language doesn't emphasize substances must be indicators at site.	Added cross-reference to 708(2).

Comment ID	Comment	Response
1331, McCain	The statement that it is MTCA's goal "to restore sites to cleanup levels without the need for future restrictions on the use of	Ecology still believes this is a valid goal that is consistent with the statutory preference for permanent remedies, even for industrial facilities.

	affected properties or resources" is not consistent with the Statutory goal pertaining to industrial cleanup standards.	
243, Gillett 2164, WSPA	In (b), clarify that quantitative risk assessment for remediation levels can involve changing not only the assumptions in the equations but also other modifications as allowed under 702 & 708.	We concur that is the intent of this provision. Since this is an overview, additional detail is not needed here. This concept is addressed in more detail in the media-specific sections and Section 708.
241, Gillett 245, Gillett 2163, WSPA	The reference should be to 440(f) not just 440 (with regard to future restrictions on property).	Ecology disagrees. Could involve restrictions for other reasons—for example, use of a conditional point of compliance or use of remediation levels, in addition to restrictions needed to address terrestrial ecological concerns.
246, Gillett	In (c), clarify that quantitative risk assessment for remediation levels can involve changing not only the assumptions in the equations but also other modifications as allowed under 702 & 708.	We concur that is the intent of this provision. Since this is an overview, additional detail is not needed here. This concept is addressed in more detail in the media-specific Sections and Section 708.
451, Allen 1153, Kenefick 1236, Gillett	The description of routine cleanup action is no longer in 130. Change to 200.	Comment addressed in 2000 proposal.
452, Allen; 1150, Kenefick	(5)(b) needs to be clarified that this adjustment for additive risk does not need to be made if the total risk level doesn't exceed a HQ = 1 or 1 X 10-5 cancer risk.	That is the intent of this provision. Comment addressed in 2000 proposal.
453, Allen	Ecology needs to provide justification for using a more stringent level of cancer risk than EPA.	See 1991 responsiveness summary for discussion of acceptable level of risks used in MTCA.
624, K Johnson	Need to add discussion of cleanup levels for land uses other than residential and industrial and remediation levels.	Comment addressed in 2000 proposal by addition of language to Section 708(3).
734, 2398 Newlon	Suggests adding a table to explain the differences between standard and modified cleanup levels and remediation levels (i.e. what variables can be changed). Latest comment indicated can be addressed in guidance.	To be addressed in guidance.
870, Goold	Suggests calling Method A "tier 1"; standard methods B and C "tier 2" and modified methods B and C "tier 3".	Ecology proposed using "Tiers" in earlier proposals. Received comments objecting to making that change, and so it has not been incorporated.
1333, McCain	Add or move clause "except for industrial Method A soil cleanup levels" to end of sentence when discussing what is "clean".	Ecology believes this is still an appropriate statement for industrial properties—see response to similar comment in 700(4).
1423, Belcher	Remove reference to Figure 700-1.	Removed in 2000 proposal.
2571, White	Change "media" to "medium".	Comment addressed in adopted rule.
2572, White	Define ARARs	Description added to adopted rule.

455, Allen	Couldn't find 707	No changes were proposed for Section 707 so it did not appear in the proposed rule amendments. This Section will appear in published rule.
456, Allen	Suggests adding a reference to Berthouex, 1991 for dealing with PQLs and highly censored data sets.	Methods cited are a reflection of current Ecology guidance. We acknowledge that other methods have been published and may be useful references.
457, Allen	Due to rule complexity, need a technical guidance document that is subject to public review and comment.	To be addressed in guidance.
1334, McCain	Don't delete the reference to "new scientific". Add a cross-reference to 702(14).	Comment addressed in 2000 proposal by adding sentence specifically discussing new science.
625, K Johnson 1335, McCain	Needs to incorporate concept of remediation level. McCain suggests wording	Comment addressed in 2000 proposal.
91, POG 2251, POG 2392, Newlon	Suggests rewording (b)(ii) as follows: "This chapter provides for a three tiered approach for establishing Method B and Method C tiered cleanup levels and remediation levels at sites that involve the release of TPH."	This part of the overview focuses on cleanup levels.

9.2 General Policies (WAC 173-340-702)

Several amendments to WAC 173-340-702 were made for clarification purposes and to reflect changes made to other chapters, including updating several cross-references. Policies (2) through (9) were moved into this Section from Section 700. Substantive and other changes to these provisions, listed by subsection, include the following:

(1) Purpose
Editing changes.

(2) Policy on expediting cleanups
Statement from 700(7)(b) moved here with no changes.

(3) Goal for cleanups
Statement from 700(7)(c) moved here and broadened to include cleanup actions.

(4) Current and potential site and resource uses
Statement from 700(7)(d) moved here and broadened to include cleanup actions.

(5) Presumption for cleanup actions
Statement from 700(7)(e) moved here with no changes.

(6) Cost considerations
Statement from 700(7)(f) moved here with no changes.

(7) Cleanup action alternatives
Statement from 700(7)(g) moved here with editing changes.

(8) Cross-media impacts
Statement from 700(7)(h) moved here with no changes.

(9) Relationship between cleanup levels and cleanup actions
Statement from 700(7)(i) moved here with editing changes.

(10) Relationship to federal cleanup law
Added Sections 350, 355, 357, 410, 420, 440, 450 and 830 as legally applicable requirements under CERCLA.

(11) Reviewing and updating cleanup standards
No changes

(12) Applicability of new cleanup levels
Added policy statement explaining how cleanups under the existing law are affected by the rule amendments.

(13) Institutional controls
Removed language discussing when institutional controls are required. These provisions were moved to WAC 173-340-44(4).

(14) Burden of proof
Added statements clarifying who has the burden of proof for alternative reasonable maximum exposure scenarios and other than default risk assessment assumptions.

(15) New scientific information
Broadened policy statement to include remediation levels and a time limit for when new scientific information can be considered in the cleanup process.

(16) Criteria for quality of information
Added criteria to be considered when evaluating the information used to modify methods or default values specified in the rule.

GQ 9.2.1
What amendments has Ecology made to make the MTCA rule consistent with its proposed strategy of elimination of bioaccumulative chemicals of concern (BCC)?

(330, 562, 2200)

Three comments were received requesting that an additional policy statement be added to WAC 173-340-702 addressing bioaccumulative chemicals of concern (BCC). Specifically, Valeriano stated the following:

> Ecology has announced that it will be pursuing a strategy to virtually eliminate bioaccumulative chemicals of concern at cleanup sites by 2025. If Ecology is serious about this strategy these chemicals need to be specifically addressed as part of this rule. This means that Ecology needs to be as aggressive as possible when dealing with sites where these chemicals exist and independent cleanups and risk assessments should not be an option. Achieving cleanups as close to "background" levels as possible at these sites should be a priority. A clear policy statement in this regard should be made in the rule.

Response:
Ecology has proposed a draft strategy to reduce persistent, bioaccumulative, toxins (PBTs) in Washington State (Ecology, 2000b). This strategy was prepared in response to a legislative directive during the year 2000 legislative session.

Most of the strategy focuses on efforts to eliminate future emissions of these chemicals to the environment. In addition, Ecology has provided several recommendations related to site cleanup. Specifically, the following steps are recommended:

- For site contaminated with PBTs, Ecology will emphasize remedies that address these pollutants.

- When Ecology ranks hazardous waste sites for cleanup, toxicity of the contaminants on site (including PBTs) will continue to be a factor in scoring/ranking and priority setting of those sites.

- Ecology will establish site-specific sediment cleanup requirements designed to prevent harm to human health and the environment associated with the accumulation of PBT chemicals in the aquatic food web.

As can be seen, these recommendations are modest first steps in dealing with these very damaging substances. Ecology believes it would be premature to pursue the aggressive strategy advocated in the above comments. We have, however, carefully reviewed available human health information and incorporated that information into the Method A cleanup levels for PBT substances. Additional information on how those cleanup levels were set is provided in Appendix D. In addition, the addition of languate on terrestrial exological evaluations to the rule will provide a more consistent framework for addressing potential ecological impacts of these and other PBTs at cleanup sites.

GQ 9.2.2
Does MTCA apply to the cleanup of radionuclide contamination?

(1219, 2007, 2023, 2611)

Three comments were received asking that Ecology clarify how MTCA applies to the cleanup of radionuclides. Specifically Jezlorski stated the following:

> A new issue arising from the Department of Health's proposed rule is a need to clearly state a rule that MTCA and its WAC chapter apply to all releases or threatened releases of hazardous substances, including radionuclides and radiation within the definition of carcinogens.
>
> There is a need to specify that even if a carcinogen or radioactive release site is "closed" under another permit, these rules and cleanup requirements still apply to if risk from residual contamination exceeds cleanup levels in MTCA. We urge other agencies and affected businesses that they are not exempt from the Model Toxic Control Act.

In contrast, K. Johnson (Weyerhauser), submitted proposed rule language on behalf of the Association of Washington Business that would eliminate all definitions pertaining to radionuclides, potentially implying that MTCA does not apply to the cleanup of radionuclides.

Response:
Ecology believes that MTCA applies to the cleanup of radionuclide contaminated sites. This is because the statutory definition of hazardous substances in RCW 70.105D.020 includes a reference to CERCLA and other laws that address radionuclides. The rule already contains several definitions and Method A table values pertaining to radionuclides.

In response to Jezlorski's suggestion, we believe it would be inappropriate to single out these substances for such a discussion when there are many other contaminants of concern addressed by MTCA.

Ecology is aware of the Department of Health's rules pertaining to the cleanup of radionuclide contaminated sites. We are also aware that the approach used to set standards for radionuclides under those rules is different than that used under the MTCA rules. This is because of federal rules governing radionuclides and the long-standing unique regulatory approach for radionuclides. At this point, a decision has not been made on how the differences in these approaches will be resolved. Ecology expects to address these and other issues regarding implementation of MTCA with respect to radionuclides in a future rulemaking.

GQ 9.2.3
What is the intent of adding cleanup actions to WAC 173-340-702(3)?

(250, 561, 626, 1337, 2167)

Several comments were received expressing concern with the policy statement in WAC 173-340-702(3). Specifically Gillett, states:

> Subsection (3) requires that cleanup actions provide conservative estimates of risk to human health and the environment, whereas the current rule only applies this requirement to cleanup standards. This appears to undercut the role of remediation levels, which are intended to be based on realistic estimates of risk.

And from K. Johnson:

> Subsection -702(3) states that, in order to comply with MTCA policies, cleanup standards and cleanup actions "…shall be established which provide conservative estimates of human health and environmental risks that protect susceptible individuals as well as the general population." We have been unable to ascertain the source for this statement. This appears to be another instance where Ecology has used the overviews to state a conservative interpretation of the law, rather than that embodied in the statute, in the PAC report, or in any of the other sources used to revise the rule. Remedy - Subsection -702(3) should be removed from the rule.

In contrast, Wingard expressed concern that a strong statement be retained:

> Clean-up standards must be based on and protective of the most sensitive populations, including pregnant women, unborn children, children and most sensitive wildlife and plant species.

Response:
This policy statement was moved from WAC 173-340-700 in the current rule, with one modification—the addition of cleanup actions. The origin of the policy statement, as described in Ecology's 1991 policy statement, stems from the statutory requirement in RCW 70.105D.030 that cleanup standards be:

> at least as stringent as the cleanup standards under section 121 of the federal cleanup law, 42 U.S.C. Sec. 9621, and at least as stringent as all applicable state and federal laws, including health-based standards under state and federal law;

and the requirement in RCW 70.105D.010 which states, in part:

> (1) 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.

The reason why Ecology believes it is appropriate to include cleanup actions in this statement is that the PAC made a clear recommendation regarding the exposure scenarios to be addressed by cleanup actions. Specifically, in the PAC recommended changes to Section 708 of the rule, the following paragraph was recommended:

> (d) Persons performing cleanup actions under this chapter may also use alternate reasonable maximum exposure scenarios to help assess the protectiveness to human health of a cleanup action alternative that incorporates remediation levels and uses engineered controls and/or institutional controls to limit exposure to the contamination remaining on the site.
>
> (i) An alternate reasonable maximum exposure scenario shall reflect the highest exposure that is reasonably expected to occur under current and potential future site exposure considering, among other appropriate factors, the potential for institutional controls to fail and the extent of the time period of failure under these scenarios and the land uses at the site.

Final PAC Report, p. 62. The clear meaning of this recommendation is that remediation levels should be based on conservative exposure scenarios. Indeed, G. Pollet – a member of the MTCA PAC – in his comments on the proposed rule amendments stated he believed that this was the intent of this provision. Ecology also believes this is consistent with the statutory intent in RCW 70.105D.010. While it is expected that different exposure scenarios will be used for assessing the protectiveness of remedies and remediation levels than are used for establishing cleanup levels, when constructing these exposure scenarios, conservative (high estimates of exposure) are expected to be used.

Thus, for example, rather than assuming a child is living on the site and being exposed to a small amount of soil every day, a risk assessment assessing the protectiveness of a cap over contaminated soil could be based on short-term exposures resulting when the cap is breached. Examples could be an adult worker being exposed to the soil during construction/maintenance activities and/or exposure of a child playing in construction dirt piles. In making these assessments, one might assume a shorter duration exposure but more dirt ingestion during the shortened exposure episode.

GQ 9.2.4
What is meant by current and potential site and resource uses in WAC 173-340-702(4)?

(683)

One comment was received expressing concern about the policy statement in WAC 173-340-702(4). Specifically, Burden, stated the following:

> As currently written, no boundaries are placed on the universe of "potential" future uses. By our reading, essentially any possibility remains available under this scenario, including those that could be extraordinarily unlikely. Institutional controls, including property deed restrictions, can effectively and permanently restrict potential future uses of land and resources thereby creating a smaller subset of expected future uses. Tesoro believes tools such as institutional controls should remain available to cleanup action decision-makers. Accordingly, an expectation of reasonableness should be placed on the regulatory framework,
>
> RECOMMENDATION: Requests the following revision be made to this subsection: "Current and potential site and resource uses. Cleanup standards and cleanup actions selected under this chapter shall be established that protect human health and the environment for current and REASONABLY EXPECTED potential future site and resources uses."

Response:
This policy statement was moved from WAC 173-340-700 in the current rule, with one modification—the addition of cleanup actions. With regard to cleanup standards it reflects current language already in the rule that was specifically evaluated and reaffirmed by the PAC. With regard to cleanup actions, this parallels language that was specifically recommended by the PAC in WAC 173-340-708(3):

> Cleanup levels and remediation levels shall be based on estimates of current and future resource uses and reasonable maximum exposures expected to occur under both current and potential future site use conditions, as specified further in this chapter.

Final PAC Report, p. 61. This statement also is based on the statutory policy statement in 70.105D.010 which states in part:

> (1) 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.
> …
> (4) It is in the public's interest to efficiently use our finite land base, to integrate our land use planning policies with our cleanup policies, and to clean up and reuse contaminated industrial properties in order to minimize industrial development pressures on undeveloped land and to make clean land available for future social use.

RCW 50.105D.010(1), (4). For industrial properties, the definition of what is an actual and potential industrial site use is stated in the statute and in WAC 173-340-745. For other land and resource uses, the rule articulates what the presumed reasonable maximum exposure (RME) cleanup levels are to be based on, with land use addressed in WAC 173-340-740. These RME's further articulate what the meaning of this policy statement is with regard to cleanup levels.

As for cleanup actions, the proposed provisions in WAC 173-340-708(3) and (10) provide more detail needed to implement this policy statement. That language clearly allows the use of institutional controls to be factored into cleanup action decisions.

Ecology believes that introducing a new phrase to modify the meaning of this statement would not provide additional clarification and could add confusion by introducing a difference with Section 708. Ecology intends to work with the SAB in developing guidance on appropriate exposure scenarios to use when evaluating the protectiveness of remediation levels that incorporate institutional and/or engineered controls.

GQ 9.2.5
Is there a presumption in MTCA that remediation levels are protective of human health and the environment?

(627, 1263)

Two persons requested that the policy statement in WAC 173-340-702(5) be broadened to include remediation levels. Specifically, K. Johnson raised the following concern:

> …Subsection -702(5) states that only cleanup actions that achieve cleanup standards under Methods A, B or C "…shall be presumed to be protective of human health and the environment." The PAC Report clearly states that a cleanup action is protective of human health and the environment even where hazardous

> substances are left on-site at concentrations above cleanup levels (i.e., at remediation levels) so long as the cleanup action complies with other requirements of the regulation (see page 35 of the Final Report)….

Response:
This policy statement is language in WAC 173-340-700(7) of the existing rule that was moved here. It is specifically intended to establish a legal presumption of protectiveness for sites meeting cleanup levels at the applicable point of compliance. See Chapter 5 for a discussion of remediation levels.

GQ 9.2.6
What is the role of cost in setting cleanup standards?

(684)

Response:
The role of cost in setting cleanup standards was discussed in detail in the 1991 Responsiveness Summary. The PAC did not recommend any changes to the rule regarding this issue and no changes are proposed in these rule amendments. See pages 99-106 of the 1991 Responsiveness Summary for a detailed discussion of this issue.

GQ 9.2.7
Did the PAC recommend that the policy statement in WAC 173-340-702(9) be removed from the MTCA rule?

(628, 1338)

Two comments were received questioning the policy statement in WAC 173-340-700(9). For example, Johnson stated the following:

> Subsection 702(9) describes the relationship between cleanup levels and cleanup actions, but again relies on vague language and makes statements that have no discernible source. Ecology's proposed rule language that the rules are "…intended to promote thorough cleanups rather than long-term partial cleanups or containment measures…" is inaccurate and an attempt to impose the hierarchy that the PAC specifically recommended be eliminated. Remedy - The language should be removed from the rule.

Response:
This policy statement is existing language moved from WAC 173-340-700(7) in the current rule, with editing to refer to the newly reorganized remedy selection sections.

This policy statement is based on the statutory preference for remedies that are "permanent to the maximum extent practicable" and reflects the intent of cleanup standards under MTCA. The PAC discussed the statutory preference for permanent remedies and reaffirmed that it was appropriate as part of its remedy selection recommendations. While the PAC did recommend the "hierarchy" be removed from WAC 173-340-360, there is no discussion in that recommendation that Ecology should alter the rule definition of what is a clean site. Removing this policy

statement would be contrary to the statutory intent and the PAC reaffirmation that remedies be selected that are "permanent to the maximum extent practicable".

GQ 9.2.8
Does WAC 173-340-702(10) require MTCA model remedies to be used at CERCLA sites in Washington State?

(251)

The 1999 proposal included a cross-reference to model remedies as an applicable requirement under CERCLA. One person requested further clarification of this issue.

Response:
Ecology did not intend to make use of model remedies required at CERCLA sites being cleaned up in Washington State (although they may be used, if appropriate for the site). The earlier reference to model remedies in this provision was deleted in the 2000 proposal.

See also discussion of model remedies under Chapter 5 of the CES.

GQ 9.2.9
What is the relationship between cleanups under CERCLA and MTCA?

(362, 380, 459, 2621, 2637, 2641, 2642)

Two persons requested further clarification on the relationship between MTCA and the federal cleanup law (CERCLA). Specifically, Allen noted that not every provision in the cited Sections may apply to a particular response action and Rasmussen, made the following recommendation:

> This section should be revised to state that cleanup actions selected under the federal cleanup law which (1) incorporate substantive provisions of MTCA, and, (2) are approved (or co-approved in conjunction with EPA) by Ecology shall be deemed to satisfy the requirements of MTCA. This would eliminate the jeopardy of completing an approved cleanup action under the federal cleanup law only to face the possibility of a subsequent cleanup action imposed under MTCA.

Response:
Ecology believes that it is appropriate to make a statement in rule on which Sections contain substantive provisions that are fundamental to implementation of the statute.

EPA has, in previous correspondence, acknowledged the applicability of these Sections to CERCLA cleanups. In making this acknowledgement, EPA noted that there is some interpretation in determining how specific provisions in these Sections apply to a particular site. Ecology concurs that some interpretation is appropriate and these revisions are not intended to alter that approach in the future. It is Ecology's intent that these Sections as a whole, not necessarily every specific provision in them, be considered applicable state law under the federal cleanup law. Ecology believes to provide a more specific discussion of this in the rule would be a level of detail that is better reserved for guidance prepared in consultation with EPA.

With regard to the recommendation by Rasmussen, Ecology does not believe it would be appropriate to add such a statement to this provision. Under the MTCA, such a guarantee (covenant not to sue) can only be granted through a consent decree with Ecology and the Attorney General.

GQ 9.2.10
With regard to WAC 173-340-702(11), how often does Ecology intend to update the CLARC tables?

(629)

K. Johnson noted he concurred with updating the rule at least once every five years. He requested that Ecology also commit to updating its Cleanup Levels and Risk Calculations (CLARC) guidance annually.

Response:
Ecology has previously issued guidance called "CLARC" which provide tables of pre-calculated cleanup levels and other useful information. Ecology agrees that this guidance document will need to be updated after this rule amendment is adopted. Further updates beyond that will be done as the need arises and resources permit.

GQ 9.2.11
Can Ecology provide any additional protection to responsible parties that have completed cleanups under the current rule beyond what is provided in WAC 173-340-702(12)?

(14, 30, 45, 68, 460, 461, 589, 801, 832, 833, 834, 850, 851, 917, 927, 928, 1065, 1077, 1108, 1138, 1424, 2605, 2016, 2485, 2559, 2560, 2561)

Numerous persons expressed concern that the proposed "grandfather clause" in WAC 173-340-702(12) does not provide sufficient assurances to responsible parties that have completed cleanup under the current MTCA rules. Some suggested that this clause presents new liability for sites cleaned up under the former cleanup standards, because it reserves the right for Ecology to decide on a case-by-case basis whether a prior cleanup is sufficiently protective. Others thought the concept of grandfathering some sites under the former cleanup standards was inconsistent with the need for new, more stringent standards to protect human health and the environment. They suggested the clause be removed. Others expressed concern this subsection will result in a flood of requests for review of previous cleanups. One person requested Ecology issue guidance explaining how PLPs can demonstrate compliance with the more stringent soil cleanup levels by verifying that the ground water at a site is not impacted and another requested clarification if cleanups done under the interim TPH policy will be subject to future review.

Response:
The grandfather clause was not part of the agreement by the MTCA Policy Advisory Committee (PAC), but was included at the request of business representatives. It does not create any new

liability. Under MTCA, unless a site is cleaned up under a consent decree that contains a covenant not to sue, there is no legal limitation on the State's ability to require further cleanup in the future. Thus there is no limit on the State's authority to require further cleanup at independent sites or sites cleaned up under an order. Even for sites cleaned up under a consent decree that contains a covenant not to sue, the law requires that the covenant include a "reopener" that allows the State to require further cleanup if the State discovers factors that were not known at the time the consent decree was entered and that present a previously unknown threat to human health or the environment. RCW 70.105D.040(4)(c). The grandfather clause does not, and legally cannot, change these requirements in the cleanup statute.

The grandfather clause does provide some certainty as to the cleanup standards Ecology will use when evaluating sites that are in the remediation process when the new rules take effect. Ecology believes the rule is beneficial to parties conducting cleanup, and has therefore chosen not to remove the clause. The language reserving Ecology's right to require more cleanup if Ecology determines, on a case-by-case basis, that the prior cleanup is no longer sufficiently protective, is necessary in order for the rule to be consistent with the statute. As noted above, the cleanup law prohibits Ecology from agreeing that it will never require further cleanup at a site. That does not mean that Ecology will or must require more cleanup at all sites where the new standards might apply. For example, a prior cleanup may have resulted in contaminated soil being contained on site. If the new, more stringent cleanup standard is for protection of the direct contact pathway, Ecology may determine that the containment remedy is still protective of that pathway, even if the new cleanup standard is applied. Therefore Ecology would not require any additional cleanup at that site.

Ecology is also retaining the provision that for cleanups overseen by Ecology, the agency will use the cleanup standards in effect on the date of issuance of the final cleanup action plan. Most cleanups overseen by Ecology are conducted under a consent decree. MTCA requires Ecology to find that a cleanup under a consent decree will be in compliance with cleanup standards. RCW 70.105D.040(4)(a). Ecology believes that approving cleanups under cleanup standards that Ecology knows would not be protective of human health or the environment is inconsistent with the goals of MTCA. Persons conducting cleanups have been aware for some time of many of the proposed changes to the cleanup standards. Further, application of the new standards will not always require that the remedial investigation or feasibility study be redone. Whether additional work will be necessary depends on the facts in any given case.

Most of the concerns expressed with regard to this provision appear to have been precipitated by the proposed more stringent Method A soil cleanup levels pertaining to petroleum cleanups. Ecology does not anticipate that previous cleaned up sites that fail to meet the new Method A soil cleanup levels would automatically be required to do additional cleanup. As noted later in this document, all of the more stringent Method A soil cleanup levels are driven by ground water protection concerns. Thus, if ground water monitoring data indicated that residual soil contamination left at a site is protective of ground water, there would not be a need for additional soil cleanup.

As for cleanups being conducted under the interim-TPH policy, Ecology does not anticipate reopening these cleanups unless new information comes to light indicating that these sites are posing a threat to human health or the environment.

GQ 9.2.12
When are cleanups being done under an order or decree subject to complying with the requirements in the revised MTCA rule?

(589, 1077, 1108, 1138)

Several commentors suggested that once an order or decree has been issued requiring the conducting of a remedial investigation/feasibility study, the cleanup should not be subject to review under the revised MTCA rule. Concern was expressed that having these sites subject to the revised MTCA rules could result in the need to redo the site investigation because of more stringent cleanup levels.

Response:
Ecology continues to believe that the final cleanup action plan is the appropriate point in the process to apply the new cleanup levels. This is because this is the point in the process where cleanup levels are actually set. We also believe that it is unlikely many, if any, sites will have to re-do site investigations because of the proposed amendments.

GQ 9.2.13
Under WAC 173-340-702(14), what burden of proof must be met for persons proposing a site-specific risk assessment that changes the default reasonable maximum exposure scenario or default assumptions?

(252, 630, 1339, 2168)

Four persons expressed concerns that the proposed amendments to WAC 173-340-702(14) were not part of the PAC recommendations. One person also expressed concern that the legal standard is not defined by these amendments.

Response:
Given the PAC's emphasis on risk assessment, Ecology believes it is consistent with the PAC recommendations to state who has the obligation to demonstrate the changes being proposed as part of a site-specific risk assessment are protective. We believe the above provisions are merely restating the obvious—that the proponent of a change to the standard methods has the obligation to show that the changed approach would be protective of human health and the environment.

The legal standard of review for Ecology's decision to accept or deny such proposed changes is set forth in MTCA (RCW 70.105D.060). Under RCW 70.105D.060, Ecology actions (such as a decision to accept or deny such a change) are reviewable exclusively in Superior Court and only at certain times. Under RCW 70.105D.060, such actions are reviewed by the court under an arbitrary and capricious standard. The above language does not change that legal standard.

GQ 9.2.14
Once Ecology approves the use of new scientific information at one site under WAC 173-340-702(15), can that information be used at other sites?

(253, 2169)

In WAC 173-340-702(16), Ecology is proposing criteria for evaluating new scientific information. These criteria were based on a PAC recommendation (Final PAC Report, p. 60). Two persons requested that the rule be amended to state that once Ecology approves the use of new scientific information at one site, that information can be used at other sites without having to the approval process described in WAC 173-340-702(15).

Response:
Ecology believes it would be inappropriate to establish in the rule that all decisions regarding new scientific information at one site can be applied to other sites. While it may be possible to do this for some decisions, typically, such decisions are highly dependent on site-specific conditions. In fact, two of the PAC recommended criteria for evaluating new scientific information are as follows:

> (iv) Whether the assumptions used in applying the information **to the facility** are valid and would ensure the proposed modification would err on behalf of protection of human health and the environment;
>
> (v) Whether the information adequately addresses populations that are more highly exposed than the population as a whole and are reasonably likely to be present **at the site**;

Final PAC Report, p. 60 (emphasis added). Both of these criteria very clearly require site-specific conditions to be factored into any decision to allow use of new scientific information.

However, in response to this comment, Ecology proposed in the 2000 proposal to amend the provisions in WAC 173-340-708(7), (8) and (9) related to the establishment of a non-standard reference dose, cancer potency factor and bioconcentration factor. Because such decisions are typically chemical specific, not site specific, Ecology believes that once a decision is made on these characteristics of a contaminant, that decision can be applied to other sites. An example of this is the reference doses assigned to petroleum fractions, which have been reviewed by EPA, the Department of Health and the MTCA SAB.

GQ 9.2.15
Has Ecology applied the criteria in WAC 173-340-702(16) to the rule amendments?

(49, 593, 648, 1123, 1369)

Response:

In rule-making, Ecology is obligated to meet the standards for review under the Administrative Procedures Act, not the criteria in WAC 173-340-702(16). However, because of the level of concern raised about the addition of the dermal pathway to the rule, Ecology did address the quality of information criteria in a technical memorandum to the MTCA Science Advisory Board dated January 25, 1999. Quality of information criteria from WAC 173-340-702 (14) were noted and detailed responses for all criteria were provided to the SAB. After considerable deliberation, as indicated by the SAB memo (1/17/99) commenting on the proposed rule amendments, the Board concluded that the available technical information is of sufficient quality to recommend that the dermal exposure pathway be evaluated at all MTCA sites. Furthermore, in a letter commenting on the 1999 proposal, EPA and the Department of Health noted that "… support documentation for the evaluation and inclusion of the dermal exposure pathway in the proposed amendments meets and exceeds technical standards for peer reviewed guidance, documentation and technical information."

GQ 9.2.16
Can "new scientific information" be used to propose site-specific risk assessment methods beyond those described in WAC 173-340-720 through -750?

(254, 2170)

Response:
WAC 173-340-702(15) and (16) describe a process and provide criteria for approval of new scientific information for use in a site-specific risk assessment at a contaminated site. The intent of these provisions is to allow the introduction of new methods that are not described or otherwise addressed in the current rule. An example of this is EPA's IEUBK model for assessing soil lead contamination.

GQ 9.2.17
Other comments regarding WAC 173-340-702 are addressed in the following table:

Comment ID	Comment	Response
2573, White	Suggests adding "resulting in exposure to people, animals and plants".	Ecology believes it is not necessary to add this phrase to this provision. Releases may also be important to address simply because of their impacts on the resource, whether exposure is occurring at the time or not.
1340, McCain	The time period for consideration of new scientific information should be the time of issuance of the CAP, not the order or decree.	Comment addressed in 1999 and 2000 proposals.
93, POG 2253 POG	Change the term "factors" to "exposure parameters".	Comment addressed in adopted rule.

9.3 Selection of Indicator Hazardous Substances (WAC 173-340-703)

WAC 173-340-703 is a new section that was created by moving the provisions in WAC 173-340-708(2) to this location. One change was made to the final rule, adding essential nutrients as a factor to consider, discussed below.

GQ 9.3.1
Must cleanup levels be established for all hazardous substances found at a site?

(490, 2308)

One commentor expressed concern that some users of the rule amendment do not understand that cleanup standards only need to be established for only "indicator hazardous substance". Two commentors requested that WAC 173-340-708(2) be moved to a separate section so it is more visible and to make it clear that the process for selecting indicator hazardous substances applies to both ecological risk assessment and human health risk assessment. The POG requested that an additional criterion be added noting that a substance is not an indicator hazardous substance if there is no reference dose or cancer potency factor and it is not bioaccumulative, persistent or highly mobile in environmental media.

Response:
Ecology concurs that cleanup levels are not required to be established for all substances found at a site. That is the intent of the criteria for selecting indicator hazardous substances. To address the concern that selection of indicator hazardous substances applies to both ecological risk assessment as well as human health risk assessment, these provisions have been moved to a new WAC 173-340-703. With regard to the suggested additional criterion, Ecology believes that the existing criteria adequately address this concern.

GQ 9.3.2
How are essential nutrients considered when selecting indicator hazardous substances?

(464, 490)

Allen requested that the following language be added to WAC 173-340-708(2):

> The National Academy of Sciences/National Research Council has calculated acceptable daily intake levels for essential nutrients. When the chemical concentration for essential nutrients is at or below the corresponding daily acceptable level, they should be eliminated from further consideration.

Response:
Ecology agrees that a factor that can be considered when selecting indicator hazardous substances is whether the substance is an essential nutrient at the concentrations found at a site. The final rule has been amended to add this as a factor to consider when selecting indicator hazardous substances. In doing so, however, it should be noted that Ecology's intent is not to allow elimination of such substances when they are at concentrations above essential nutrient levels for humans or to eliminate such substances if they are of ecological concern.

9.4 Use of Method A (WAC 173-340-704)

Several amendments to WAC 173-340-704 were made for clarification purposes and to reflect changes made to other chapters, including updating several cross-references. Substantive and other changes include the following:

- (1)(c) Added 2 criteria for when Method A can be used.
- (2)(c) Added a statement to WAC 173-340-704(2) that establishing Method A cleanup levels at natural background or the PQL only applies to substances deemed "indicator hazardous substances".
- (4) Deleted caution statement on using the Method A tables since this statement is already in the individual tables as part of the footnotes. Added a description of how the protectiveness of a remedy can be evaluated at a site using Method A cleanup levels.

GQ 9.4.1
This Section limits use of Method A to sites with "a few hazardous substances." Why is this a restriction on the use of Method A? How many substances constitute "a few"?

(324, 396, 631, 738, 2400, 2591)

Two comments were received requested that this restriction be removed. In contrast, other commentors asked that additional explanation be provided.

Response:
The condition that a site have "few hazardous substances" has always been present as a footnote to the Method A tables. In the rule amendments, parallel language was added to WAC 173-340-704 to provide internal consistency in the rule. For internal consistency, Ecology believes the proposed language should remain in WAC 173-340-704. Note that the reason for this requirement is that additive risk is not taken into account in the development of the values in these tables and it may need to be when setting cleanup levels under Method A at a particular site where there are several substances present with the same toxic effect.

Ecology acknowledges the POG's concern that the Method A values have been developed assuming specific exposure conditions. These values may not be applicable to sites with unique receptors or exposure pathways not considered in establishing these levels. However, Ecology believes these situations will be rarely encountered. If they are, Ecology retains the authority to require more stringent cleanup levels on a site-specific basis in the Sections discussing cleanup levels for the various media.

GQ 9.4.2
Why has terrestrial ecological risk been added as a condition for the use of the Method A soil cleanup levels?

(1341, 1377, 2087)

One commentor (McCain) expressed concern that the condition addressing terrestrial ecological risk could overly restrict the use of Method A. They noted that soil cleanup standards addressing terrestrial ecological risk may not need to be established at all sites.

Response:
The above restriction was added to Method A soil cleanup levels because these values do not take into account terrestrial ecological risk. This was added in response to the rule advisory committee's recommendation that terrestrial ecological risk be addressed separate from the Method A tables, since it was felt terrestrial ecological risk will not be an issue at many Method A sites.

It is expected that many sites using Method A soil cleanup levels will qualify for an exclusion under WAC 173-340-7491 or will qualify for a simplified terrestrial ecological assessment under WAC 173-340-7492 and will chose to use the tables values. Ecology concurs that this does not need to be a threshold criterion for use of Method A soil cleanup levels. Thus, this criterion has been removed from Method A and a statement directing the reader to those parts of the rule discussing how to conduct a terrestrial ecological evaluation has been added to the procedures.

GQ 9.4.3
What concentration is to be used as the Method A cleanup level if there is no published ARAR or table value?

(125, 474, 511, 753, 771, 772, 1144, 1273, 2286, 2408, 2412, 2443)

Under Method A, if no standard is available as a published ARAR or table value, the user is directed to use natural background or the PQL as the cleanup level. A parallel statement to that in WAC 173-340-704 was added to the individual medium Sections, prompting several persons to express concerns about this provision, suggesting that establishing cleanup levels under Method B should be allowed in this circumstance.

Response:
This requirement is existing rule language that was not proposed to be changed by these rule amendments. The reason for not allowing the use of Method B to establish cleanup levels under Method A is because Method A is intended to provide quick "lookup values", not direct the user through calculations as would be required under Method B. In addition, Method A does not take into account additive risk or incorporate many of the narrative standards in Method B. For these reasons, Ecology stands by the current rule language. If setting a cleanup level at natural background or the PQL is a concern at a site, cleanup levels should be established under Method B.

9.5 Use of Method B (WAC 173-340-705)

Several amendments to WAC 173-340-705 were made for clarification purposes and to reflect changes made to other chapters, including updating several cross-references. Substantive and other changes, include the following:

- (2) Added description of standard and modified Method B.
- (2)(b) Replaced general standard for protection of terrestrial life with reference to ecological procedures in WAC 173-340-7490 through 173-340-7494.
- (3) Added statement that more stringent cleanup levels must comply with WAC 173-340-702 and 173-340-708.
- (4) Added statement on when adjustment for multiple hazardous substances or pathways needs to be made.
- (5) Reworded existing statement describing when ARARs must be adjusted.
- (6) Added statement on how PQLs and natural background get factored into cleanup levels.
- (7) Added description of how Method B formulas can be modified to establish remediation levels.

GQ 9.5.1
What does it mean that an applicable state and federal law must be "sufficiently protective" to be used as the basis for a cleanup level?

(381, 388, 636, 2023, 2643, 2646)

The Department of Energy had the following comment on the proposed rule amendments:

> …add a statement to this section indicating that cleanup levels under applicable state and federal law shall be considered sufficiently protective provided the associated cancer risk does not exceed one in one hundred thousand or a hazard index of one. Similar statements need to be included at various other locations in the regulation. Without such language, the regulation could be interpreted to require Method B cleanup to a one in one million cancer risk (being the most stringent limit) in situations where a state or federal cleanup limit represents a cancer risk in excess of one in one million, but less than one in one hundred thousand. (Note that the regulatory language requires that Method B cleanup levels be at least as stringent as all the listed criteria, implying that calculated cleanup levels would take precedence over levels based on applicable law when the former are more stringent.)

In contrast, Weyerhaeuser, in the draft rule attached to their comment letter, proposed the "sufficiently protective" qualifier be deleted throughout the rule where Method B cleanup levels are discussed.

Response:
The phrase "sufficiently protective" is intended to mean that the state or federal standard being used as the basis for a cleanup level meets the maximum acceptable levels of risk allowed under MTCA. For carcinogens, this means the standard is based on a level of risk that does not exceed one in one hundred thousand. For noncarcinogens, this means that the standard is based on a level of risk that does not exceed a hazard quotient of one. Cleanups levels based on applicable laws that exceed these levels of risk must be adjusted to the MTCA maximum acceptable level of risk or Method B must be used to set the cleanup level. If they do not exceed these levels of risk,

no adjustment is intended. To address the above concern, the following language was added to WAC 173-340-705 and similar language was added throughout the rule.

> **(5) Adjustments to cleanup levels based on applicable laws.** Where a cleanup level is based on an applicable state or federal law, and the level of risk upon which the applicable state and federal law is based exceeds an excess cancer risk of one in one hundred thousand (1×10^{-5}) or a hazard index of one (1), the cleanup level must be adjusted downward so that the total excess cancer risk and hazard index at the site does not exceed the limits established in subsection (4) of this section.

With regard to the parenthetical concern expressed about the way the Method B cleanup levels are formatted in WAC 173-340-720 through 173-340-750, these provisions are not intended to require values derived using the Method B formulas to be used instead of ARARs. This is why the introductory paragraph to the Method B formulas in each of these Sections only requires use of the formulas if the ARARs are not "sufficiently protective".

GQ 9.5.2
When a chemical has both a reference dose and cancer potency factor, which is the cleanup level based on?

(385)

Response:
When a chemical has both a reference dose and cancer potency factor, a concentration needs to be calculated addressing both carcinogenic and noncarcinogenic health effects. The most stringent of the two values is then selected as the cleanup level (assuming there are no other considerations, such as a value in applicable state and federal law). This is addressed by rule language prefacing the equations in WAC 173-340-720 through 173-340-750.

GQ 9.5.3
Other comments regarding WAC 173-340-705 are addressed in the following table:

Comment ID	Comment	Response
674, AM Johnson	Provide a case example of Method B (and C) and show how this is a process improvement.	To be addressed in guidance.
1342, McCain	Need to add a discussion of remediation levels	Comment addressed in 1999 and 2000 proposals.

9.6 Use of Method C (WAC 173-340-706)

Several amendments to WAC 173-340-706 were made for clarification purposes and to reflect changes made to other chapters, including updating several cross-references. Substantive and other changes, include the following:

- (1)(a) Modified language to restrict use of Method C soil to industrial properties.
- (1)(c) Modified language to allow use of Method C for air at industrial properties and for utility vaults and manholes.
- (2) Added description of standard and modified Method C.
- (2)(b) Replaced general standard for protection of terrestrial life with reference to ecological procedures in WAC 173-340-7490 through 173-340-7494.,
- (3) Added statement that more stringent cleanup levels must comply with Sections 702 and 708.
- (5) Reworded existing statement describing when ARARs must be adjusted.
- (6) Added statement on how PQLs and natural background get factored into cleanup levels.
- (7) Added description of how Method C formulas can be modified to establish remediation levels.

GQ 9.6.1
Why has Method C been eliminated as a option for setting cleanup levels for non-residential land uses, except industrial properties?

(94, 165, 256, 260, 282, 587, 633, 692, 807, 968, 1107, 1118, 1119, 1216, 1343, 2051, 2171, 2172, 2183, 2227, 2254, 2255, 2354)

Numerous persons expressed concerns about change to WAC 173-340-706 and 173-340-708(3) and in other parts of the rule eliminating the use of Method C soil cleanup levels for all but industrial properties, stating they believed this change was inconsistent with the recommendations of the MTCA Policy Advisory Committee (PAC). For example, Gillett, in commenting on WAC 173-340-708(3) stated the following:

> … this proposal was not included in the PAC recommendations. In fact, it is inconsistent with the PAC recommendation that the default commercial exposure scenario be eliminated, but that commercial sites be allowed to establish cleanup levels using a site-specific risk assessment including the use of alternate exposure scenarios. The PAC even stated that it expects many types of commercial sites to qualify for alternative exposure scenarios.

And Feole:

> In its report, the PAC recommended that site specific risk assessments could be performed for a variety of land uses including agricultural and commercial properties. The risk assessment sections as currently written do not allow for development of cleanup levels for commercial or other properties, only industrial or residential cleanup levels. The proposed rule should be changed to reflect the site specific risk assessment recommendations made by the PAC.

In contrast, L. Valeriano, a member of the PAC, stated the following:

> We have read the comments from business representatives saying that the elimination of Method C soil cleanup levels in this section is inconsistent with the PAC recommendations. We strongly disagree with that interpretation. The PAC clearly recommended that Method C soil cleanup levels were to be eliminated for all but industrial properties.

In addition, some commentors on earlier drafts of the rule requested additional discussion of how land use was to be considered in evaluating the protectiveness of remedies, as discussed in the PAC report.

Response:
Ecology believes its proposal is consistent with the PAC recommendations, based on Ecology's involvement in the PAC process, discussions with other PAC members, and on the language of the Final PAC Report. The changes in this and other Sections allow only residential and industrial land uses to be used as the basis for a reasonable maximum exposure scenario (RME) for purposes of establishing a cleanup level. Other land uses, such as commercial, recreational, and agricultural, may be used to establish a remediation level as part of remedy selection, but not a cleanup level.

The PAC intended that the parameters that could be modified in developing a cleanup level were those that did not depend on human behavior but could be reliably measured at the site. See Final PAC Report, pp. 24, C-9, C-10. The Final PAC Report specifically states:

> The use of alternative RME scenarios allows elimination of separate 'commercial site cleanup levels' under the old MTCA. It allows tailoring an appropriate commercial RME scenario, recreational RME scenario, or 'urban residential' RME scenario for calculation of Method B remediation levels appropriate to specific sites.

PAC Report at p. 25 (emphasis added). This is consistent with the December 10, 1996 memorandum from Pete Kmet (Final PAC Report, pp. C-12 through C-15), which "reflects PAC recommendations on land use considerations within the new requirements outlined in revised MTCA sections -702 and -708" (Final PAC Report, p. 25). Although parts of that memo on issues other than land use were not incorporated into the PAC recommendation (e.g., rule making, level of risk, values in table A), the PAC specifically indicated that the memo reflected its recommendations on land use.

There are several reasons, beyond the PAC recommendation, that Ecology believes support the elimination of Method C for non-industrial land uses:

- Commercial zoning allows a wide range of land uses, some of which could result in high exposure such as childcare facilities;
- People have an expectation that parks and other recreational areas are not contaminated;
- Silvicultural and agricultural lands are being converted to residential uses at a fast pace, increasing the potential for higher exposure in the future; and,
- Setting stringent standards that emphasize cleanup of these properties is consistent with the statutory requirement that remedies be "permanent to the maximum extent practicable".

However, it is recognized that, if contact with the soil is minimized by the selected remedy and proper controls on the use of a property are put in place, a remedy that does not meet residential

cleanup standards may still be protective. This is reflected in WAC 173-340-708(3)(d)(ii) and (iii) which explain how land uses such as commercial or recreational may be used in remedy selection. For example, if containment is the proposed remedy for contaminated soil at a commercial site, the reasonable maximum exposure scenario for evaluating the protectiveness of the containment system for the direct contact pathway could be changed from a child living on the site to a maintenance worker or child trespasser. In this exposure scenario it would be assumed that a shorter period of exposure occurs because the cap had been temporarily breached. See WAC 173-340-708(3)(d)(ii), (iii).

GQ 9.6.2
Why is "all practicable method of treatment" a precondition to use of Method C cleanup levels?

(682, 716, 1074, 2119, 2120, 2377, 2380)

Several commentors objected to the retaining of the condition that "all practicable methods of treatment" be demonstrated before use of Method C is allowed. For example, Riley, stated the following:

> Yet another example of the bias for active treatment is found in the criteria for use of Method C. The proposed amendments retain a requirement of the current rule that a PLP may use a risk-based method C cleanup level only after "all practicable methods of treatment are used." If method C levels are protective of human health and the environment, and a non-treatment-based cleanup action meets the applicable remedy selection standards (including permanent to the maximum extent practicable), what is the logical justification for requiring treatment? The retention of this language is inconsistent with the PAC recommendation to eliminate the priority given to treatment technologies in remedy selection.

A.M. Johnson also asked for clarification if this pre-condition applies to industrial sites such as oil terminals.

Response:
The precondition that sites use "all practical methods of treatment" in order to use Method C is not a new requirement – it is an existing regulatory requirement in WAC 173-340-706(1)(b)(ii) that was established in 1991. The PAC did not recommend that this requirement be removed and changing this requirement is beyond the scope of this rule-making action. See Chapter 5 of the CES for how Ecology addressed the PAC recommendation to remove the hierarchy as stand-alone criteria for remedy selection.

As for industrial sites, the statute specifically authorizes Ecology to adopt cleanup standards for industrial properties. Thus for industrial properties, this is not a precondition for use of Method C soil or air cleanup levels at industrial properties. Whether a particular oil terminal would qualify as an industrial property will depend on whether the site meets the description of industrial property provided in WAC 173-340-745.

GQ 9.6.3
Comments specific to WAC 173-340-706(a)(i) and (ii) are addressed below.

(382, 1066, 1425, 2644)

Two comments were received on WAC 173-340-706(a)(i) and (ii) that require additional explanation.

WAC 173-340-706(a)(i) states the following:

> (i) Where Method A or B cleanup levels are below area background concentrations, Method C cleanup levels may be established at concentrations that are equal to area background concentrations, but in no case greater than concentrations specified in subsection (2) of this section;

Rasmussen, expressed the following concern with this provision:

> Language retained in this section states that "[w]here Method A or Method B cleanup levels are below area background concentrations, Method C cleanup levels may be established at concentrations that are equal to area background concentrations, but in no case greater than concentrations specified in subsection (2) of this section." Subsection (2), however, specifies a hazard quotient no greater than 1 and carcinogenic risk no greater than one in one hundred thousand. This requirement could require a cleanup standard that, in certain situations, is below background levels. In contrast to the Section 706(1)(a)(i) provisions, Sections 700(6)(e) and 706(6) merely (and reasonably) provide that Method B and Method C cleanup levels do not need to be set below background levels. It is recommended that Section 706(1)(a)(i) be deleted.

Response:
It is not the intent of this provision to preclude adjustments for natural background and the PQL under subsection (6). According to normal legal construction, the more specific provisions in subsection (6) would prevail if Method C cleanup levels were below natural background or the practical quantitation limit. Thus, no change has been made to the rule.

GQ 9.6.4
Is WAC 173-340-706(a)(ii) intended to imply that Method C cleanup levels are not protective of human health?

WAC 173-340-706(a)(ii) states the following:

> (ii) Where attainment of Method A or B cleanup levels has the potential for creating a significantly greater overall threat to human health or the environment than attainment of Method C cleanup levels established under this chapter, Method C cleanup levels may be established at concentrations that minimize those overall threats, but in no case greater than concentrations specified in subsection (2) of this section. Factors that shall be considered in making this determination include:
>
> (A) Results of a site-specific risk assessment;
> (B) Duration of threats;
> (C) Reversibility of threats;
> (D) Magnitude of threats; and
> (E) Nature of affected population.

Belcher (1066), expressed the following concern with this provision:

> This statement is confusing and potentially misleading. Cleanup levels obtained by any one of these methods are fully protective of human health. Although there is provision to assume higher risk factors (and to have higher cleanup values) under Method C than A or B, this must be justified by site-specific analysis. And Methods A and B include purposefully conservative cleanup levels. Thus, none of the methods result in unacceptable human health threat. Therefore, the statement in the regulations improperly implies that certain Methods may result in less protection of human health and the environment, when this is not actually so. This provision should be clarified.

Response:
This provision is not intended to imply that Method C cleanup levels are not protective (provided the conditions for their use are met). Rather this is intended to address a situation where meeting the Method A or B cleanup levels could cause significant harm. For example, take the case where contaminated ground water is seeping into a surface water body and to restore the ground water to a method A or B cleanup level requires intercepting and treating the ground water. However, in the process of doing this, the surface water body would dry up. In this situation it may be possible to demonstrate that achieving the Method A or B cleanup level would cause a greater overall threat to the environment and thus a Method C cleanup level could be justified.

GQ 9.6.5
Other comments regarding WAC 173-340-706 are addressed in the following table:

Comment ID	Section	Comment	Response
885, Goold	706(4)	The target risk for individual chemical and individual pathways is the same as for cumulative pathways and chemicals. This can only be true in the case of a single chemical and a single route of exposure - a highly unlikely scenario.	Comment noted.
257, Gillett	706(6)	Subsection could be read to imply that Ecology may, but is not required to, set cleanup levels below the PQL or natural background, which would be inconsistent with the proposed WAC 173-340-700(6)(d). Strike "are not required to" and insert "shall not".	Comment addressed in 2000 proposal.

9.7 Human Health Risk Assessment Procedures (WAC 173-340-708)

Several amendments to WAC 173-340-708 were made for clarification purposes and to reflect changes made to other chapters, including incorporation of remediation levels and updating several cross-references. Substantive changes, listed by subsection, include the following:

(1) Purpose

Purpose discussion expanded to incorporate SSRA and concern that SSRA not result in significant delay in cleanups.

(2) Selection of Indicator Hazardous Substances

Moved most of subsection to 703.

(3) Reasonable Maximum Exposure

(d) Added discussion on how alternate reasonable maximum exposure scenarios can be used to determine the protectiveness of a remedy that uses engineered or institutional controls, including a discussion of land use and caps.

(e) Incorporated use of conceptual site model into discussion of multiple exposure pathways and updated cross-references.

(5) Multiple Hazardous Substances

Added statement that adjustments for multiple hazardous substances and multiple exposure pathways should not result in cleanup levels and remediation levels less than the PQL or natural background.

(6) Multiple Hazardous Substances or Pathways

Added statement that adjustments for multiple hazardous substances and multiple exposure pathways should not result in cleanup levels and remediation levels less than the PQL or natural background.

(7) Reference Doses

(b) Added requirement that respiratory deposition and absorption characteristics of gases and inhaled particles be taken into account, where available, when using air concentration data to develop reference doses and cancer potency factors for the inhalation pathway.

(f) Added HEAST and NCEA as acceptable alternative sources of reference doses and cancer potency factors.

(f) Clarified that RfDs and CPFs do not always have to be developed for substances at a site when they are not available (subject to Department decision).

(g) Added requirement that scientific data for changing a reference dose and reference concentration shall be subject to Section 702 requirements.

(8) Cancer Potency Factor

(a) Added HEAST and NCEA as acceptable alternative sources of reference doses and cancer potency factors.

(c) Clarified that RfDs and CPFs do not always have to be developed for substances at a site when they are not available (subject to Department decision).

(c) Added requirement that respiratory deposition and absorption characteristics of gases and inhaled particles be taken into account, where available, when using air concentration data to develop reference doses and cancer potency factors for the inhalation pathway.

(e) Added toxicity equivalency factors as an acceptable method for assessing the cancer risk of certain dioxins, furans and polycyclic aromatic hydrocarbons.

(f) Added requirement that scientific data for changing a carcinogenic potency factor shall be subject to Section 702 requirements.

(9) Bioconcentration factors

(a) Changed standard for alternate values from “clear and convincing” to “adequate”

(a) Added statement that literature sources and empirical data can be used to develop bioconcentration factors when no value is available from EPA.

(b) Scientific data for an alternative BCF must meet the requirements for new science in 702.

(10) Exposure parameters
(b) Added description of which exposure parameters can be changed when calculating cleanup levels and remediation levels.
(b) Changed "clear and convincing" standard to "adequate" for scientific data supporting a change to the gastrointestinal absorption rate, inhalation correction factor, bioconcentration factor and inhalation absorption rate.
(c) Added statement that other exposure pathways need to be addressed when changes to exposure parameters result in "significantly higher" cleanup or remediation levels than would be calculated with default assumptions.
(d) Requires scientific data supporting changes to default values to meet requirements for new science in 702.
(11) Probabilistic Risk Assessment
Former (a)-(e) Deleted discussion of methods for defining background concentrations – moved to new Section 709.
Former (12) Deleted significant figures limitation.
Added statement that probabilistic risk assessments may be used as an informational tool to evaluate alternative remedies.

GQ 9.7.1
Why is site-specific risk assessment being incorporated into the MTCA rule? Why are there so many constraints on its use?

(163, 164, 329, 462, 466, 467, 1030, 1118, 1121, 1142, 1215, 2008, 2199, 2612, 2614)

There are a number of provisions proposed in WAC 173-340-708 and throughout the MTCA Cleanup Regulaton that provide for the use of site-specific risk assessment, but also constrain its use. Several comments were received on these provisions. For example, Kenefick stated the following:

> The linchpin of the "new MTCA" was to be the use of site-specific risk assessment. The rule would be more flexible in allowing risk assessments to be used to develop remediation levels. Remediation levels could be used in lieu of cleanup levels in the remedy selection process. Remediation decisions could be made on the basis of Methods B and C cleanup/remediation levels that incorporated site-specific information, so long as these alternative levels were supported by a reasonable maximum exposure (RME) scenario. The PAC specifically allowed the use of alternative exposure scenarios, where appropriate, for commercial properties, recreational properties, urban residential properties, and agricultural properties, where landscaping, buildings, and pavement would cover much or all of the site.
>
> The rule, as amended, fails to comply with these recommendations. Through omissions and revisions throughout the rule, Ecology has eroded the intent of the PAC by eliminating or eroding the ability of a PLP to use risk to evaluate a cleanup level or cleanup alternative realistically.

And Belcher:

> This section states that exposure parameters are not expected to vary on a site-by-site basis other than in the most restricted scenarios (such as use of engineered controls). To the contrary, however, exposure parameters at industrial sites can and do vary significantly. Failure to take this into account will result in an overestimation of risk. Thus, ATA urges Ecology to reevaluate this statement and allow the regulated

> community to use realistic, site-specific exposure parameters in performing risk-based analysis. Further, Ecology should allow the exposure parameters to be based on reasonable, real world industrial uses and exposures so the exposure parameter variable can be implemented effectively, without undue barriers. The use of site-specific parameters does not result in any increased threat to human health or the environment. To the contrary, use of such parameters ensures that risks posed at a specific site are addressed appropriately so that risks are within acceptable limits. This is the real goal behind all risk-based corrective action.

Related to the above, Kenefick also expressed concern that delay not be singled out as the only concern with using site-specific risk assessments, but also other factors be added including available data, proposed methodology, and community concerns, as well as schedule.

In contrast, Valeriano stated the following concern:

> We are concerned with the general policy direction of the rule to rely more on site-specific risk assessments. Risk assessments are at best inadequate and imprecise estimates of actual risk. They attempt to assess only a few of the many risks associated with contaminant exposures and cannot predict the complex interactions among the many chemicals to which potential victims are always exposed. Outcomes can often be heavily influenced by the biases of the risk assessors and it is easy to bias an outcome through inappropriate use of overly favorable assumptions. Allowing more risk assessments on a site by site basis makes it more difficult for the public to be involved, more difficult from an enforcement and oversight perspective and more difficult to ensure that cleanups will happen. In our experience, we have seen risk assessments used mostly for establishing less protective cleanup level not more protective levels and this is extremely concerning. How will the Department ensure that this will not occur under the new MTCA?

And Pollet:

> The agreement to allow use of site specific risk assessment was based upon specific agreements to improve public participation in highly technical decisions. The rule should specify that the approval of the use of site specific risk assessment at any site is a determination of the Department, which must be based on compliance with the public notice and involvement requirements, and the access to technical assistance and grants provided for in the current law and proposed rule. If Ecology or the Legislature acts to restrict public involvement, including funding for, or access to, Public Participation Grants for hazardous substance release site affected citizen groups and the technical adviser, the rule should specify that Ecology will not be able to approve of the use of site specific risk assessments that vary important default assumptions or which could result in significant restriction on public access to land or resources.

Response:
The proposed revisions incorporating site specific risk assessment (SSRA) in the MTCA rule are intended to implement the PAC recommendation for Priority Issue #1. See Final PAC Report, pp. 24-27. This recommendation established the framework for conducting site-specific risk assessments under MTCA. It is important to note that the recommendation was not for unrestrained site-specific risk assessment, rather it specifically stated such risk assessments are to be constrained. The following is from PAC recommendation for Priority Issue #1:

> Allow the use of site-specific risk assessment in setting cleanup levels, remedial action levels, or in making remedial action decisions under MTCA **with the limitations and requirements established by the PAC in the accompanying documentation**.

Final PAC Report, p. 25 (emphasis added). The Final PAC Report goes on to describe these limitations and requirements. Ecology agrees that it is appropriate to maintain constraints on site-specific risk assessments to provide predictability and prevent inordinate delay in the cleanup of contaminated sites. This very issue of flexibility and predictability was discussed in the 1991 Responsiveness Summary and is still valid today:

> The mission of the Department of Ecology is to protect, preserve, and enhance Washington's environment and promote the wise management of our air, land, and water for the benefit of current and future generations (Department of Ecology, 1989). The development of cleanup standards under the MTCA has been guided in part by the Department's perception that this mission has been undermined by the excessive flexibility in the cleanup process. This view is shared by the Office of Technology Assessment which concluded in a recent report (OTA 1989) that "reducing excessive flexibility in the superfund implementation is critical to reducing the constant confrontation among nearly everyone affected by and working in the program...." OTA concluded that excessive flexibility, in combination with opposing views of risks to human health and the environment, have resulted in a system in which competing interests find too many opportunities to achieve their objectives at too great an expense to their adversaries. A similar conclusion was reached by Clean Sites Inc., a non-profit organization which organizes/mediates superfund cleanup efforts involving large numbers of responsible parties (Clean Sites, 1990).
>
> In developing the cleanup regulations, Ecology has attempted to balance the competing goals of flexibility and predictability. The tradeoffs between these two characteristics have been discussed by Hodge and Roman (1990). They noted that "[f]lexible regulation is an oxymoron. The notion that broad discretion granted to bureaucrats will automatically be converted into the "best" social/technical solutions and limited politically motivated interference is simply wrong. The real world is full of tradeoffs. The less rigidity there is in rules and the greater discretion that is allowed, the more opportunity there is for both of the evils Freeze and Cherry decry: political interference and legal adversarial proceedings. When the rules are clear and rigid, there is no room for lawyers or politicians to interfere. The lawyer's ability to laugh all the way to the bank is created by ambiguity, broad discretion in regulation, and any other flexibility in which effective advocacy can encourage the regulator to flex in the direction of the client's interest...." (Hodge & Roman 1990)

With regard to Ms. Valeriano’s concerns and similar concerns expressed by others, Ecology acknowledges that site-specific risk assessments can be difficult for citizens to decipher and comment on. This was a theme expressed by many participants during the PAC discussions. This is another reason site-specific risk assessment is constrained under MTCA and there is considerable process imposed on persons proposing to deviate from the standard risk assessment assumptions. Also, as recommended by the PAC, Ecology will be hiring a “citizen technical advisor” to help the public with questions about the application of site-specific risk assessment at a particular site.

With regard to the concerns raised by Pollet, we agree that the PAC's intent was to insure enhanced public participation at sites using a site-specific risk assessment. In accordance with the PAC recommendations, several provisions were added to Section 600 to insure to added emphasis is placed on public participation in these circumstances.

As for Kenefick's suggestion of adding criteria for site-specific risk assessment, WAC 173-340-708(1) was specifically recommended by the PAC and includes language that a representative from Mr. Kenefick's firm participated in developing. The concern with delay was specifically called out for inclusion here. Ecology agrees that there are many other factors that are considered when deciding whether to approve alternative site-specific risk assessment assumptions or methods. These factors are addressed more specifically in other parts of the rule and to repeat them here is unnecessary.

REASONABLE MAXIMUM EXPOSURE (WAC 173-340-708(3))

Several comments were received regarding WAC 173-340-708(3). These comments are addressed below. See also the earlier discussion of land use under WAC 173-340-706.

GQ 9.7.2
Can you clarify what "evaluation criteria" are being referred to in WAC 173-340-708(3)(c)?

(259, 2172)

Two commentors requested clarification of what is meant by the phrase "evaluation criteria in WAC 173-340-720 through 173-340-760."

Response:
For ground water, the evaluation criteria for determining if drinking water is the highest beneficial use are identified in WAC 173-340-720(2).

For surface water, the evaluation criteria for determining the highest beneficial use of surface water are identified in WAC 173-340-730(1)(a).

For soils, the evaluation criteria for determining if residential land use is the highest beneficial use are identified in WAC 173-340-740(1)(a).

For industrial soils, the evaluation criteria for determining if a site qualifies for use of industrial soil cleanup levels are identified in WAC 173-340-745(1)

For air, the evaluation criteria for determining if residential land use is the highest beneficial use are identified in WAC 173-340-750(1)(b).

GQ 9.7.3
Is the discussion pertaining to land use in WAC 173-340-708(3)(d)(iii) intended to apply to the direct contact pathway only?

(2221)

Ms. Valeriano stated the following:

> It should be made clear in (3)(d)(iii) that the alternative exposure scenarios described apply to the direct soil contact pathway only. Surface land use would not affect the leaching pathway (protection of ground water).

Response:
Ecology agrees. This provision is intended to address exposure due to the soil direct contact exposure pathway. That clearly was the focus of the PAC recommendation that this is based on. WAC 173-340-708(3)(d)(iii) has been changed in the final rule as follows:

> **(iii)** The department expects that in evaluating the protectiveness of a remedy with regard to the soil direct contact pathway, many types of commercial sites may, where appropriate, qualify for alternative exposure scenarios under this provision since contaminated soil at these sites is typically characterized by a cover of buildings, pavement, and landscaped areas.

GQ 9.7.4
When does an adjustment for additive risk need to be made for exposure to multiple pathways?

(465, 466, 1058, 1404, 2008, 2612, 2614)

Allen requested the following clarification to WAC 173-340-708(6):

> The proposed MTCA revisions frequently mention combined effects from individual hazardous substances and the cumulative effects of combined exposure pathways. There should be clarification of exposure to individuals or groups of individuals in terms of exposure scenarios. We recommend that the MTCA include clear language explaining that exposure pathways should not automatically be combined, but should represent the realistic RME exposure scenarios developed for a site.

Belcher expressed a similar concern. In contrast, Heart of America Northwest, expressed the following concern:

> The current rule does not explicitly state how external dose from exposure to residual radionuclides in soil or groundwater shall be modeled and factored into the determination of a soil action or remediation level. However, the rule is clear that the total carcinogen risk must be calculated, and that the assumptions in any external dose calculation model must not vary from the rule (except after the provisions allowing site specific risk assessment are adopted). The lack of any provision specific for the choice of an external dose model for determining cumulative carcinogenic risk from all pathways, has led some to claim that the dose does not have to be calculated, and others to claim that the model can modify default values for the risk assessment. Therefore, Ecology should simply clarify that all exposures must be modeled and included in calculating the total carcinogen risk, and that the choice of dose or other exposure models must meet the current proposed rule's standards for science and use of assumptions.

Allen [466], also asked that references be provided for other acceptable sources of formulas for exposure pathways not specifically addressed in the MTCA rule.

Response:
Under the current rule, additive risk from all possible exposure pathways is not normally considered at most sites beyond what is already included in the MTCA equations. An example of inclusion of concurrent exposure under the current rule is the provision for setting drinking water cleanup levels. These standard equations consider concurrent exposure to drinking water plus (for volatile substances) vapors originating from that same water. Similarly, federal and state water quality standards consider the possibility of eating fish and consuming water from the same surface water body. In the proposed rule, equations have been included that consider concurrent exposure due to soil ingestion and dermal contact with the soil. Other than these specific situations, such an adjustment is not normally done under the current rule. This is not expected to change under the proposed rule amendments. In response to Allen's comment, to clarify when additive risk due to multiple exposure pathways needs to be taken into account, the following language was added to WAC 173-340-708(6) in the 2000 proposal:

> **(b)** Cleanup levels and remediation levels based on one pathway of exposure shall be adjusted downward to take into account exposures from more than one exposure pathway. The number of exposure pathways considered at a given site shall be based on the reasonable maximum exposure scenario as defined in WAC 173-340-708(3). <u>This adjustment needs to be made only if exposure through multiple pathways is likely to occur at a site and, without the adjustment, the hazard index would exceed one (1) or the total excess cancer risk would exceed one in one hundred thousand (1×10^{-5}).</u>

In response to the concern raised by Heart of America, Ecology acknowledges that the current MTCA equations do not take into account many potential pathways of exposure such as external radiation dose or ingestion of garden vegetables, pathways that have traditionally been included in radiation exposure models. However, if there is a concern at a site, Ecology can require these and other additional exposure pathways to be evaluated when establishing cleanup levels and assessing the protectiveness of remedies. For example, under the general considerations pertaining to soil cleanup standards in WAC 173-340-740(1), the following language is provided:

> **(c)** The department may require more stringent soil cleanup standards than required by this section where, based on a site-specific evaluation, the department determines that this is necessary to protect human health and the environment. Any imposition of more stringent requirements under this provision shall comply with WAC 173-340-702 and 173-340-708. The following are examples of situations that may require more stringent cleanup levels.
>
> **(i)** Concentrations that eliminate or substantially reduce the potential for food chain contamination;
>
> **(ii)** Concentrations that eliminate or substantially reduce the potential for damage to soils or biota in the soils which could impair the use of soils for agricultural or silvicultural purposes;
>
> **(iii)** Concentrations necessary to address the potential health risk posed by dust at a site;

(iv) Concentrations necessary to protect the ground water at a particular site;

(v) Concentrations necessary to protect nearby surface waters from hazardous substances in runoff from the site; and

(vi) Concentrations that eliminate or minimize the potential for the accumulation of vapors in buildings or other structures.

WAC 173-340-740(1)(c). While external radiation dose is not specifically addressed in the examples provided, if this is a concern at a site, Ecology can require this pathway to be addressed under this provision.

As for acceptable references for addressing exposure pathways not specifically addressed in the MTCA rule, Ecology recommends the following sources:

- U.S. Environmental Protection Agency, Interim Final Guidance: Developing Risk-Based Cleanup Levels At Resource Conservation and Recovery Act Sites in Region 10, EPA 910/R-98-001, January 1998.

- U.S. Environmental Protection Agency. Federal Register Notice Volume 57, No. 104. Friday, May 29, 1992. Guidelines for Exposure Assessment. Pages 22888 - 22938.

- U.S. Environmental Protection Agency. March 25, 1991. OSWER Directive 9285.6-03. Technical memorandum: Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors."

- U.S. Environmental Protection Agency. August 1997. Exposure Factors Handbook, Volume I: General Factors. EPA/600/P-95/002Fa

- U.S. Environmental Protection Agency. August 1997. Exposure Factors Handbook, Volume II: Food Ingestion Factors. EPA/600/P-95/002Fb

- U.S. Environmental Protection Agency. August 1997. Exposure Factors Handbook, Volume III: Activity Factors. EPA/600/P-95/002Fc

- U.S. Environmental Protection Agency. April 1990. Risk Assessment Guidance for Superfund: Volume I -Human Health Evaluation Manual (Part A). Publication # 9285.7-01/FS.

- U.S. Environmental Protection Agency. December 1991. Risk Assessment Guidance for Superfund: Volume I -Human Health Evaluation Manual (Part B). Publication # 9285.7-01BFS.

- U.S. Environmental Protection Agency. December 1991. Risk Assessment Guidance for Superfund: Volume I -Human Health Evaluation Manual (Part C, Risk Evaluation of Remedial Alternatives). Publication # EPA/540/R-92/004.

REFERENCE DOSES (WAC 173-340-708(7))

GQ 9.7.5
What are acceptable sources for reference doses and cancer potency factors for use under MTCA?

(1289)

Response:
Reference doses and cancer potency factors are one of the variables needed to calculate a cleanup level or to assess the protectiveness of a remediation level. Ecology has traditionally used two EPA databases as sources of these values – Integrated Risk Information System (IRIS) and Health Effects Assessment Summary Tables (HEAST). The current rule acknowledges the use of IRIS but did not include HEAST. This was discussed during the PAC process and changed in the final rule, as recommended by the PAC. In addition, in response to a comment from the POG on the 1999 proposal, the National Center for Environmental Assessment (NCEA), a division of the federal EPA, was added as an acceptable source of these values. The rule also contains a process for establishing these values when one is not available from these sources.

GQ 9.7.6
The referenced EPA document in WAC 173-340-708(7)(f) should be updated to the latest version of this guidance.

(95, 2256)

The POG requested that the reference in WAC 173-340-708(7)(f) be updated to: "Reference Dose (RfD): Description and Use in Human Health Risk Assessments: Background Document 1A, March 15, 1993."

Response:
The requested change has been made in the adopted rule.

GQ 9.7.7
Should HEAST be retained as an acceptable reference for toxicity values?

(739, 2401)

Response:
Ecology recognizes that the HEAST database has been largely replaced with IRIS. For some substances there is no reference dose or cancer potency factor available in IRIS, but a value is available in HEAST. That is why HEAST is retained as an acceptable source for these substances. Note that HEAST is identified as an acceptable source only if a value is unavailable from IRIS. This is in recognition that IRIS contains more up-to-date information.

GQ 9.7.8
Are reference doses and cancer potency factors not available in IRIS or HEAST required to be subject to public review before they are used at a site?

(1067, 1426)

Response:
WAC 173-340-708 (7)(h) and (8) (g) does provide for public review and comment on values that are not in the three acceptable sources cited in the rule.

GQ 9.7.9
Why haven't EPA's IEUBK model for lead and EPA's adult lead model been included as an acceptable method for deriving soil lead cleanup levels?

(634, 1350, 2236)

Response:
Ecology had proposed using the EPA IEUBK model for deriving soil cleanup levels in an earlier draft of the rule, however, we withdrew that language because of public objection. Also, during discussions with the MTCA Science Advisory Board on the use of this model, it became apparent that additional work was needed before adopting its use through rule. For these reasons, this model was not included in the latest draft of the proposed rule amendments. The EPA adult lead model has not been proposed in any previous rule draft to date. Given these earlier objections to the IEUBK model, Ecology believes it would be inappropriate to include the EPA adult lead model as a specific alternative without further public review and comment. However, by not specifically incorporating these models into the rule, it is not Ecology's intent to prohibit use of these models on a site-specific basis, as provided for in WAC 173-340-702.

Ecology plans to address use of these models in a future rule-making, as resources permit.

GQ 9.7.10
What reference dose values are to be used for petroleum mixtures?

(31, 475, 502, 742, 1426, 2403, 4/15/99 letter from MTCA SAB)

Response:
Petroleum products are complex mixtures that include hundreds of compounds. How to estimate the toxicity of such mixtures has been the subject of considerable discussion throughout the rule-making process, involving Ecology, the State Department of Health, the TPH Project Oversight Group, the U.S. EPA, and numerous stakeholders. Based on this work, consensus was reached on three principles:

1. Where reference doses and cancer potency factors are available for individual substances that are part of the petroleum mixture, these values should be used for these substances.

2. The remainder of the mixture should be divided into several groups of substances, or fractions, and a reference dose assigned to each fraction based on known toxicological information about substances found in those fractions or with a similar chemical structure.
3. Because of the wide range of chemicals and potential health effects, the noncarcinogenic toxicity posed by the various fractions should be assumed to be additive for the purposes of estimating the toxicity of a petroleum mixture.

Based on information developed by the National TPH Criteria Working Group (NTPHCWG), it was determined that the mixture of substances should be split into two main groups—aliphatic hydrocarbons and aromatic hydrocarbons. Each of these main groups was then further subdivided into fractions with similar physical properties.

Initial reference doses were derived from work done by the National TPH Criteria Working Group and the Massachusetts Department of Environmental Protection. At the request of EPA Region 10, the EPA's National Center for Environmental Assessment reviewed these values and recommended some adjustments. These recommendations were endorsed by the POG and the MTCA Science Advisory Board. These values are reproduced in Table 9-1.

Table 9-1: Recommended Reference Doses for Petroleum Fractions and Individual Hazardous Substances.

Fraction/Compound and Equivalent Carbon (EC)	Surrogate	Oral RfD (mg/kg-day)	Inhalation RfD (mg/kg-day)	Source
Aliphatic EC5 to EC6	Cyclohexane	5.7	5.7	EPA
Aliphatic >EC6 to EC8	Cylcohexane	5.7	5.7	EPA
Aliphatic >EC8 to EC10	(See Note 1)	0.03	0.085	EPA
Aliphatic >EC10 to EC12	(See Note 1)	0.03	0.085	EPA
Aliphatic >EC12 to EC16	(See Note 1)	0.03	NA	EPA
Aliphatic >EC16 to EC21	Mineral Oil	2	NA	CWG/EPA
Aliphatic >EC21 to EC36	Mineral Oil	2	NA	CWG/EPA
Aromatic EC8 to EC10	Biphenyl	0.05	0.05	EPA
Aromatic >EC10 to EC12	Biphenyl	0.05	0.05	EPA
Aromatic >EC12 to EC16	Biphenyl	0.05	NA	EPA
Aromatic >EC16 to EC21	Pyrene	0.03	NA	MaDEP/EPA
Aromatic >EC21 to EC36	Pyrene	0.03	NA	MaDEP/EPA
n-Hexane		0.06*	0.057*	EPA
Benzene		0.003	0.0017	EPA
Ethyl benzene		0.1*	0.286*	EPA
Toluene		0.2*	0.114*	EPA
Xylenes		2*	0.2*	EPA
Naphthalene		0.02**	0.00086*	EPA
1,2 dibromoethane		0.000057*	0.000057*	EPA

Note 1: The aliphatic fractions with an oral reference dose = 0.03 and an inhalation reference dose = 0.085 is based on a "mixture of alkanes" for ingestion and ATSDR chronic MRL (minimal risk level) of 0.3 mg/m3 for JP-7 as the inhalation surrogate for EC8 to EC16 which equals an inhalation RfD of 0 .085 mg/kg-day.

Note 2: In some cases the EPA fractions are slightly different but for consistency and simplicity they were adjusted to these which are very close (within one equivalent carbon number).

Note 3: "Volatile" is defined as EC 12 and less plus naphthalenes; therefore no inhalation reference doses are needed for higher fractions.

Additional Notes:

- NA = Not Applicable (because not volatile)
- CWG = Total Petroleum Hydrocarbon Criteria Working Group
- MaDEP = Massachusetts's Department of Environmental Protection
- EPA = Environmental Protection Agency (reviews of CWG & MaDEP recommendations)
- = Value currently in CLARC (Cleanup and Risk Calculations Guidance)
- ** = New IRIS value, not yet in CLARC

GQ 9.7.11

Does an RfD always need to be established for a hazardous substance?

(2309, 2236)

Two commentors expressed concern that the current rule language could be interpreted to require the development of a reference dose for all chemicals at a site, whether or not it is appropriate to do so. For example, the POG made the following comment:

> The way that the language in Section 708(7)(f) is written, it appears that when an RfD is missing, the user must ("shall") calculate an RfD. The POG recommends changing the language from "shall" to "may" and inserting an important comma, as follows: "… may be established on a case by case basis, using the methods described in "Reference Dose (RfD): Description and Use in Health Risk Assessments: Background Document 1A, March 15, 1993 available on the internet at http://www.epa/gov/iris/rfd.htm." This change will clarify that developing an RfD is optional, but that if an RfD is developed, the cited document must be used.

Response:

Ecology concurs that it is not the intent of this language to require the development of an RfD for every substance at a site. For example, in most circumstances it would be unnecessary to do so if the substance were a suspected carcinogen and had a published cancer potency factor. Accordingly, in the final rule, WAC 173-340-708(7)(f) has been changed to read:

> **(f)** If a reference dose/reference concentration for a hazardous substance~~s~~ including petroleum fractions and petroleum constituents is not available through IRIS, HEAST or the NCEA or is demonstrated to be inappropriate under (e) of this subsection~~,~~ and the department determines that development of a reference dose/reference concentration is necessary for the hazardous substance at the site, then a reference dose/reference concentration shall be established on a case-by-case basis. When establishing a reference dose on a case-by-case basis, ~~using~~ the methods described in ~~Risk Assessment Guidance for Superfund, Human Health Evaluation Manual, Part A (October~~

~~1989)~~ "Reference Dose (RfD): Description and Use in Health Risk Assessment: Background Document 1A", USEPA, March 15, 1993, shall be used.

A parallel change has been made to WAC 173-340-708(8)(c) for the same reasons.

CANCER POTENCY FACTORS (WAC 173-340-708(8))

GQ 9.7.12
Should the terminology be updated to use "unit risk factors" instead of "cancer potency factors"?

(2238)

Response:
Ecology does not believe it is necessary to change the nomenclature from the use of the term "cancer/carcinogenic potency factor" to "unit risk factors." The USEPA has historically used the term cancer/carcinogenic potency factor and continues to use this term in many risk assessment documents (U.S. EPA, 1990; U.S. EPA, 1991d; U.S. EPA, 1998b). We believe altering these terms at this stage in the process could cause more confusion than benefit.

GQ 9.7.13
What is the appropriate model for establishing cancer potency factors?

(635, 1124)

Two commentors indicated that the linear multistage model has been rejected by the USEPA as a default approach in its recent carcinogenic risk assessment guidance and suggested this be deleted as the default model for establishing cancer potency factors when one is not in IRIS or HEAST or the NCEA.

Response:
Ecology contacted EPA's Region 10 to determine if the commentor was correct. EPA's response, in a letter dated March 16, 2000 was as follows:

> The proposed changes to EPA's cancer risk assessment guidelines have been published in the Federal Register, but they have not been finalized. Substantial changes are possible prior to finalization; however, the specific proposal to use straight-line extrapolation for a linear default is unlikely to change. Even when finalized, there are no plans to re-visit all the existing slope factors. The LMS-generated slope factors will be all that are available in IRIS (until a petition or other activity causes the chemical to be re-evaluated). Additionally, not all the existing slope factors in IRIS use the LMS. For instance, the slope factors based on human epidemiology data are not based on the LMS. Finally, EPA did not "reject" the LMS but made the following statement in the proposed guidelines: "This change is made because the former modeling gave an appearance of specific knowledge and sophistication unwarranted for default. The proposed approach is also

more like that employed by the FDA. The numerical results of the straight line and LMS procedures are not significantly different." (USEPA Proposed Guidelines for Carcinogen Risk Assessment, EPA600/P-92/003C, April 1996). In contrast to the commenter's statement, EPA recommended a change in the default modeling procedure to make it simple, consistent with other federal agencies and because the results are not significantly different than those resulting from use of the LMS. The existing language in MTCA, cited in the commenter's statement above, should be sufficiently flexible to allow for any warranted deviations from the LMS model. (Patricia Cirone, USEPA)

Based on this response Ecology does not believe making the suggested change would be appropriate.

GQ 9.7.14
Is it appropriate to use toxicity equivalency factors for PCB's?

(808, 943)

Two comments were received recommending Ecology adopt the use of toxicity equivalency factors (TEFs) for PCBs.

Response:
Ecology is aware that the USEPA is moving in the direction of using TEF's for PCBs. However because this is an area of still-evolving science and is beyond the scope of this rule-making, we did not include it. We do plan on exploring this issue with the MTCA Science Advisory Board in the future and this may be proposed in a future rule revision. In the interim, the use of TEFs for PCBs could be proposed as new scientific information on a site-specific basis under WAC 173-340-702(15).

GQ 9.7.15
What is the basis for including the use of toxicity equivalency factors (TEFs) for dioxins and furans?

(944, 1348, 4/15/99 SAB letter)

Three comments were received regarding the use of TEFs for dioxins and furans. One commentor (McCain) questioned the source of this addition, since it was not a PAC recommendation. A second commentor (USEPA) suggested Ecology consider using the TEFs adopted by the World Health Organization. The third comment was from the MTCA Science Advisory Board recommending use of TEFs for dioxins and furans and endorsing Ecology's approach.

Response:
Toxicity equivalency factors for assessing the risk of dioxins and furans were added to the rule based on a recommendation from the MTCA Science Advisory Board. In their recommendation, the Board noted that use of TEFs has become standard risk assessment practice for dioxins and

furans. Since TEFs will allow a more accurate assessment of the toxicity of mixtures of dioxins and furans, the addition of TEFs is also consistent with the PAC recommendations for use of site-specific information in assessing site risks.

With regard to which approach to use for establishing TEFs, when Ecology proposed using the TEFs available from the U.S. EPA, the World Health Organization (WHO) (Van den Berg, M.L. et al., 1998) recommendations were still under development. We believe it would be inappropriate to make this change at this stage of the rule-making process. We do acknowledge that the WHO approach may be a better approach because it addresses both human health and ecological risk. Ecology intends to look at the WHO approach for consideration in a possible future rule-making. In the interim, it could be proposed as new scientific information on a site-specific basis under WAC 173-340-702(15).

GQ 9.7.16
Why have toxicity equivalency factors (TEFs) been included as part of modified Method B (instead of standard Method B)?

(477, 1148)

Two commentors recommended that TEFs be incorporated into standard Methods B and C, rather than modified Methods B and C.

Response:
While use of TEFs is fairly common, it does involve an extra level of calculation that appeared to fit best under Modified method B. Establishing a standard under Modified method B does not necessarily imply it is less protective, just that site-specific information is being used to determine cleanup levels.

GQ 9.7.17
What is the basis for including use of toxicity equivalency factors (TEFs) for carcinogenic PAHs?

(945, 1349, SAB 4/15/99 letter)

Response:
Toxicity equivalency factors for assessing the risk of carcinogenic PAHs were added to the rule based on a recommendation from the MTCA Science Advisory Board. In their recommendation, the Board noted that use of TEFs has become standard risk assessment practice. The USEPA has concurred with this recommendation, including the use of the CalEPA toxicity equivalency factors. Since TEFs will allow a more accurate assessment of the toxicity of mixtures of carcinogenic PAHs, the addition of TEFs is also consistent with the PAC recommendations for use of site-specific information in assessing site risks.

BIOCONCENTRATION FACTORS (WAC 173-340-708(9))

GQ 9.7.18
Comments regarding bioconcentration factors.

(887, 1271)

One commentor asked that Ecology provide a table of these factors because they are not always readily available. The POG, had the following comments:

> It is the POG's opinion that it is not sufficient to rely on bioconcentration factors alone for determining surface water cleanup levels for petroleum, indicator substances, or other substances intended to be protective of human health via fish ingestion. First, it is commonly understood that chemical-specific bioconcentration factors, bioaccumulation factors and biota-sediment accumulation factors are all important for predicting concentrations in fish. Which factor should be used depends upon the log Kow of the specific chemical (or fraction, in the case of petroleum). The reader can be directed to appropriate EPA guidance for assistance in making these determinations. Second, other sources of information (empirical or other literature) should be available to a site owner to calculate alternative surface water cleanup levels if it is evident that bioconcentration factors are not appropriate for a specific chemical of concern.
>
> The POG continues to recommend that Ecology incorporate BAFs and BSAFs as appropriate on a chemical-specific basis, into its approach for calculating surface water cleanup levels.

Response:
Ecology has included information on bioconcentration factors in our "CLARC" guidance tables and intends to update that information and make it available in the future.

With regard to the POGs recommendation that the rule be changed to provide for the use of bioaccumulation factors (BAFs) and biota-sediment accumulation factors (BSAF), Ecology acknowledges that the USEPA has published guidance recommending this change (U.S. EPA, 1998a). The recommended change was not made to this subsection and WAC 173-340-730 because this change is beyond the scope of this rule making.

Should the state or federal water quality regulations be changed to adopt more stringent standards based on this approach, those standards would be required to be used. Ecology also intends to explore this issue more with the MTCA Science Advisory Board and this may result in future guidance or rule-making on this issue. In the interim, if there is a concern at a particular site that cleanup levels calculated using the existing equations are not protective, Ecology can use its authority in WAC 173-340-730 (1)(e) to require more stringent cleanup levels.

See Chapter 11 of the CES for additional discussion of issues related to surface water cleanup levels.

EXPOSURE PARAMETERS (WAC 173-340-708(10))

GQ 9.7.19
Is it the intent of the constraints in WAC 173-340-708(10) to prevent the use of more conservative risk assessment assumptions, if they are necessary to protect human health?

(470, 2112)

In addition to the general comments on risk assessment, discussed earlier, two comments were received expressing concern that, as written, this subsection would prevent the department from requiring the use of more stringent risk assessment assumptions, even when necessary to protect human health. For example the Lower Ehlwa Tribe expressed the following concern:

> In the proposed revisions to MTCA, however, the subsection on exposure parameters (WAC 173-340-708(10)(b)) indicates that the default exposure parameters, including fish consumption rates, "shall not be changed when calculating cleanup levels." The provision no longer allows for modification of the exposure parameters, even if those parameters may underestimate actual exposures. Based on recent tribal fish consumption surveys for the Puget Sound and the Columbia River regions, actual fish consumption rates of adult tribal members may be significantly higher than the rate of 54 grams per day established by Ecology. The most recent consumption survey, completed by the Suquamish Tribe in cooperation with the Washington Department of Health and the Agency for Toxic Substances and Disease Registry (ATSDR), indicates that mean adult fish consumption rates are four times higher than the rate established by Ecology, and high end (95th percentile) consumers may be consuming 10 to 15 times more than the established rate.
>
> Not allowing for modification of exposure parameters at sites where higher exposures occur will result in cleanup levels which are not protective of tribal fishers or other subsistence fish consumers.

Response:
In every section of the rule establishing the procedures for medium-specific cleanup levels, there is a provision allowing Ecology to establish more specific cleanup levels on a case-by-case basis. For example, WAC 173-340-730(1)(e) states the following:

> **(e)** The department may require more stringent cleanup levels than specified in this section where necessary to protect other beneficial uses or otherwise protect human health and the environment. Any imposition of more stringent requirements under this provision shall comply with WAC 173-340-702 and 173-340-708.

This is existing rule language, with new cross-references added to WAC 173-340-702 and 173-340-708. Those cross-references were added because it was the department's understanding that the PAC intended that the department be held to the same constraints as a PLP would in making such revisions. Discussion of what parameters would be allowed to be changed as part of a site-specific risk assessment was the subject on considerable debate during the PAC process. The proposed language in this subsection reflects nearly verbatim the PAC recommendation on this issue. In light of the above comments, Ecology reviewed the Final PAC Report and discussions regarding this issue. In that review, we can find no indication that the PAC intended that the department be unable to make a change to an assumption if the resulting cleanup level was not protective of human health, a requirement of the MTCA statute. Accordingly, in the final rule, the following change has been made to WAC 173-340-708(10)(b):

> **(b)** Exposure parameters that are primarily a function of the exposed population characteristics (such as body weight and lifetime) and those that are primarily a function of human behavior that cannot be controlled through an engineered or institutional control (such as: Fish consumption rate; soil ingestion rate; drinking water ingestion rate; and breathing rate) are not expected to vary on a site-by-site basis. The default values for these exposure parameters shall not be changed when calculating cleanup levels except when necessary to establish a more stringent cleanup level to protect human health. For remediation levels the default values for these exposure parameters may only be changed when an alternate reasonable maximum exposure scenario is used, as provided for in WAC 173-340-708 (3)(d), that reflects a different exposed population such as using an adult instead of a child exposure scenario. Other exposure parameters may be changed only as follows:

This also addresses concerns raised by the Yakima Indian Nation in comments on an earlier draft of the rule pertaining to other exposure pathways, in addition to fish consumption. In making this change, it should be noted that it is clear from the PAC records that the expectation was that a site-specific change in fish consumption rate to account for tribal consumption would be required to meet the requirements for "new scientific information". That requirement has not been altered by this change.

GQ 9.7.20
In WAC 173-340-708(10)(c), what would be a significant enough change to require evaluation of additional exposure pathways, including dermal and vapor exposure?

(54, 58, 59, 471, 637, 876, 950, 2036, 2037)

Several comments were received expressing concerns about this provision. Most were concerned about the lack of a specific definition of "significantly higher". For example, K. Johnson had the following comment:

> In subsection -708(10)(c) the term "significantly" is ambiguous and should be defined so that the trigger for adding other pathways is presented. Furthermore, given the constraints on changing any of the parameters in the models presented in the rule, it would be appropriate only to consider additional pathways in site-specific risk assessment and not in situations where a PLP has changed inputs into the default model to modify a cleanup level.

And Graves:

> The Policy Advisory Committee (PAC) Report did not anticipate evaluation of the dermal or other exposure pathways except in those cases where site-specific risk assessment provided for a "significantly" higher cleanup level. The proposed regulation considers dermal exposure when calculating Method B and C cleanup levels for petroleum contamination in all cases. In addition, the vapor pathway must be considered when soil cleanup levels for the protection of groundwater are calculated using anything other than default formula values. This was not the intent of the PAC. In addition, guidance needs to be provided on what is "significant." One potential approach for Ecology to consider is to require assessment of other exposure pathways when cleanup levels increase by over an order of magnitude due to modified exposure parameters.

> This approach appears appropriate in that risk assessment procedures are conservative by nature and EPA practice is to consider risk assessment calculations no more accurate than an order of magnitude. The State of Oregon has recently adopted this approach in evaluation of "hot spots" under its revised cleanup regulations.

Another commentor asked who makes the decision as to what is significant, and another stated that they felt that this provision will result in having to do two calculations, one including other exposure pathways, and one not, to determine if a change was "significant".

Response:
This wording reflects the PAC recommendation for when additional exposure pathways need to be addressed. Changing inputs into the default models to reflect site-specific conditions is a form of site-specific risk assessment that can result in much higher concentrations being left on site. The PAC recognized that in these circumstances there is a need to evaluate additional exposure pathways. Persons doing risk assessments can voluntarily include an evaluation of additional exposure pathways without having to go through an evaluation for "significance". Ecology plans to prepare guidance to help persons doing risk assessments to understand when other pathways should be examined.

The requirement to evaluate the dermal pathway concurrent with soil ingestion at petroleum contaminated sites is consistent with the PAC recommendations because the PAC deferred specifics related to petroleum risk assessment to the POG. Evaluation of the vapor pathway is not always required (see WAC 173-340-740(3)(c)(ii)(iv)). The rule does not define what is a "significant increase" because what is significant will depend on a number of factors and could vary for different exposure pathways. Bailey, for example, in commenting on this provision noted the following relative to the dermal pathway:

> There are a number of factors that can affect the relative significance of dermal contact with contaminated soil. Contaminants with relatively high ABS values (e.g. PCP, PAHs, PCBs) will generally have the largest percent impacts on cleanup levels although corrections for gastrointestinal absorption efficiency will also be a determining factor (e.g. cadmium). It is also useful to note that meaningful reductions of current soil cleanup values are dependent upon the absolute, not just the percent, decrease. For example, a reduction in the Method B cleanup level for pyrene (ABS = 0.13) from 2400 to 1816 ppm is more meaningful than a reduction of 1.6 to 1.2 ppm for PCBs (ABS = 0.14). In addition, the overall impact of the dermal route on soil cleanup levels is magnified under the Method C versus Method B approach as demonstrated in spreadsheets provided to the SAB by the technical team. This discrepancy is due to the lower soil ingestion rate assumed under Method C resulting in a relatively higher dermal contribution to overall risk. (Bailey, USEPA)

With regard to Graves suggestion of using an order of magnitude, since that was EPA practice, Ecology contacted the U.S. EPA's Region 10 for confirmation of this. Their response was as follows:

> From a technical perspective, the practice in performing site-specific risk assessment calculations (i.e., both the exposure estimate step and the risk characterization step) is to work with as many significant figures as the data support. In particular, due to the precision of analytical equipment in measuring contaminants, exposure estimates may have several significant figures. Hence, no "order of magnitude" adjustments are made during the preparation of the risk calculations. The appropriate number of significant figures

> presented in the final risk estimates is determined by the number of significant figures in the least precise data used in the assessment. Sometimes the least precise data are the toxicity values (i.e., non-cancer reference dose or cancer slope factor), but it can not be generalized that toxicity values are "order of magnitude" in precision. (Patricia Cirone, USEPA)

In light of this response and the statement above by Ms. Cirone, Ecology believes using an order of magnitude as the measurement for what is "significant" would be inappropriate. Furthermore, defining what is "significant" will depend on many factors and is best left to guidance rather than rule. Instead, the rule focuses on clarifying what is the comparison baseline for triggering assessment of the dermal and vapor pathways.

PROBABLISTIC RISK ASSESSMENT (WAC 173-340-708(11))

GQ 9.7.21
Why is probabilistic risk assessment included in the rule amendments?

(353, 1124, 1125, 2222)

Two contrasting comments were received regarding the use of probabilistic risk assessment. Kenefick, stated the following:

> WAC 173-340-708(11) relegates probabilistic risk assessments to "informational" because Ecology has not yet developed protocols or policies for such assessments. Ecology failure to keep its policies and technical expertise current is no reason to reject the use of probabilistic risk assessments. Evaluating the uncertainty of a risk estimate has not only been deemed as acceptable scientifically, but is now required by EPA and recommended by the National Research Council. Probabilistic techniques, such as Monte Carlo analysis, are acceptable means of quantifying uncertainty and have been used and reviewed by EPA for several years now. Furthermore, Monte Carlo analysis is an acceptable statistical technique which dates back more than 15 years and is used throughout the country in various disciplines besides risk assessments, such as financial forecasting, stock analyses, and traffic design. The state of Washington uses the statistical technique for many purposes as well. It is not justified to marginalize well developed, broadly acceptable, and scientifically defensible statistical technique until Ecology "adequately describes" a protocol….

In contrast, Valeriano stated the following:

> Probabilistic risk assessment should not be allowed here and should be eliminated in the definition as well. The PAC recommended a REVIEW of probabilistic risk assessment for FUTURE inclusion in MTCA. I have never seen this review. These methods are still in the early stages of development and need a lot more public discussion before they should be allowed to be applied at sites to develop cleanup standards. They are also very difficult for the public to understand and critically evaluate. All references to this type of risk assessment should be removed, until a more thorough public debate has occurred.

Response:
The appropriate use of probabilistic risk assessment was the subject of considerable discussion during the PAC process. As the PAC worked through this issue it became readily apparent that these types of risk assessments are very complicated and difficult to correctly apply and understand, not only by the general public, but also by persons who work in the remediation

field. In addition, it also became apparent that the outcome of these types of risk assessments is heavily dependent on assumptions made in the calculations and that many of variables in the calculations have insufficient data to describe a distribution. For these reasons, the PAC recommended that probabilistic risk assessment be limited to use for informational purposes, not for setting cleanup standards and remediation levels. The rule language reflects this recommendation.

GQ 9.7.22
Why is the distribution of toxicity factors not allowed when conducting a probabilistic risk assessment?

(1124)

One commentor requested that the definition of "probabilistic risk assessment" be amended to allow consideration of distributions for dose-response relationships.

Response:
Ecology disagrees that the rule should allow the use of distributions for dose-response relationships. This restriction is consistent with USEPA guidance and the generally accepted practice when using probabilistic risk assessment. For example, EPA, in their policy on the use of probabilistic risk assessment (U.S. EPA, 1997b), states the following:

> For human health risk assessments, the application of Monte Carlo and other probabilistic techniques has been limited to exposure assessments in the majority of cases. The current policy, Conditions for Acceptance and associated guiding principles are not intended to apply to dose response evaluations for human health risk assessment until this application of probabilistic analysis has been studied further.

Furthermore, in a review of probabilistic risk assessment, PTI Environmental Services (PTI, 1995), made a similar statement:

> Because definitive information regarding the distribution of CPFs is not available and a widely accepted, standard procedure for developing such distributions does not currently exist, it is not currently possible to defensibly incorporate such distributions into human health sediment quality criteria as reflecting actual variations in potential risk levels.

Consistent with the PAC recommendations, Ecology intends to continue to evaluate probabilistic risk assessment methods and consider their use in a future rule-making.

GQ 9.7.23
Can probabilistic risk assessment be used for both human health and environmental risk assessment?

(1124)

Response:
While the focus of the PAC discussions was on human health risk assessment, the language in the PAC recommendation is not limited to human health risk assessment. Thus, it is Ecology's intent that WAC 173-340-708(11) also apply to the use of probabilistic risk assessment for environmental risk assessments.

GQ 9.7.24
Why was the provision discussing significant figures deleted?

(638, 1352)

The proposed rule deletes the language requiring risk assessment results to be presented to one significant figure. Two commentors expressed concern with this deletion, noting that this was not part of the PAC recommendations.

Response:
This language was struck based on a recommendation from the Science Advisory Board (4/15/99 letter) and Ecology concurred with that recommendation. In their recommendation the Board noted that while it is often appropriate to round risk assessment results to one significant figure, always requiring this is not consistent with the scientific method for determining the number of significant figures in calculations. They also noted that several of the Method A table values are expressed at more than one significant figure and that this illustrates the impracticability of always rounding to one significant figure.

GQ 9.7.25
Other comments regarding WAC 173-340-708 are addressed in the following table:

Comment ID	Comment	Response
1347, McCain	Add language stating what risk levels are to be used for RELs based on alternative RMEs.	Addressed in 350(12)
Section 708(9)		
468, Allen	Rephrase as follows: "If the department determines that a bioconcentration factor is appropriate for a specific hazardous substance, then appropriate EPA documents, literature sources or empirical information may be used to determine a bioconcentration factor."	Comment addressed in 1999 proposal.
743, Newlon 2423, Newlon 2424, Newlon	POG did not recommend Kow as method for calculating BCF. A BCF and Kow may not work for all chemicals. Need to broaden to allow use of additional literature information and/or empirical testing.	Comment addressed in 2000 proposal.
887, Goold	Ecology should provide a table of BCFs since they are not readily available.	Ecology does provide a table of BCFs in CLARC database.
1351, McCain	Should add "if appropriate"	Comment addressed in 1999 proposal.

2423, POG	POG did not recommend Kow as method for calculating BCF.	Comment addressed in 2000 proposal.
Section 708(10)		
86, POG 2246, POG	Replace the term "input parameters" with "exposure parameters".	Comment addressed in adopted rule.
469, Allen	Ecology should use EPA's national data for default values.	The basis for the various default values in the rule are discussed in the 1991 Responsiveness Summary and this document. EPA's data was used for most.
741, Newlon 2402 Newlon	Should add a table summarizing what variables can be changed for CULs and RELs. Later comments notes addressing in guidance will be sufficient.	These variables will be included in future guidance.
744, Newlon 2425 Newlon	Add a discussion of conceptual site model.	Comment addressed in 1999 proposal.
1251, Gillett	In (c), add comma after, "in this chapter"	Comment addressed in 2000 proposal.
2360, Nelson	Limitations on SSRA are inconsistent with ESHB 1810.	Ecology disagrees. This was PAC recommendation.
2474, White	Remove "are" from (10)(b)(i).	Comment addressed in adopted rule.
Section 708(11)		
2329, Heaton	PHSKC supports limiting use of probabilistic risk assessments. Federal use of these has only lead to lengthy legal and technical arguments.	Comment noted.

9.8 Methods for Defining Background Concentrations (WAC 173-340-709)

Most of WAC 173-340-709 consists of existing language moved from WAC 173-340-708(11) with several editing changes. Substantive changes to this section include the following:

- The assumption that background data sets are normally distributed has been changed to lognormally distributed.
- The tolerance interval approach has been deleted and replaced with an upper bound approach.
- The specific reference to use of probit and regression methods for handing data below the method detection limit or PQL has been changed to a general reference allowing alternate statistical methods.

GQ 9.8.1
Will the statistical procedures for comparing site data to background result in the need to clean up sites that are not contaminated?

(472, 555)

Response:
In Ecology's default method, a value from the high end of the background distribution is used to reduce the possibility of failing a clean site when comparing the upper confidence limit on the

mean site concentration with a background-based cleanup level. In addition, no single site concentration can exceed twice the cleanup level, and no more than ten percent of the site sample concentrations can exceed the cleanup level. Modifications to these numerical criteria are permitted based on the background distribution characteristics.

Ecology evaluated the performance of this three-part method with respect to false positive (failing a clean site) and false negative (passing a contaminated site) errors, as well as the alternative approach suggested by the commentor. Performance of the suggested alternative was better under some scenarios, while the method proposed by Ecology performed better under others.

One disadvantage of the suggested alternative is that it does not generate a background concentration for direct comparison with a cleanup level to determine whether the cleanup level is below background. Ease of use is another difficulty with the suggested alternative. However, while Ecology chose not to adopt the suggested alternative as the default method, the rule amendment does allow for the use of alternative approaches where appropriate.

GQ 9.8.2
Why are more samples required for establishing area background than natural background for soil?

(1428)

Response:
The requirements for the number of samples to establish area and natural background for soil are existing requirements and have not been changed. The reason provided in the 1991 Responsiveness Summary for this difference is as follows:

> The minimum sample sizes were selected following consideration of environmental distributions, sample costs and the level of confidence in sample results. The department recognizes that there are many site-specific and contaminant-specific variables which will influence this determination. The selected values represent a reasonable balance between the need for regulatory efficiency and the practical aspects of collecting and analyzing large numbers of samples.

1991 RS, Chapter XV, Issue #1, p. 172.

GQ 9.8.3
Should WAC 173-340-709(4) identify methods for establishing natural background concentrations in ground water?

(969, 2052)

Response:

The language in WAC 173-340-709(4) identifies the sample size to determine natural and area background concentrations for soil only and indicates that for other media this will be established on a case-by-case basis. This is a current regulatory standard and Ecology is not proposing to adopt any new sampling requirements at this time. In addition, EPA has published extensive guidance on this issue and Ecology believes this issue is best addressed through using that guidance.

9.9 Applicable Local, State and Federal Laws (WAC 173-340-710)

Several amendments to WAC 173-340-710 were made for clarification purposes and to reflect changes made to other chapters, including updating several cross-references. Substantive changes include the following:

- Subsection (7)(c): Added cross-reference to newer solid waste landfill closure requirements.
- Subsection (9): Added description of permit exemption process.

GQ 9.9.1
The reference to "proposed permit exemptions" is in conflict with the statute, which grants an outright exemption.

(2085)

McCain expressed the following concern on the language in 710(9)(d) pertaining to "proposed permit exemptions":

> …This language inaccurately describes the nature of permit exemptions provided by statute under RCW 70.105D.090. That is, the permit exemptions arise automatically by operation of law, and thus do not need "proposal" or "approval" by Ecology. Indeed, the statute reserves to Ecology the ability to nullify the exemption only if it determines that the exemption would result in loss of approval from a federal agency necessary for the state to administer a federal law.

Response:
Ecology concurs. WAC 173-340-710(9)(d)(iii) was changed in the final rule as follows:

> **(iii)** A public notice of the order, decree or work plan shall be issued in accordance with WAC 173-340-600. The notice shall specifically identify the permits ~~proposed for exemption~~ exempted under RCW 70.105D.090 and seek comment on ~~these exemptions~~ the substantive requirements proposed to be applied to the remedial action. This notice shall be mailed to the state agencies and local governments that would otherwise implement these permits. This notice shall also be mailed to the same individuals that the state agencies and local government have identified that would normally be mailed notice to if a permit was being issued.

A similar change was made to paragraph (i) in the same subsection and to several provisions in WAC 173-340-600.

GQ 9.9.2
Other comments regarding WAC 173-340-710 are addressed in the following table.

Comment ID	Comment	Response
2088, McCain	Change permit related language.	Comment addressed in adopted rule.

Chapter 10 Ground Water Cleanup Standards

Several amendments to WAC 173-340-720 were made for clarification purposes and to reflect changes made to other chapters, including updating several cross-references. Substantive changes, listed by subsection, include the following:

Subsection (1) – General considerations.
(a) Edited to direct the user to the appropriate subsections for establishing ground water cleanup levels as part of the restructuring of this Section. Drinking water use remains default use.
(b) Deleted language about treatment, removal and containment and replaced with trigger that cleanup action is required where cleanup levels are exceeded.
(c) Added statement that releases of hazardous substances to ground water cannot cause violations of standards for other media. And that a site that qualifies for a Method C ground water cleanup level doesn't mean that Method C can be used for other media.
(d) Added discussion on when the department may require more stringent cleanup levels.

Subsection (2) – Drinking water aquifer criteria.
(b) Added note that total dissolved solids concentration is an example and there may be other situations where high natural background may result in ground water not being considered a drinking water aquifer.
(c) Deleted statement of when more stringent cleanup levels can be required by the dept. Added statement describing what types of "interconnection" are of concern. Also deleted former (c), (d) and (e).
(d) Added provision (d) to replace former (c), describing when potable ground water discharging to surface water can be classified as nonpotable for the purposes of establishing ground water standards. Key addition is the use of the term "sufficiently hydraulically connected" (combined with other criteria) to define when there is an extremely low probability that the ground water will be used for drinking water beneficial use.

Subsection (3) – Method A cleanup levels for potable ground water.
(a) Added cross-reference to Section 704 to describe what sites can use Method A.
(b) Deleted Table 1 – moved to new section 900 and re-named Table 720-1, with several changes to values and footnotes. See Chapter 19 for further discussion of the changes to this table.
(b) Federal secondary maximum contaminant levels for drinking water deleted as an ARAR.
(b) Updated cross-reference to State's maximum contaminant levels. Deleted former (b) and (c)

Subsection (4) – Method B cleanup levels for potable ground water.
(a) Added discussion providing for "standard" and "modified" Method B.
(b) Re-titled as a description of "standard" Method B. Added (iii) describing when surface water beneficial uses must be protected (replaces former (c)).
(b) Added description of default values to be used for the inhalation correction factor in equations 720-1 & 720-2.

(b) Added "drinking water fraction" and default value of 1.0 ; "averaging time" and "exposure duration" and default value of 6 years for both to equations 720-1 and 720-2. Also, minor editing to other terms in both equations and deleted former (b).
(b) Added description of how site-specific TPH cleanup levels are to be calculated.
(c) Added description of "modified" Method B and a list of what changes can be made to the default assumptions in standard Method B to derive site-specific Method B cleanup levels.
(d) Added a statement that changes to the reasonable maximum exposure scenario and default exposure assumptions can be made as part of a quantitative SSRA for demonstrating the protectiveness of a remedy and provides cross-references to appropriate provisions.

Subsection (5) – Method C cleanup levels for potable ground water.
(a) Deleted current description on Method C cleanup levels can be used and how they are to be developed and replaced with discussion providing for "standard" and "modified" Method C and statement that only sites qualifying for use of Method C under Section 706 can use this method.
(b) Added description of how to develop standard Method C ground water cleanup levels.
(i) Identifies ARARs.
(ii) Describes when surface water beneficial uses must be protected.
(ii) Through appropriate cross-references, identifies the methods and default assumptions to be used in equations 720-1, 720-2 and 720-3 when calculating Method C ground water cleanup levels.
(c) Describes Modified Method C and, by cross-reference, that the same limitations and adjustments for Modified Method B apply to Modified Method C.
(d) Describes how Modified Method C can be used for demonstrating the protectiveness of a remedy and provides cross-references to appropriate provisions.

Subsection (6) – Cleanup Levels for nonpotable ground water
(a) Provides explanation of when nonpotable ground water cleanup levels can be used.
(b) Allows for the use of potable ground water cleanup levels or a SSRA to establish cleanup levels.
(i) Requires SSRA to comply with WAC 173-340-702 and 173-340-708 and that all potential exposure pathways be evaluated. (A) through (F) describe conditions a Method B SSRA must meet.
(ii) Describes applicability and requirements for Method C SSRA.
(iii) Establishes limitations for SSRA including notification requirements and when institutional controls are required.

Subsection (7) – Adjustments to Cleanup Levels
- Reworded statement on when ARARs must be adjusted.
- Added statement on how PQLs and natural background get factored into cleanup levels.
- Added free product limitation.

Subsection (8) – Point of Compliance
(b) & (c) Added a distinction between a "standard" and "conditional" point of compliance.
(c) Added cross-reference to the remedy selection process.
(d) Added discussion of 3 types of off-property point of compliance.

(d)(i) Modified to apply to sites abutting surface water. Includes two added and one modified conditions:
(A) A demonstration that the contamination is entering the surface water and will continue to do so after remediation.
(B) A demonstration that it is not practicable to meet the cleanup level prior to the ground water entering the surface water.
(F) Monitoring requirement modified to require both ground water and surface water monitoring. Also, deleted former reference to inhalation correct factors – moved to subsection (2).
(G) Added requirement to notice natural resource trustees, WA State DNR and CORPS.
d)(ii) Added provisions allowing a conditional point of compliance within surface water for site near, but not abutting, surface water. Includes a requirement that affected property owners must agree.
(d)(iii) Added provisions allowing an off property conditional point of compliance in cases of area-wide contamination, provided certain conditions are met.
(e) Added provisions providing for the use of ground water monitoring wells in place of surface water monitoring.

Subsection (9) – Compliance Monitoring
(a) Added requirement that ground water monitoring be done to demonstrate compliance. Also, that surface water analysis, bioassays or other biomonitoring may be required where the ground water cleanup level is based on the protection of surface water.
(b) Minor editing changes.
(c) & (d) Restructured and updated to reflect Ecology's current statistical guidance including:

- An assumption that sampling data are lognormally distributed and citation of various statistical methods for rejecting this assumption and determining the upper confidence limit.
- Allowance for exceedance to the 2 times and 10% rules when the cleanup level is based on background, to control false positive error rates at 5%.
- New methods for handling data sets with a lot of values below the PQL.

10.1 General (WAC 173-340-720(1) through (2))

GQ 10.1.1
Why was WAC 173-340-720(1)(d)(v) changed to remove discussion of the point of compliance for ground water discharging to surface water?

(268, 687, 2178)

Response:
This is an existing rule requirement, moved to this location from previous WAC 173-340-720(4). The point of compliance aspect of this statement was removed because how the point of compliance is to be determined when ground water is flowing into surface water is addressed in detail in subsection (8). It should be noted that this issue was subject to considerable debate by

the PAC and addressed specifically by their recommendations, which have been incorporated into subsection (8).

GQ 10.1.2
Why has protection of ground water for drinking water use been selected as the reasonable maximum exposure?

(688, 709, 710, 721, 918, 1071, 1190, 2123, 2361)

The 2000 proposal retains the approach adopted in the current rule and reaffirmed in the 1999 proposed rule amendments. Under WAC 173-340-720(2), ground water is classified as potable for protection of drinking water beneficial uses unless it can be demonstrated that the ground water is not potable. The requirements and criteria for making that demonstration are provided in WAC 173-340-720(2). If that demonstration cannot be made, then ground water cleanup levels must be established under WAC 173-340-720(3), (4) or (5), as applicable, to protect drinking water beneficial uses. If that demonstration can be made, then ground water cleanup levels may be established under WAC 173-340-720(6) to protect beneficial uses other than drinking water.

Several commentors objected to the presumption that ground water cleanup levels be based on the presumption of drinking water beneficial use. For example, Riley, stated the following:

> Foundational to the problems in the proposed amendments is the very limited ability to evaluate and use realistic exposure scenarios in establishing cleanup levels. MTCA (and the ASTM RBCA) provides for the use of Reasonable Maximum Exposure (RME) scenarios based on estimates of current and future resource uses. However, MTCA subsequently establishes that groundwater use as drinking water will be the RME at most sites, allowing for only very limited exceptions. The criteria for demonstrating that groundwater is not a reasonable current or future source of drinking water are very narrowly defined and result in the over-classification of a number of groundwater resources. This stipulation of almost all groundwater as drinking water is over-conservative and is inconsistent with the RME definition of "reasonably expected to occur at a site under current and potential future site use. This is particularly true given the current understanding of attenuation processes and the natural degradation of petroleum compounds over time.

And Aldrich:

> Although the development and use of site-specific risk assessment is addressed in Subsection -708, in application the rule does not facilitate the use of a realistic evaluation of potential risks in making remedy selection decisions. In the case of groundwater, for example, the regulation stipulates that the RME for groundwater use will be drinking water at almost all sites, with only a few limited exceptions. By restricting the ability of a party to establish a site-specific RME based on the presence of non-drinking water, the rule effectively restricts the integration of a site-specific risk assessment. This is contrary to the intent of the legislature and the PAC.

Response:
As explained in WAC 173-340-720(1), ground water cleanup levels must be based on estimates of the highest beneficial use and the reasonable maximum exposure expected to occur under both current and potential future site use conditions. Ecology is not proposing to change the current rule language stating that at most sites use of ground water as a source of drinking water is the

highest beneficial use requiring the highest quality of ground water and that exposure to hazardous substances through ingestion of drinking water represents the reasonable maximum exposure.

Ecology disagrees that the PAC intended to change this presumption. This was an issue that was discussed during the deliberations of the MTCA Policy Advisory Committee and there was no recommendation made to change the current rule. Furthermore, such a change would not meet MTCA's goal of protecting human health and the environment and would be inconsistent with the State's water laws and public values that emphasize protection of ground water. This is especially true given the current difficulty of securing water rights.

The MTCA Cleanup Regulation does provide, however, a level of flexibility when establishing a conditional point of compliance ground water cleanup levels, by allowing the establishment of cleanup levels to protect beneficial uses other than drinking water if certain conditions are met, and when evaluating the protectiveness of a remedy. This flexibility does reflect the PACs goal of allowing greater use of site-specific risk assessment in contaminated site cleanup.

Moreover, even if ground water is classified as a potential future source of drinking water under WAC 173-340-720(2), Ecology recognizes that there may be sites where there is an extremely low probability that the ground water will be used for that purpose because of the site's proximity to surface water that is not suitable as a domestic water supply. An example of this situation would be the shallow ground waters in close proximity to marine waters such as on Harbor Island in Seattle. At such sites, Ecology may allow ground water to be classified as nonpotable for the purposes of WAC 173-340-720 if each of the stated conditions can be demonstrated. This scenario is defined in the current rule and has been reaffirmed in the proposed rule amendments (see WAC 173-340-720(2)(d)).

GQ 10.1.3
Is it appropriate to protect ground water beneath industrial properties for potential drinking water use?

(1059, 1060, 1405, 1406, 1409)

Two commentors expressed the opinion that ground water cleanup levels should not be established to protect drinking water beneficial uses at commercial and industrial sites.

Response:
Ground water cleanup levels are based on the potential productivity of the aquifer underlying a site, independent of the surface land use. Contrary to the suggestion, many commercial and industrial areas throughout the state are underlain by highly productive aquifers. Examples include the Airdustrial Park area in Tumwater, the Nalley Valley in Tacoma, Ponders Corner in Lakewood, the Spokane Valley sole source aquifer, and municipal water supply wells for the Cities of Vancouver, Richland and Union Gap. This is also apparent from the number of public water systems that have become contaminated by nearby industrial and commercial sites. Furthermore, given the difficulty of securing water rights, water utilities are taking a second look

at areas that were previously thought of be unsuitable for drinking water sources. For these reasons, the proposed rule retains the approach adopted in 1991 as part of the current rule.

GQ 10.1.4
Is it the intent of WAC 173-340-720(2)(b)(i) to result in ground water being classified as non-potable in urban areas?

(679, 886, 1126)

Several commentors suggested that in urban areas already served by public water supply it should not be necessary to protect the ground water for drinking water use. One commentor even suggested that it is not possible to obtain a permit to drill a well in King County and thus the requirement to protect ground water for drinking water beneficial uses shouldn't apply in the county. During the rule-making process others have suggested that WAC 173-340-720(2)(b)(i) is meant to imply ground water can be considered non-potable in areas where well setback or construction requirements can't be met.

Response:
WAC 173-340-720(2)(b)(i) is existing language that is not being altered by these rule amendments. In reviewing the Responsiveness Summary for the 1991 rule, there is nothing to suggest that this provision was intended to result in ground water being classified as non-potable in urban areas served by public water supplies and areas where well setback or construction requirements can't be met.

Construction of wells is not always prohibited in urban areas. Where it is prohibited, ordinances and regulations governing the siting and construction of wells often change and variances to these requirements can be granted. As water rights become increasingly more difficult to secure, water utilities are taking a second look at areas that were previously thought of be unsuitable for drinking water sources. Even if the water in these areas doesn't meet drinking water standards, it may be feasible to treat the water for drinking water use, and the cleaner the water is to begin with, the less it will cost to treat for use. In response to the comment regarding King County, Ecology staff contacted our Bellevue office to determine if well permits were being issued in King County. They indicated that there is no prohibition on drilling wells in King County and many exempt wells continue to be drilled.

GQ 10.1.5
Is it the intent of WAC 173-340-720(2)(b)(ii) to result in areas that do not meet drinking water criteria to be determined to be non-potable under MTCA?

(686)

One commentor suggested that if ground water at a site doesn't meet drinking water standards, the ground water should be considered non-potable under MTCA.

Response:

WAC 173-340-720(2)(b)(ii) is existing rule language that was edited for clarification, not to change its intent. Note that it is not the intent of WAC 173-340-720(2)(b)(ii) to result in areas that cannot meet drinking water criteria to be considered non-potable. Even aquifers that have naturally occurring inorganic contaminants above drinking water standards can often be treated for use. For example, removal of naturally occurring iron is common practice. This provision is intended to address areas where the natural water quality is so poor relative to other available sources that it is not even practical to treat the ground water for use.

Ecology disagrees with the suggestion that this criterion be expanded to encompass areas contaminated by human activities. This would create an incentive to pollute ground water and, even if the natural water quality is marginal, would complicate the removal of naturally occurring contaminants, making it more expensive to treat the ground water for use.

GQ 10.1.6
What is the intent of the criterion specified in WAC 173-340-720(2)(c)?

(972, 1410, 2055)

Two commentors asked for further clarification of WAC 173-340-720(2)(c). Belcher, for example made the following comment:

> This section also states (in 3c) that Ecology has to determine that it is "unlikely that hazardous substances will be transported from contaminated ground water that is a current or potential source of drinking water." Yet, Ecology has not clarified how such a determination will be made. ATA suggests that Ecology consider using the modeling or empirical demonstration performed under section 173-340-747 (7), verifying that no non-aqueous phase liquid ("NAPL") will reach ground water, for making this determination. Ecology should not tie this determination to the "Residual Saturation" concept in Section 173-340-747 (9)…

And Graves:

> WAC 173-340-720(2)(c)(iii) section indicates “The likelihood of inter-connection between the contaminated ground water and the ground water that is a current or potential future source of drinking water due to well construction practices in the area of the state where the site is located.” It is unclear what role regional well construction practices have on identifying the likelihood of inter-connection. We suggest that Ecology identify more defined procedures based on hydrogeologic principles for evaluating the potential for inter-aquifer communication. These procedures are necessary to develop consistency in application of this section.

Response:
WAC 173-340-720(2)(c)(iii) is existing rule language that was edited for clarification, not to change the intent, in the proposed rule amendment. This provision is intended to insure that if an aquifer is classified as nonpotable under MTCA and contamination allowed to remain, the contamination will not migrate to a deeper or adjacent aquifer that is potable. In many cases this will depend on the natural connectivity of the two aquifers, as determined by hydrogeologic studies. However, in some cases, abandoned or poorly sealed wells could result in interconnections between aquifers that would not be expected based on natural conditions.

With regard to the suggestion that this determination be tied to residual saturation, Ecology disagrees. Dissolved phase transport of contaminants, not bulk flow of hydrophobic substances, is likely to be the predominant transport mode in these situations. However, if significant amounts of non-aqueous phase liquids are present at a site, movement of free product may need to be considered in an analysis demonstrating compliance with this provision.

GQ 10.1.7
Are the revisions to 720(2)(d) intended to substantially alter the current so-called "Harbor Island" exemption?

(679, 746, 970, 2053, 2237, 2239, 2396, 2426, 2486, 2613)

In comments on earlier drafts of the rule amendments, further clarification was requested of what is meant by WAC 173-340-720(2)(d) that there is an "extremely low probability" of ground water use. One commentor suggested that areas subject to salt water intrusion should be included. In response to these comments, Ecology added a criterion that states that for a site to qualify for this exemption, it has to be demonstrated that "The groundwater is sufficiently hydraulically connected to the surface water that the ground water is not practicable to use as a drinking water source. Several commentors expressed concern about this added requirement, indicating it could potentially conflict with studies of the lower Duwamish River area and other areas to define the ground water as nonpotable. For example Baker stated the following:

> Recent revisions to the MTCA regulations in WAC 173-340-720(2)(c) are unnecessarily restrictive in regards to a nonpotability demonstration. In particular, the restriction under 720(2)(c)(iv) requires that, for a nonpotable determination, it must be shown that "The groundwater is sufficiently hydraulically connected to the surface water that the groundwater is not practicable to use as a drinking water source."
>
> This requirement essentially eliminates the ability to use surface water standards on any properties that are not immediately adjacent to the surface water body. When groundwater is not a current or future source of drinking water, and the groundwater discharges to a surface water body, it is reasonable to use surface water standards….

And Nordstrom

> This criteria, inserted in the most recent version of the proposed amendments, makes it all but impossible for a determination that a site's groundwater beneficial use is as recharge to surface water, unless the site is actually adjacent to surface water. This is contrary to the formerly purported message that the revisions would be favorable to brownfields redevelopment efforts and help cleanups to occur in areas where cleanups might otherwise never be started. In the Duwamish Industrial area, for instance, it is not reasonable to assume that groundwater will be used as a source of drinking water. Cleanups in that area should take into account recharge to the Duwamish River as the highest beneficial use. However, given the permeable aquifer in the area, no sites other than those abutting the surface water would be able to obtain a determination that the water is non-potable. This places an undue burden on industry trying to cleanup sites, and encourages responsible parties to walk away from impacted sites.

In addition, the Port of Seattle requested clarification if waivers could be granted to this criterion and (ii) which requires definition of "known or projected points of entry of the ground water into the surface water".

Response:
The provisions in WAC 173-340-720(2)(d) were edited and revised in the 2000 proposal to make this criterion fit with the other revisions in this Section. As noted above, the "sufficiently hydraulically connected" criterion was added in response to earlier comments during the rule-making process to further clarify when this exemption could be applied to a site.

In reviewing the 1991 Responsive Summary discussion of this criterion, it is apparent that these provisions were primarily intended to address ground water in areas in close proximity to salt water and to surface waters with marginal water quality. This also reflects how Ecology staff have used this provision over the years. It is fully expected that ground water in areas subject to salt water intrusion or near surface water of marginal water quality would continue to qualify for this exemption. In areas like the lower Duwamish and the Tacoma Tideflats, this is likely to include areas well removed from the open harbor areas because of tidal influence.

With regard to the Port's request for a waiver to these provisions, there are no such waiver provisions in the current or proposed rule amendments. Each site is required to make a demonstration that it meets these and other criteria. This was recognized in the studies of the lower Duwamish area ground water and is not a new requirement.

GQ 10.1.8
Why have the secondary maximum contaminant levels been deleted as an applicable requirement under WAC 173-340-720?

(473)

Response:
The federal secondary maximum contaminant levels were deleted as an applicable standard based on a comment on an earlier draft of the rule. That comment pointed out that these part of the federal drinking water standards were advisory and did not establish enforceable standards. While this particular reference has been deleted, it should be noted that, except for the federal odor standard, the secondary MCLs are incorporated into the State Department of Health's regulations for public water supplies. Since the State's standards remain an applicable state law, they are still considered applicable standards under MTCA.

10.2 Cleanup Levels (WAC 173-340-720(3) through (7))

GQ 10.2.1
What is the technical basis for an inhalation correction factor of 2? Shouldn't this factor be zero for nonvolatile chemicals?

(891)

One commentor asked for the basis for the inhalation correction factor of 2. He also suggested that for nonvolatile chemicals, this factor should be zero, not 1.

Response:
The inhalation correction factor of 2 for volatile chemicals is an existing rule requirement that is not changed by these rule amendments. It is intended to take into account exposure to hazardous substances, which are volatilized and inhaled during showering and other domestic activities. The basis for this assumption was discussed in the 1991 Responsiveness Summary. This assumption is consistent with USEPA guidance (U.S. EPA, 1991a, 1998b)

As for nonvolatile chemicals, an inhalation correction factor of 1 means that just ingestion contributes to the dose received, not volatilization. From a mathematical perspective, if zero was used for this factor, it would not be possible to calculate a cleanup level, since that would put zero in the denominator of the equation.

GQ 10.2.2
Since there is no reference dose or cancer potency factor for lead and mercury, what is the Method B cleanup level for these substances?

(397)

Response:
It is correct that there are no references doses or cancer potency factors currently readily available for lead and mercury. For lead, the maximum contaminant level goal of zero (adjusted to natural background) would be the relevant standard used under Methods B and C. For mercury, the drinking water standard (0.002 ug/l for mercury) would be the relevant standard used under Methods B and C.

GQ 10.2.3
In equation 720-3 and similar petroleum mixture equations, what does "n" mean?

(475, 2313)

Two comments were received on this issue. Allen had the following comment:

> What specifically is meant by "petroleum fractions and volatile hazardous substances" (WAC 173-340-720(4)(b)(ii)(C) ? Are these the different equivalent carbon numbers reported in the volatile petroleum hydrocarbons (VPH) and extractable petroleum hydrocarbons (EPH) analytical methods?

And from the POG:

> POG members are receiving analytical data from the labs in a format that displays EPH concentrations, VPH concentrations, and the volatile organic compound concentrations (as indicators) below. The definition of n above suggests that to compute the Hazard Index, one must sum the EPH plus the VPH plus the indicators. However, ethylbenzene and xylenes in the C8-C10 range would be double counted, potentially overestimating the HI. The POG understands that defining n is complex. We request Ecology's clarification and assurance that the definition of n above does NOT restrict the user from subtracting double counted chemicals. This definition of n and the manipulation of these risk equations underscores the need for TPH guidance.

Response:
The term "n" is defined in the explanatory notes to these equations as:

> n = The number of petroleum components (petroleum fractions plus volatile hazardous substances with a reference dose) present in the petroleum mixture.

The petroleum fractions are those fractions listed in table 747-4 and measured using "Analytical Methods for Petroleum Hydrocarbons", Ecology publication # ECY 97-602, June, 1997. This includes both VPH and EPH fractions. Where there is an overlap in the equivalent carbon fractions in the VPH and EPH methods, the higher of the two should be assigned to that fraction.

For individual volatile hazardous substances that can be identified in the petroleum mixture, only those substances with a reference dose are included separately in the calculation (for example, benzene, toluene, ethyl benzene, xylene, hexane and naphthalene). This is because, while they could be included with the corresponding equivalent carbon fraction, the reference dose assigned to that particular fraction may over or under represent the toxicity of that substance.

Where these substances are measured separately, they need to be subtracted from the corresponding equivalent carbon fraction. For example, the amount of ethyl benzene and xylene must be subtracted from the EC >8-10 fraction to avoid double counting of these substances in the calculation.

GQ 10.2.4
Do the MCLs for iron and manganese and other naturally occurring metals need to be met in the ground water for petroleum releases?

(559, 747, 1272, 2405)

Two commentors expressed concern that the statement in WAC 173-340-720(4)(b)(iii)(C) could result in sites finding it very difficult to establish a Method B cleanup level because of naturally occurring iron and manganese concentrations. It was suggested that a statement be added to this provision addressing naturally occurring background concentrations.

Response:
When petroleum mixtures degrade, they cause a reducing condition to occur within the ground water. This reducing condition typically causes naturally occurring metals in the aquifer material to come into solution and be present in the ground water in excess of drinking water standards and sometimes in excess of surface water standards. Typically this manifests itself as elevated concentrations of iron and manganese and, sometimes other naturally occurring metals, such as arsenic (U.S. EPA, 1999; Borden et. al, 1995). Thus, when developing a petroleum mixture cleanup level under Method A or B to protect the ground water for drinking water use, it is not enough to develop a cleanup level that addresses the toxic components of the petroleum mixture if degradation the residual petroleum components will render the water unusable.

Ecology acknowledges it may not be easy to make the demonstration required under WAC 173-340-720(4)(b)(iii)(C) where elevated metal concentrations are due to high natural background concentrations. In response to this concern, an allowance for this has been added into the final rule by amending this provision as follows:

> A total petroleum hydrocarbon cleanup level for petroleum mixtures derived using Equation 720-3 shall be adjusted when necessary so that biological degradation of the petroleum does not result in exceedances of the maximum contaminant levels in chapter 246-290 WAC or natural background, whichever is higher.

GQ 10.2.5
Why is a site-specific risk assessment required when deriving a cleanup level for non-potable ground water?

As noted earlier, for nonpotable ground water, the two options provided for establishing a cleanup level are using the drinking water cleanup levels or using a site-specific risk assessment to establish cleanup levels. Two commentors expressed concern about this approach. For example, Riley stated the following:

> The proposed MTCA amendments contain only a very limited ability to establish cleanup levels based on non-drinking water RMEs. Further, establishing cleanup levels based on non-drinking water utility is technically complex. For example, the establishment of cleanup levels for non-potable groundwater requires the use of a site-specific risk assessment . By comparison, the ASTM RBCA provides for Tier 1 cleanup levels for both soil and groundwater based on a variety of exposure pathways including ingestion, direct contact, and transport to other media. This results in a system that is more useable for all sites.

Response:
Under the current regulation, a cleanup level for non-potable ground water must be established to protect the beneficial uses of ground water. If the drinking water standards are not used and no standard exists for these beneficial uses, then a standard must be set on a case-by-case basis using a site-specific risk assessment to determine the appropriate standard. This does not change under the proposed rule amendments. What the amendments do is provide more detail on the use of a site-specific risk assessment.

Note that under MTCA, it is not sufficient to ignore potential ground water exposure pathways when it is determined that the ground water is non-potable. While drinking the water may no longer be a concern, there are many other potential pathways that could result in exposure to contaminants in the ground water. For example, while the ground water may not be suitable for drinking water use, it may be suitable for irrigation or use in industrial processes. If the contamination is likely to reach surface water, then potential surface water impacts will need to be considered. The potential for vapor impacts on occupants of buildings over the area of ground water contamination may also need to be considered. In cases of shallow ground water, exposure to construction and maintenance workers may be a concern or exposure to ground water removed by construction dewatering systems or foundation drains may need to be considered. While at some sites it may turn out that these other exposure pathways are inconsequential, that cannot be assumed until an evaluation is completed as part of a site-specific risk assessment.

GQ 10.2.6
Why is a public notice required when a site-specific risk assessment is being used to derive a cleanup level for nonpotable ground water?

(270)

One comment was received regarding the public notice requirement for nonpotable ground water in WAC 173-340-720(6)(c)(iii)(A). Gillett stated the following:

> …There is no apparent reason why the notice provisions under WAC 173-340-600 are inadequate with respect to this matter. Has Ecology experienced any problems with the notice requirements under the current provision? This special notice provision seems unnecessary. In addition, it is not clear who is required to re-ceive this special notice. The provision refers to property owners, local governments and water purveyors with jurisdiction in the area who are potentially affected by the proposal. How are property owners, local governments or water purveyors potentially affected by a contaminant that is located in ground water if it is not practicable for them to use that ground water for reasons wholly unrelated to the contamination?

Response:
This notice is intended to fulfill the PAC recommendation that the potentially affected community be invited to participate in decisions at sites where use of a site-specific risk assessment could impact future site or resource use. A notice separate from the normal public participation process provided for in WAC 173-340-600 is provided for here because the outcome of this public process could affect what alternative remedies are considered in the feasibility study, when a public notice is typically issued. It is also intended to insure that independent remedial actions follow this notification procedure.

GQ 10.2.7
Why has a limitation on non-aqueous phase liquid been added as a limitation to the ground water cleanup levels?

(72, 96, 128, 267, 476, 748, 749, 1192, 1272, 2177, 2223, 2257, 2289, 2406, 2407)

Several commentors expressed concern about adding the limitation to ground water cleanup levels in WAC 173-340-720(7)(d) that they not result in the formation of free product in or on the ground water. The primary concern expressed by several commentors was that the requirement be limited to "measureable" free product. Others suggested that this limitation only apply at the property boundary. Still others expressed concern with a presumption in the 1999 proposal that solubility limit could be used as a way of demonstrating compliance with this standard because of the difficulty of determining solubility limit for chemical mixtures.

Response:
The free product limitation was added when it became evident during the POG discussions that a site-specific risk assessment for petroleum contamination could result in establishing cleanup levels that exceed the solubility limit, resulting in a separate phase of petroleum product within

the ground water. While not specifically recommended by the POG, Ecology has included this limitation on cleanup levels for all hazardous substances. The reason for including this limitation is that ground water with a separate phase of pure product on or in it is not protective of human health and the environment and, if it reached surface water, would result in a violation of federal water quality law (40 C.F.R. Part 110). This law applies to both petroleum and non-petroleum oils.

At the POG's earlier recommendation, this provision was moved to subsection (5) to cover all methods for setting cleanup levels. From a drafting perspective, placing this limitation in subsection (5) avoids having to repeat this statement for each method of calculating cleanup levels. In a subsequent comment the POG indicated that it was unlikely that the proposed Method A cleanup levels would be high enough to violate this standard, and suggested it apply to only Methods B and C. Ecology agrees it is unlikely that any Method A value will result in the formation of free product on the ground water but we have decided to keep this limitation in the final rule since this is an appropriate safeguard to prevent this from occurring.

With regard to concerns with use of the solubility limit to determine compliance with this limitation, this presumption was removed in the 2000 proposal. While it was removed, Ecology still believes this can be a useful tool for screening calculated cleanup levels and plan to address this in future guidance.

Finally, Ecology does not agree this standard should be "measurable free product". The policy being conveyed by this limitation is that a cleanup level cannot exceed a concentration that would result in the formation of any NAPL in or on the ground water, as that would not be protective of human health and the environment. While removing measurable free product is an expected minimum outcome of any remedy, it would not restore the ground water to a useable condition. Because several commentors appear to be associating the term "free product" with "measurable", that term has been changed to NAPL in the final rule. This is to more clearly distinguish between the requirements for cleanup levels and the minimum remediation requirement to removed free product to the maximum extent practical in WAC 173-340-360(2)(c)(ii)(A).

10.3 Point of Compliance (WAC 173-340-720(8))

GQ 10.3.1
Why is the application of "all practicable methods of treatment" a precondition to the use of a ground water conditional point of compliance?

(715, 717, 724, 872, 888, 894, 1297)

Several commentors expressed concern that the rule contains a requirement that "all practicable methods of treatment" be met before a conditional point of compliance can be used. Some indicated they believed this was inconsistent with PAC recommendations. Others indicated they

believed this will require an analysis that goes beyond demonstrating the use of "treatment to the maximum extent practicable" and that this will be particularly onerous.

Response:
The requirement is existing rule language and was not proposed to be changed by the amendments. The PAC did not recommend this specific provision be changed.

In reviewing the 1991 Responsiveness Summary discussion relative to this provision, this provision is intended to create a bias towards use of permanent remedies rather than simply moving the point of compliance to demonstrate compliance. Since use of permanent remedies is still a statutory requirement, Ecology sees no reason to eliminate this pre-condition.

As for the level of analysis required to demonstrate compliance with this provision, this has not been an issue to date and we do not anticipating this being an issue in the future under the amended rule.

GQ 10.3.2
Why must it be demonstrated that it is not practicable to meet the ground water cleanup level "throughout the site" before a conditional point of compliance can be used?

(274, 923, 975, 2056, 2121, 2179)

In the 2000 proposal, Ecology made some adjustments to the opening paragraph introducing the conditional point of compliance WAC 173-340-720(8)(c). This paragraph requires users to demonstrate that it is not practicable to meet the cleanup level throughout the site within a reasonable restoration timeframe before using a conditional point of compliance. Some commentors interpreted this as adding a new requirement. Others suggested the requirement was inconsistent with a risk-based approach to cleanup. Still others requested clarification if Ecology was intending some additional process beyond the remedy selection process to make the required demonstration.

Response:
The requirement that a site meet the ground water cleanup level throughout the site for the ground water to be considered clean is an existing requirement, and is an appropriate starting point for any remedy selection analysis. The added language in this provision is not intended to be substantive but rather clarify the relationship between the remedy selection process and the process for establishing a conditional point of compliance. As under the current rule, it is anticipated that this demonstration can be made through the remedy selection process and no additional evaluation process is anticipated.

GQ 10.3.3
Is the reasonable restoration timeframe in WAC 173-340-720(8)(c) different from the same term used in WAC 173-340-360?

(893)

Response:
The term reasonable restoration timeframe, as used in WAC 173-340-720(8)(c) is not intended to imply a different process than that described in WAC 173-340-360.

GQ 10.3.4
Why is application of institutional controls not sufficient to obtain an off-property point of compliance?

(1193, 2483)

Two commentors requested that the rule be amended to allow use of an off-property point of compliance as long as institutional controls are in place to prevent use of the ground water. Boyd, for examples stated the following:

> The proposed changes to the regulation include options for a conditional groundwater point of compliance to be off-property in three cases: sites abutting surface water, sites near surface water, and an area-wide point of compliance. The proposed changes exclude one case where an off-property point of compliance may, in some situations, be appropriate. For sites where the person conducting the cleanup can assure that institutional controls are implemented to prevent use of groundwater and where the affected property owners agree, a conditional point of compliance off of the property should be allowed even if the groundwater does not discharge to nearby surface water.

Response:
The conditions for use of an off-property point of compliance were specifically addressed by the PAC and resulted in the addition of WAC 173-340-720(8)(d)(ii) and (iii). Changing this process to allow the automatic deferral to institutional controls would not be consistent with the statutory requirement for selecting remedies that are "permanent to the maximum extent practicable". Also, because ground water is a resource of the State, Ecology cannot delegate its statutory obligation to protect the State's ground water resources to private property owners.

GQ 10.3.5
Why is there a requirement in WAC 173-340-720(8)(d)(i)(F) to perform monitoring to assess potential bioaccumulation problems resulting from ground water discharges to surface water below method detection limits in the surface water?

(790)

Newlon had the following comment on this provision:

> Why would anyone have to conduct any type of testing on a chemical below the MDL? This reference to bioaccumulation had been deleted (strike through) from the 12/14/98 draft of the rule and now it's back in this draft. The Port believes this requirement is so unusual and difficult to comply with that it should be deleted.

Response:

This is an existing requirement, edited somewhat to tie this monitoring requirement better with the compliance monitoring provisions in WAC 173-340-410. Note that this requirement applies only if the point of compliance is within the surface water. This provision exists because as the ground water seeps into the surface water, contaminants can become highly diluted, yet even highly diluted chemicals within a surface water body can bioaccumulate and affect aquatic life. Ecology acknowledges that at sites where there are multiple sources of similar contaminants it may be difficult to determine what is causing the bioaccumulation of chemicals in aquatic life. Never the less, it doesn't remove the obligation to monitor to see if the remedy is protecting human health and the environment.

GQ 10.3.6
Why is there a prohibition on the use of a mixing zone to demonstrate compliance with surface water cleanup levels when using a conditional point of compliance within the surface water?

(1132, 1133, 1134)

One person commented on this provision. Kenefick, among other comments, stated the following:

> …the lack of dilution zones will lead to absurd results. Consider, for example, a site with groundwater that exceeds surface water quality standards. Cleanup of the groundwater would be required regardless of the total amount of hazardous substances flowing into the surface waters and the total flow of the receiving surface water. Groundwater flowing at a rate of one ounce per day into the Columbia River would have to be cleaned up if it exceeded the surface water quality standard at the groundwater surface water interface. (Given that the sampling would occur "as close as technically possible" to the point of entry, there is no telling how close Ecology would require the sampling to occur.) The total loading of the substance would be trivial and any further reductions would not reduce risks to human health and the environment.

Response:
This is an existing requirement that was not proposed to change by these rule revisions (other than updating the reference and terminology). The reasons for not allowing the use of dilution zones (mixing zones under the rule amendments) were stated in the 1991 Responsiveness Summary as follows:

> Ecology believes that the use of surface water "mixing" or "dilution" zones for ground water discharges from contaminated sites is inappropriate. We believe it would be inappropriate to allow such mixing zones at contaminated sites for the following reasons:
>
> It is generally technically possible to eliminate ground water discharges to surface waters through the use of cutoff walls and/or ground water pumping;
>
> There appears to be no direct public benefit that will result from the approval of a dilution zone; and

> Ground water discharges are very difficult to measure and quantify due to the heterogeneous nature of ground water flow systems and the interface with the surface water body.

1991 RS, Chapter XVIII, Issue #9, p. 221. Also, it should be noted that ground water discharges to surface water are unique in that the discharge seeps out the bank or through the bottom sediments into the surface water body. These are very sensitive zones with an abundance of aquatic life with the potential to be exposed to contamination before dilution can occur.

GQ 10.3.7
Why is AKART included as a condition for using a conditional point of compliance within the surface water body?

(354, 570, 715, 723, 725, 726, 1358, 2224, 2376, 2378, 2379, 2455)

Three commentors requested that the requirement that "all known and reasonable methods of treatment" (AKART) be removed from the rule, citing a PAC recommendation. In contrast, two other commentors indicated that this provision should remain intact.

Response:
The requirement that ground water discharges to surface water be subject to AKART is an existing rule requirement that is not proposed for change under these amendments. The PAC as part of their recommendations, did not specify that AKART be removed but rather directed Ecology to evaluate whether this requirement is necessary in light of the remedy selection revisions.

Ecology has reviewed the requirement for application of AKART and has retained the requirement because AKART is an ARAR. We believe continued application of AKART as a precondition to use of a conditional point of compliance within surface water is consistent with water quality law. Consistent with the PAC recommendation, Ecology intends to develop guidance on how to conduct an AKART analysis at a cleanup site in conjunction with MTCA's remedy selection requirements.

GQ 10.3.8
Can monitored natural attenuation be used to demonstrate compliance with AKART?

(974)

Response:
The intent behind the requirement to apply AKART is to emphasize use of technologies to treat or contain contamination to minimize discharge of contaminants to surface water. Ecology's expectation for the use of natural attenuation is articulated in WAC 173-340-370(7).

GQ 10.3.9
What is the intent of WAC 173-340-720(8)(d)(i)(E) requiring ground water discharges to not result in violations of sediment quality values?

(270, 788, 2417)

Newlon raised the following concern regarding this provision:

> Although the Port agrees that sediments should not be impacted by contaminated ground water that enters surface waters, we are concerned that this new language will be interpreted to require that PLPs "prove the negative" in a context where absolute proof will require unnecessarily elaborate and expensive modeling and sediment sampling. In very many instances, ground water discharges occur through sediment that has been contaminated due to surface sources such as point source industrial discharges or CSOs. This type of contamination is especially common in urban waterways. This ubiquitous background contamination makes proof that ground water discharges will not cause an exceedance very difficult to obtain. We would also like to posit that it is unlikely that sediments are being contaminated if the ground water that flows into surface waters does not exceed surface water cleanup levels. If Ecology has reason to believe that the surface water standards are not adequate to protect sediment quality, then perhaps the surface water standards should be more restrictive. For purposes of MTCA cleanup approvals, we recommend changing this provision to simply state that use of surface water standards is not permitted if the department determines that use of such standards will cause a violation of surface water or sediment cleanup level.

Another commentor raised a similar concern.

Response:
The comment refers to existing rule language and addresses an issue that is beyond the scope of the rule-making action. Note that Ecology believes it is appropriate for the burden of proof to remain with the person conducting the remedial action to demonstrate the conditional point of compliance will not cause a violation of sediment quality values as this is consistent with water quality permitting. Furthermore, just because the water meets water quality standards does not mean the sediments will be clean. For example, organic chemicals can absorb to the organic carbon in the sediment and build up to toxic levels. This is especially true since contaminated ground water would be seeping through the sediments as it discharges to the surface water.

GQ 10.3.10
Why is there a requirement that for sites near, but not abutting, surface water, an agreement with affected property owners must be reached before a conditional point of compliance can be approved?

(325, 481, 1093, 1136, 2371)

Response:
For sites that are near but not abutting surface water, WAC 173-340-720(8)(d)(ii) requires that affected property owners must agree to the approval of a conditional point of compliance. This condition is included because it was part of the PAC recommendations. Ecology believes this condition also is appropriate because the affected property owner's water rights or land value could be adversely affected by the contamination. One commentor asserted that requiring

affected property owners permission is a delegation of Ecology's statutory authority and thus cannot be done. Ecology disagrees. This is not a delegation of Ecology's authority since the decision on whether to grant a conditional point of compliance is ultimately Ecology's decision and is subject to meeting several conditions, not just obtaining approval from affected property owners.

GQ 10.3.11
In WAC 173-340-720(8)(d)(ii), why isn't the point of compliance allowed to extend beyond the current extent of contamination?

(970, 2057, 2717)

Nordstrom raised the following concern regarding this provision:

> The section refers back to criteria in (d)(i) of this section. This is contradictory since some of the criteria in (d)(i) specifically apply to sites abutting surface water, while this section [(d)(ii)] applies to sites not abutting surface water. For instance, under 173-340-720(8)(d)(i)(A) you must demonstrate that contaminated groundwater is entering the surface water. It seems illogical that to consider a conditional point of compliance for a non-abutting-surface water site that one MUST have impacted surface water. If the site is not abutting surface water, it would make sense that the impacted groundwater might not have reached the surface water yet. If this criteria is left in place, it would be beneficial to a PLP to wait to clean up a site until this condition is met. Further, the paragraph under (d)(ii) goes on to say that "if the contamination has not yet reached the surface water..." indicating that it is acceptable to have an off property point of compliance without prior impact to surface water. This inconsistency might be addressed by including the specific criteria under the "near but not abutting" section rather than referring back to the "abutting surface water" section.

And Graves:

> WAC 173-340-720(8)(d)(ii) states that if contamination has not reached surface water, then the conditional point of compliance cannot extend beyond the current extent of groundwater contamination. This is not practical. If it can be shown that contamination will move somewhat but will never reach surface water, then forcing expensive hydraulic control will accomplish nothing. This provision should be removed and PLPs should be forced to demonstrate that remedial actions will be protective of public health and the environment.

Response:
The intent behind this provision is to prevent the degradation of ground water and surface water resources, consistent with state water quality law and MTCA's preference for permanent remedies.

Ecology acknowledges that this limitation is inconsistent with WAC 173-340-720(8)(d)(i)(A). To correct this potential conflict, the final rule has been revised as follows:

> For a conditional point of compliance to be approved under this provision the conditions specified in (d)(i) of this subsection must be met and the affected property owners between the source of contamination and the surface water body must agree <u>in writing</u> to the use of the conditional point of compliance. Also, if the ~~contamination has~~

~~not reached~~ ground water cleanup level is not exceeded in the ground water prior to its entry into the surface water, the conditional point of compliance cannot extend beyond the extent of ground water contamination above the cleanup level at the time the department approves the conditional point of compliance.

GQ 10.3.12
Can an areawide point of compliance be used at site conducting independent remedial actions?

Two commentors raised concerns regarding the applicability of an areawide point of compliance to independent remedial actions. Wingard, had the following comment:

> Another major issue is the current language regarding Area Wide Point of Compliance. It is my strong belief that alternative points of compliance can only be allowed with Ecology approval, oversight and formal public participation. Alternative points of compliance by their very nature will involve public resources and it is not appropriate or consistent with the MTCA statute to allow such alternate compliance locations as a private deal between Ecology and polluters with no formal participation by the public, whose resources are being impacted by the decision. Please explain Ecology's rational for the current form of the Area Wide Point of Compliance, and how the public right to participate in decision making regarding impact to public resources is maintained.

And Valeriano:

> Earlier drafts of the rule required that an area-wide point of compliance be established only through a consent decree or order. The current proposal allows independent cleanup sites to declare use of this provision and avoid cleanup without adequate public oversight. The language also allows the department to approve of an area-wide point of compliance when providing technical assistance. The requirement that the department publish a public notice in the site register is totally inadequate. The general public does not read the site register, especially a property owner who may not even realize the ground water beneath their property has been contaminated by someone else. This provision should be revised to require that area-wide points of compliance only be allowed if they are part of an order and they should be discouraged as a matter of policy. This section is just another loophole for not meeting cleanup standards, as is the section on conditional points of compliance.

Response:
Under the proposed rule amendments, the department may approve an areawide point of compliance at sites conducting remedial actions under an order or decree or when providing technical assistance on an independent remedial action. WAC 173-340-720(8)(d)(iii)(D) requires more than a notice in a site register, it also requires notice of the proposal and an opportunity to comment for all property owners, tribes, local governments and water purveyors with jurisdiction in the area potentially affected by the ground water contamination. For independent remedial actions, it also requires a notice be placed in the site register. By providing for such notice, the department believes the public is provided a meaningful opportunity to review and comment on such a proposal.

GQ 10.3.13
What properties must impose a deed restriction when using an areawide point of compliance?

(1408, 2303, 2304, 2382)

Several comments were received concerning the requirement for a deed restriction when using a conditional point of compliance. For example, Newlon stated the following:

> We would like a clarification that in the context of an area-wide point of compliance, this is applicable only to the party seeking to make use of the area-wide point of compliance to receive some form of signoff from Ecology (e.g., no-further-action letter, agreed order, consent decree). In other words, all property owners within the entire area would not need to individually implement one or more institutional controls before any single property owner in the area could receive an n.f.a, agreed order, or consent decree employing an area-wide point of compliance. To require institutional controls on all properties in the area before any one property could move through the process would clearly violate PAC intentions regarding area-wide cleanups, so clarification is needed in the responsiveness summary to avoid future interpretations that would eviscerate area-wide cleanup approaches.

Response:
Ecology disagrees that the requirement for deed restrictions covering the area encompassed by the area wide point of compliance is inconsistent with PAC intentions. The requirement for institutional controls when using a conditional point of compliance is an existing requirement contained in WAC 173-340-440 and was not proposed to be changed by the PAC. WAC 173-340-440(8)(a) requires that within the properties owned by potentially liable persons, no alternative to deed restrictions are allowed. This is because the department believes such restrictions are the most reliable way of providing notice to future property owners. We also recognize that for properties not owned by the potentially liable persons at the site, it may be difficult to get agreement from other owners to place such a notice on their title. In these cases, alternative mechanisms are provided for in WAC 173-340-440(8)(c), provided a good faith effort is made to obtain deed restrictions on properties not owned by the potentially liable persons. Note that when using an area wide point of compliance, this does not necessarily mean all properties where contamination has been found must have a deed restriction, only those encompassed by the areawide point of compliance.

GQ 10.3.14
What types of sites are eligible to use an areawide point of compliance?

(2372)

Newlon requested the following clarifications regarding an areawide point of compliance:

> For this part of the rule, the Port seeks clarification in Ecology's response to these comments. Please confirm the following:
>
> > (1) The use of the area-wide point of compliance applies to multiple sources of contamination and co-mingled plumes. The fundamental requirements established by the PAC for an area-wide point of compliance designation are contamination from more than one source and commingling of the contamination such that the releases cannot be cleaned up separately.
> >
> > (3) There may be multiple sites within the area covered by the area-wide point of compliance. This is consistent with an approach that allows for incremental cleanups in urban areas with area-wide contamination problems.

Response:
As articulated in WAC 173-340-720(8)(d)(iii), Ecology concurs that an areawide point of compliance is intended apply to situations where the presence of multiple sources of contamination from different sites have co-mingled plumes of contamination that are not practicable to address separately. A classic example would be two adjacent bulk oil petroleum storage facilities with co-mingled ground water contamination plumes. In this case, it may be more appropriate to set an areawide point of compliance that encompasses both facilities. However, it should be pointed out that properties do not have to be adjacent to each other to utilize this provision.

GQ 10.3.15
Do all sources of contamination need to be identified and included in the cleanup plan to use an areawide point of compliance?

(2372)

Newlon requested the following clarifications regarding an areawide point of compliance:

> (2) The use of the area-wide point of compliance does not require identification of sources of contamination not encompassed by the "site" or properties included in the area-wide agreement. Once multiple sources and co-mingling have been identified, the party seeking to establish and use an area-wide point of compliance needs to determine the cleanup measures he will implement to attain compliance at the area-wide point of compliance. He need not perform an RI/FS on the entire area, or identify additional sources of contamination other than that needed to establish that an area-wide problem exists.
>
> (4) The plan discussed in (iii)(B) for implementation of cleanup action need not be a Cleanup Action Plan for all properties that might potentially make use of the area-wide point of compliance. Consistent with our above comments, this plan can relate just to the property seeking to make use of the area-wide point of compliance (that is, a C.A.P. for that property).

Response:
While it is certainly desirable to identify all sources of contamination and create a cleanup plan that addresses all sources in one package, Ecology concurs that this may not be practicable in all instances. However, where other sources of contamination are known, it is not sufficient to simply identify that a site is in an area of regional contamination. It must be demonstrated that it is not practicable to address the sites separately. This will, by necessity, require cooperation from all the property owners to develop a coherent plan for the area encompassed by the areawide point of compliance.

GQ
What is meant by "necessary access to affected properties"?

(2372)

Newlon requested the following clarifications regarding an areawide point of compliance:

> Similarly, the description of "necessary access" provisions relates to off-property access needed by the property owner seeking to make use of the area-wide point of compliance (e.g., for monitoring, or for cleanup of hotspots that go beyond that property's boundary and must be addressed to meet requirements at the point of compliance).

Response:
The level of access required to affected properties will depend on the remedy. At a minimum, access permission will be needed to perform the necessary monitoring. If more access is needed to address problem, such as installing a pump and treat system, then the access will go beyond just monitoring.

GQ 10.3.16
In WAC 173-340-720(8)(e), can dilution and other factors within the surface water body be taken into account when establishing a concentration within an upland monitoring well?

(275, 752, 727, 1359, 2342, 2429)

Several comments were received on WAC 173-340-720(8)(e), most pertaining to earlier draft language that was revised in response to the comments. On the 2000 proposal, one comment was received from Newlon, as follows:

> The section needs to recognize as well those factors relevant to natural attenuation in the surface water. For example:
>
> -- Some substances may stay bound to sediments, and may not contribute to surface water concentrations. If this would not lead to a sediment problem either, then this consideration should be of use.
> -- Some substances may be volatile organics, which may linger for decades in groundwater for lack of any means to volatize and escape, but will behave much differently in surface waters. In surface waters, volatile organics do not linger, but escape to the atmosphere. This attenuation is real and should be recognized.
> -- Some groundwater flows may be trivial compared to the flows and volumes of the receiving waters, yet the MTCA regulation is not set up to consider that. Rather, the regulation focuses on concentrations, or means to develop concentrations as limits, and then treats all situations the same. A groundwater flow of one quart per year into Lake Washington is treated as if it causes the lake to exceed a water quality standard when in fact its effect is trivial. This focus on concentration, without concern for the mass release rate, treats the above example no differently than a flow of millions of gallons a day to an effluent-dominated receiving water body.
>
> Some of these factors are indirectly recognized if a conditional point of compliance in the surface water is used, but they also need to be allowed where a perimeter well is used.

Response:
During the PAC discussions, it was pointed out that upland ground water monitoring wells have been used by Ecology staff for some time under the current rule to measure ground water concentrations prior to discharge to adjacent surface water where the ground water standard is based on protection of surface water. This subsection recognizes this procedure in the rule and implements the PAC recommendation to update the rule to include this provision. The evaluation required under WAC 173-340-720(8)(e) is in addition to factors that must be considered under WAC 173-340-720(8)(d)(i) and (ii). Thus, to the extent these factors are considered under WAC 173-340-720(8)(d)(i) and (ii), they must be considered under (8)(e) also.

The intent of WAC 173-340-720(8)(e)(iii) is to address natural attenuation within the aquifer, not within the surface water. Ground water discharges to surface water are unique in that the discharge seeps out the bank or through the bottom sediments into the surface water body. These are very sensitive zones with an abundance of aquatic life with the potential to be exposed to contamination before dilution can occur. Limiting such discharges from contaminated sites is consistent with the State's antidegradation policy articulated in WAC 173-201A-070.

In response to the comment on a chemical's volatility, the volatility of a chemical is already considered in establishing the surface water cleanup level as it is reflected in the bioconcentration factor used to develop a cleanup level.

It should also be noted that this provision is intended to recognize that attenuation of contaminants may occur as the ground water flows through the aquifer prior to entry into the surface water. However, there is not intended to be any presumption that attenuation will occur. How much attenuation, if any, will occur will depend on many factors including the chemical and aquifer properties, how close the monitoring well is to the surface water body and whether there are zones of naturally higher permeability materials or manmade pathways such as unsealed storm drains or backfill around pipes that provide preferential flow pathways for contaminants to the surface water.

10.4 Compliance Monitoring and Statistical Issues (WAC 173-340-720(9))

GQ 10.4.1
How does the proposed language in WAC 173-340-720(9) improve on or clarify the current methods for determining compliance with the ground water cleanup standards?

(644, 1353, 1361, 1362, 1363, 1382)

Response:
The proposed rule amendment incorporates current guidance and practice using the August 1992 document *Statistical Guidance for Ecology Site Managers* and the February 19, 1998 memo *Supplement to Statistical Guidance for Ecology Site Managers*. Ecology believes, through almost 10 years of experience in applying the current statistical guidance document, that the proposed rule language is an improvement over the current rule language. However, the proposed rule language does allow the use of other statistical methods.

This response also applies to similar comments on WAC 173-340-740(7).

GQ 10.4.2
Is filtering appropriate for ground water samples when the ground water standard is based on protection of surface water?

(482)

One comment was received on WAC 173-340-720(9)(b). The comment, from Allen:

> This section states that groundwater analyses shall be conducted on unfiltered groundwater unless it is not possible to collect low turbidity samples. Another provision should be made for samples being analyzed for metals and compared to surface water criteria. Most of the ambient surface water criteria for metals are reported on a dissolved basis (per WAC 173-201A).

Response:
The requirement for using unfiltered ground water samples is an existing rule requirement and was not proposed to be changed by these revisions (other than some minor editing). See Ecology's 1991 responsiveness summary for a detailed discussion of this issue. For the same reasons articulated in that 1991 document, Ecology does not believe any distinction should be made with regard to filtering for ground water samples based on a surface water standard.

GQ 10.4.3
Why has Land's method been selected as the default procedure for data analysis?

(485, 486, 508, 2648, 2608)

Response:
Land's method is the most commonly used procedure for calculating a confidence limit on the mean of a lognormal distribution. Some commentors noted an article in an EPA technical journal which showed that the method can be more conservative than alternatives for highly skewed distributions. The rule allows for the use of alternative methods. However, even with the use of an alternative method, highly skewed distributions may still fail the compliance requirements that no more than ten percent of the site samples can exceed the cleanup level, and no single sample concentration can exceed twice the cleanup level.

This response also applies to similar comments on WAC 173-340-740(7).

GQ 10.4.4
Why is there no provision in the proposed rule amendment for data that are neither normal or lognormally distributed?

(509, 487)

Response:
Lognormal data distribution is the default distribution because this is consistent with environmental data sets. While the proposed rule amendment does not describe how to handle data that is neither normal or lognormally distributed, other statistical methods may be used in such cases. See Section WAC 173-340-720(9)(d)(iii).

This response also applies to similar comments on WAC 173-340-740(7).

GQ 10.4.5
Should WAC 173-340-720(7) and 173-340-740(7) include statements that nonparametric methods may be considered for use if the underlying distribution of data cannot be reliably determined?

(510, 483)

Response:
The default distribution is lognormal unless it can be shown that this is not the case. For data sets where methods based on the lognormal distribution cannot be used (e.g., large proportion of the values are below detection limit), WAC 173-340-720(9)(f)(iv) allows persons to use other statistical methods than those described in the proposed rule amendment.

This response also applies to similar comments on WAC 173-340-740(7).

GQ 10.4.6
Should WAC 173-340-720(9)(d)(iii) specify alternative distribution testing methods (e.g. the Wilcoxon Rank Sum test and Quantile test)?

(389, 2647)

Response:
Ecology has included in the proposed rule amendment statistical methods that are found to be appropriate for most sites. WAC 173-340-720(9)(d)(iii) does allow the use of other statistical methods. Also see response to comments #472 and 455.

This response also applies to similar comments on Section 740(7).

GQ 10.4.7
Why is the true mean, instead of the estimated mean, used in WAC 173-340-720(9)(c)(v)(B) to evaluate compliance with ground water cleanup levels?

(484)

Response:
Compliance is based on the mean concentration in the groundwater (true mean), not the mean concentration in samples. The upper confidence limit is used to provide a conservative estimate of the true mean. This method has been used under the current policy and regulatory scheme for the last 10 years.

GQ 10.4.8
Why does WAC 173-340-720(9)(d)(ii) require that the true proportion of samples that exceed the ground water cleanup level shall be less than fifty percent instead of ninety percent?

(488, 2001)

Response:
Ecology agrees that this should be 90%. Ecology has made a change to the language in the final rule in WAC 173-340-720(9)(d)(ii).

GQ 10.4.9
Why is use of ½ the method detection limit limited to data sets with less than fifteen-percent of the values below the PQL?

(489)

Response:
For calculating an upper confidence limit, Cohen's method should be used to estimate the mean and standard deviation when data include "non-detect" values (more specifically, values that are below either the detection limit or the practical quantitation limit). However, if the proportion of non-detect values in the data set is not too large, simple substitution can be used and Cohen's method need not be applied. EPA guidance recommends fifteen percent as the criterion for using Cohen's method. See Supplement S-6 of the Statistical Guidance for Ecology Site Managers (Ecology, 1993b).

Calculation of a background percentile using normal probability plot regression analysis relies primarily on the known values in the data set. "Non-detects" are used only to establish the rank for the lowest known value. The fitted regression becomes less reliable when only a small proportion of the data are known values, however. Ecology guidance recommends that the regression not be used if "non-detects" comprise more than fifty percent of the data set.

GQ 10.4.10
To avoid inappropriate use of Cohen's method, why shouldn't the rule amendment include a statement that Cohen's method should only be used if the data are normally distributed?

(489)

Response:
Cohen's method can be used with both normally and lognormally distributed data. For the latter, the method is applied to the log-transformed values, which are normally distributed. See Supplement S-6 of the Statistical Guidance for Ecology Site Managers for further explanation. This level of detail is more appropriate for guidance.

GQ 10.4.11
Can alternative statistical methods be used?

(642, 644)

Response:

Yes, there is language in Sections 709, 720, 740 and 745 allowing for the use of other methods. Note that there are several factors that would need to be considered in deciding whether to accept an alternative method including:

- Is the proposed alternative protective of human health and the environment?
- Is the proposed alternative technically sound?
- Does Ecology have adequate expertise to evaluate the alternative?

GQ 10.4.12
Can methods other than statistical techniques be used to demonstrate compliance at small sites with only a limited number of samples?

(877)

Response:
Ecology agrees that at small sites, where the source of the soil contamination is known, a statistical evaluation to demonstrate compliance with the soil cleanup level is not necessary. A provision for a direct comparison of soil sample concentrations and cleanup levels without a statistical evaluation, from Ecology's 1995 Guidance on Sampling and Data Analysis Methods, has been included in Section 740(7)(d). However, such knowledge will not exist in the case of ground water contamination and the application of a statistical evaluation is necessary to demonstrate compliance with ground water cleanup levels. The proposed rule is consistent with the current rule and policies on this issue.

GQ 10.4.13
Why does WAC 173-340-720(9)(a) include the statement: Surface water analysis, and bioassays or other biomonitoring methods may also be required where the ground water cleanup level is based on protection of surface water?

(1360)

Response:
This addition is to make the monitoring provisions in WAC 173-340-720(9) consistent with existing language in WAC 173-340-720(8)(d)(i) and to reflect changes in WAC 173-340-730 allowing for the use of bioassays to demonstrate a cleanup level is protective of aquatic life.

10.5 Other Comments

GQ 10.5.1
Other comments regarding WAC 173-340-720 are addressed in the following table.

Comment ID	Comment	Response
(General) 639, K Johnson	In general, objects to ground water revisions because appear to be unilaterally imposed by	Comment noted

	Ecology to make the standards more stringent.	
1354, McCain	Disagrees with old overview statement the few ground waters are expected to be considered non-potable. Also disagrees with statement that carcinogens are additive. Should be only if affect same organ.	Overview removed from 1999 proposal.
2448, Newlon	Flow chart confusing	Comment addressed in 1999 proposal by removal of flowchart.
640, K Johnson	720 is more complex and difficult to apply than the prior rule. Needs to provide more guidance on how alternative risk scenarios, other than drinking water, can be incorporated into the development of CULs at a site	Ecology believes the rule, as written provides an adequate legal framework. We intend to provide guidance on use of SSRA in setting ground water CULs and remediation levels.
2332, Heaton	PHSKC supports the changes to the ground water cleanup standards	Comment noted.
(1), (1)(c) 264, Gillett	In (1)(c change "releases of haz sub…"to "Ground water CULs shall be established at concentrations that do not…". Consistent with 740, 745, 750.	Comment addressed in 2000 proposal.
694, Burden	Disagrees with statement that Method C can only be applied on a media by media basis.	This is existing language in Section 706(1) repeated here for consistency.
(1)(d) 641, K Johnson	Remove (new) statement that "Concentrations that eliminate or minimize the potential for damage to soils or biota in soils which could impair the use of the soil for agricultural or silvicultural purposes."	This is not a new requirement. Language was moved to this section from (4).
1177, Nelson 2360 Nelson	Quotes ESHB 1810 as stating that cleanup standards will not be based on "redundant conservative assumptions". Says presumption that the RME for ground water is drinking water is inconsistent with this legislative finding.	This language was in the original HB 1810 that was rejected by the legislature and substituted with ESHB 1810, creating the PAC. ESHB 1810 contains no such statement.
971, Graves 2054 Graves	Suggests adding a statement that if a site doesn't meet the criteria as a drinking water source, the ground water will be considered non-potable.	Ecology believes this is adequately stated by existing language.
269, Gillett	201A doesn't use the term "classified as a source of drinking water". It uses "domestic water supply". Change here and elsewhere.	Comment noted. See 720 (2)(d)(iii)
386, Dept. of Energy	What chemicals are considered volatile in equation 720-1?	See definition (Section 200) of "volatile organic compound".
73, POG 74, POG	In equation 720-3 the term F(i) should be defined consistent with the way it is defined in equation 740-3.	Comment addressed in 2000 proposal.
2616, Nordstrom	Suggests editing change to (4)(b)(ii).	Comment noted.
2458, SAB	Add averaging time and exposure duration to equations.	Comment addressed in adopted rule.
(5) 1061, Belcher 1411, Belcher	Method C should be modified to allow for attenuation to be taken into account. Suggests this be allowed when there is a separation to ground water (use vadose zone attenuation factor) and when there is separation between the POC and source area (use dilution attenuation factor).	This subsection addresses the concentration to be applied to the ground water to enable its use, not to the concentration in the soil. Attenuation within the vadose zone may be taken into account under 747.

		The POC for ground water is addressed in subsection (8). It is possible under (8) that a higher concentration could be left in the ground water directly beneath the source, provided the cleanup level was met at a POC some distance from the source. This analysis could take into account attenuation within the aquifer.
973, Graves	Need to add a statement on when Method C can be used.	Comment addressed in 2000 proposal (under applicability).
388, 2645 Dept. of Energy	The statement in (5)(b)(ii) that the demonstration that a hazardous substance is not likely to reach surface water "must be based on factors other than implementation of a cleanup action at the site." may be appropriate for setting cleanup levels; however, please confirm that this is not intended to prohibit factoring in the remedy when establishing remediation levels.	Ecology concurs, this statement only pertains to cleanup levels.
1356, McCain	Provision that requires a demonstration that the public water system serving the site has sufficient capacity to meet future development is unclear. Also, should delete language pertaining to sediment standards.	Addressed by deletion of subsection.
1264, Gillett	Numbering is confusing. Recommends renumbering (b)(iii) though (vii).	Addressed by deletion of subsection in 2000 proposal.
1151, Kenefick	Use of "and" & "or" confusing. Not clear if just one of the conditions or all must be met.	Addressed by deletion of subsection in 2000 proposal.
478, Allen	No need for institutional controls under (b) since this is non potable ground water.	Addressed in adopted rule under subsection (6).
2343, Newlands	Standard for ground water discharging to surface water for arsenic should be 5 ug/l.	Ecology disagrees. Not consistent with surface water standards.
(6) 271, Gillett	Replace the term "non potable" with "not a current or potential future source of drinking water" based on the criteria in 720(2).	The term "nonpotable" is a term that is commonly understood to mean the water is unsuitable for use as drinking water. While the suggested approach could be used, Ecology believes the term "nonpotable" is sufficiently defined to convey both its legal and common meaning.
778, Newlon 2428 Newlon	Incorrect cross-reference.	Comment addressed in 1999 proposal.
787, Newlon 2454 Newlon	(a)(ii) (now (6)(c)(I)(E)) should be reworded to state: "not likely to flow into POTABLE surface water".	Comment addressed in 2000 proposal.
696, Burden	Remove subsection (ii). There is no reason for ground water to not flow into surface water for it to be non-potable.	Addressed by reorganization of Section in 2000 proposal.
272, Gillett; 1357, McCain	Strike provision that not adversely impact public or private site development etc. No authority for this and its not clear what it means. Too vague.	Removed in 2000 proposal because it would be addressed as part of SSRA.
478, Allen	No need for institutional controls under (b) since this is non potable ground water	Addressed in adopted rule under subsection (6)(c)(iii).

(7) 750, Newlon 751, Newlon 2427, Newlon 2428, Newlon	Incorrect cross-reference.	Comment addressed in 1999 proposal.
479, Allen	Ecology needs to provide justification for requiring a more stringent CUL than MCLs.	See 1991 Responsiveness Summary Issue #2, pages 36 – 41.
(7)(c) 273, Gillett	Change "are not required to" to "shall not".	Comment addressed in 2000 proposal.
1406, Belcher 1407, Belcher 1412 Belcher	Industrial properties should only be required to meet the standard at the property boundary or beyond. Interior cleanup levels should not be required to meet drinking water standards.	Industrial facilities, just like any other site, are allowed a conditional POC at the property boundary, but must demonstrate the need for one.
1135, Kenefick.	The requirement in (c) for the POC to not exceed the property boundary conflicts with (d).	Comment addressed in 2000 proposal by noting exception for (d).
480, Allen	Add cross-reference to (d) in (c).	Comment addressed in 2000 proposal.
976, Graves 2057 Graves	Delete requirement in (8)(d)(ii) that POC cannot extend beyond the current extent of ground water contamination. Not practical. Requires hydraulic control even if contamination won't reach surface water.	The intent of this provision is to prevent the spread of contamination. Yes, it may require hydraulic control.
2617, Nordstrom	(8)(d)(ii) is inconsistent with (i) in that (ii) refers to contamination not yet reaching surface water but (i) requires contamination to have reached surface water to trigger POC in surface water.	Comment addressed in adopted rule.
2343, Newlands	It will not be possible to meet the statistical test plus, 10% and 2 times rules if CUL is based on natural background, such as arsenic. [Ecology acknowledges the 10% rule doesn't work when the CUL is based on natural background. Nigel needs to respond to other aspects of this.] 2001, Glass. Suggests cross-reference correction and editing change to wording.	Comment addressed in adopted rule.

Chapter 11 Surface Water Cleanup Standards

Several amendments to WAC 173-340-730 were made for clarification purposes and to reflect changes made to other chapters, including updating several cross-references. Substantive and other changes, listed by subsection, include the following:

Subsection (1) – General considerations.
(a) Updated reference for determining surface water classification and highest beneficial use. This updated reference is reflected throughout this Section.
(b) Deleted language about treatment, removal and containment and replaced with trigger that cleanup action is required where cleanup levels are exceeded.
(d) Added statement that Method C for surface water does not necessarily qualify a site for Method C in other media.
(e) Moved language from later in Section to here discussing when more stringent cleanup levels can be required by the dept. Also, reference to Sections 702 & 708 added.

Subsection (2) – Method A surface water cleanup levels.
(a) Added cross-reference to Section 704 to describe what sites can use a Method A surface water cleanup level.
(b) Deleted the discussion of when more stringent cleanup levels can be required by the dept. (moved to (1)).
(b) Added statement that drinking water standards are one of the criteria to be used to establish surface water cleanup levels if the surface water is classified as a source of drinking water.
(b) Added statement that for substances that do not have a water quality standard, natural background or the practical quantitation level must be used as the cleanup level.

Subsection (3) – Method B surface water cleanup levels.
(a) Amended language to provide for "standard" and "modified" Method B surface water cleanup levels.
(b) Added national toxics rule as an applicable law.
(b) Amended environmental protection requirement to state that this only applies if an environmental effects-based ARAR does not exist for a hazardous substance at a site. Added provision allowing the use of whole effluent toxicity testing to demonstrate that the environment is protected.
(b) Added averaging time and exposure duration and default value of 30 years to equation 730-1. Minor editing of both equations 730-1 and 730-2.
(b) Added provision describing how surface water cleanup levels for petroleum mixtures are to be established. Includes allowing the use of the Method A ground water cleanup levels to be used as surface water cleanup levels for addressing the human health risks of petroleum mixtures.
(b) Edited language referring to WAC 173-340-720 for surface water cleanup levels for potable surface water.
(c) Provided description of what changes can be made to equation default values under modified Method B to derive site-specific cleanup levels.

(d) Added statement that changes to the reasonable maximum exposure scenario and default exposure assumptions can be made as part of a quantitative SSRA for demonstrating the protectiveness of a remedy and provides cross-references to appropriate provisions.

Subsection (4) – Method C surface water cleanup levels.
(a) Added statement that Method C consists of "standard" and "modified" methods.
(b) Added provision allowing the use of whole effluent toxicity testing to demonstrate that the environment is protected.
(b) Added provision describing how surface water cleanup levels for petroleum mixtures are to be established.
(b) Edited language referring to WAC 173-340-720 for surface water cleanup levels for potable surface water.
(c) Provided description of what changes can be made to equation default values under modified Method C to derive site-specific cleanup levels and remediation levels.

Subsection (5) – Adjustments to cleanup levels.
(b) Reworded statement on when cleanup levels found under applicable laws must be adjusted.
(c) Added statement on how PQLs and natural background get factored into cleanup levels.
(d) Added provision stating surface water cleanup levels cannot result in free product being present in or on the surface water and an explanation of how this demonstration can be made.

Subsection (6) – Point of compliance.
Changed "dilution" zone to "mixing" zone and changed cross-reference.

Subsection (7) – Compliance monitoring.
(a) Added statement that sampling of surface water shall be conducted to determine compliance with surface water cleanup levels.
(f) Deleted presumption that values below the MDL can be assisgned ½ the MDL.
(g) Added statement that sampling of other aquatic organisms and sediments may be required as part of the compliance monitoring.

GQ 11.1.1
Why has a limitation on non-aqueous phase liquid been included in the surface water cleanup standards?

(98, 128, 279, 2182, 2223, 2259, 2260)

Several commentors expressed concern about adding the limitation to ground water cleanup levels in WAC 173-340-720(7)(d) that they not result in the formation of free product in or on the ground water. The primary concern expressed by several commentors was that the requirement be limited to "measureable" free product. Others suggested that this limitation only apply at the property boundary. Still others expressed concern with a presumption in the 1999 proposal that solubility limit could be used as a way of demonstrating compliance with this standard because of the difficulty of determining solubility limit for chemical mixtures.

Response:
The free product limitation was added when it became evident during the POG discussions that a site-specific risk assessment for petroleum contamination could result in establishing cleanup levels that exceed the solubility limit, resulting in a separate phase of petroleum product within the surface water. While not specifically recommended by the POG, Ecology has included this limitation on cleanup levels for all hazardous substances. The reason for including this limitation is that surface water with a separate phase of pure product on or in it is not protective of human health and the environment and, if it reached surface water, would result in a violation of federal water quality law (40 C.F.R. Part 110). This law applies to both petroleum and non-petroleum oils.

At the POG's earlier recommendation, this provision was moved to subsection (5) to cover all methods for setting cleanup levels. From a drafting perspective, placing this limitation in subsection (5) avoids having to repeat this statement for each method of calculating cleanup levels. In a subsequent comment the POG indicated that it was unlikely that the proposed Method A cleanup levels would be high enough to violate this standard, and suggested it apply to only Methods B and C. Ecology agrees it is unlikely that any Method A value will result in the formation of free product on the surface water but we have decided to keep this limitation in the final rule since this is an appropriate safeguard to prevent this from occurring.

With regard to concerns with use of the solubility limit to determine compliance with this limitation, this presumption was removed in the 2000 proposal. While it was removed, Ecology still believes this can be a useful tool for screening calculated cleanup levels and plan to address this in future guidance.

Finally, Ecology does not agree this standard should be "measurable free product". The policy being conveyed by this limitation is that a cleanup level cannot exceed a concentration that would result in the formation of any NAPL in or on the surface water, as that would not be protective of human health and the environment and would violate federal water quality law. While removing measurable free product is an expected minimum outcome of any remedy, it would not restore the surface water to a condition that would be protective of human health and the environment. Because several commentors appear to be associating the term "free product" with "measurable", that term has been changed to NAPL in the final rule. This is to more clearly distinguish between the requirements for cleanup levels and the minimum remediation requirement to removed free product to the maximum extent practical in WAC 173-340-360(2)(c)(ii)(A).

GQ 11.1.2
What surface waters are intended to be addressed by the surface water cleanup standards?

(278, 2181)

Two identical comments were received regarding WAC 173-340-730(3)(b)(iii)(B). The comment, from Gillett and WSPA was as follows:

> Subsection (3)(b)(iii)(B) currently requires cleanup levels to address carcinogenic effects if the surface water supports fish or shellfish populations. Ecology proposes to amend this to include those surface water which have the potential to support fish or shellfish populations (which conforms to the current language for Method C cleanup levels). Is this potential determined by the characteristic use classifications under 173-201A WAC? If so, won't that mean that all surface waters will be covered by this provision, since all water classes identify fish or fish and shellfish as a characteristic use?

Response:
This change was intended to address a drafting error/inconsistency between WAC 173-340-730(3)(b)(iii)(A) and (B). From the 1991 Responsiveness Summary, including surface waters that support, as well as have the potential to support, fish and shellfish populations was the original intent of the rule. This is also consistent with the way these provisions have been implemented under the current rule. All surface water are intended to be covered by the current rule and the language does not change this standard. As the commentor has noted, this is also consistent with chapter 173-201A WAC.

GQ 11.1.3
Why have provisions been included addressing the establishment of cleanup levels for petroleum mixtures?

(97, 789, 2258)

One commentor requested that Ecology remove all provisions pertaining to calculation of surface water cleanup levels for petroleum mixtures, indicating that bioconcentration factors are not available for petroleum fractions. In addition they requested that the Method A TPH ground water cleanup levels be allowed to be used until additional information is developed to enable calculation of surface water cleanup levels for TPH mixtures.

Response:
As noted earlier, a narrative provision addressing petroleum mixture surface water cleanup levels was added under Methods B and C. Ecology is retaining this provision in the final rule because we believe it is important to provide a framework to enable site-specific calculations for petroleum mixture cleanup levels.

As for the recommendation to use the Method A ground water TPH cleanup levels as surface water standards, no documentation was provided by the commentor on the technical justification for that recommendation. Ecology believes it is appropriate to include this recommendation as a default approach for setting surface water cleanup levels for TPH mixtures for human health only. Our justification for this is summarized as follows:

Using the same approach as was used for ground water cleanup levels, it is possible to derive the following equation for surface water cleanup levels for petroleum mixtures:

$$C_w = \frac{HI}{\sum_{i=1}^{n} \left[\frac{F(i)\,x\,BCF(i)}{RfD(i)} \right] x \left[\frac{FCR\,x\,FDF}{ABW\,xUCF1\,xUCF2} \right]}$$

In order to use this equation, one must assign bioconcentration factors (BCF) to each of the petroleum fractions and constituents. While no published BCFs are available, a number of researchers have correlated BCF with a variety of other physical properties, most notably the octanol-water partitioning coefficient and solubility. One uncertainty in using these correlations is that there is a concern that they may overestimate the BCF for the heavier end fractions. However, since these fractions are extremely low in solubility, their contribution to risk should be minimal when calculating a dissolved phase cleanup level. Using dissolved phase compositions derived using Ecology's 4-phase model, various correlations to estimate the BCF of petroleum fractions, and the above equation, it is possible to calculate a range of cleanup levels for other petroleum mixtures. The results of these calculations are summarized in Table 11-1.

As a check on these calculations, we conducted a limited review of the literature and located whole product BCFs for one petroleum mixture, JP8 jet fuel. This jet fuel is similar in composition to diesel fuel and thus should be a good surrogate for diesel fuel. Surface water cleanup levels were calculated for JP8 using these BCFs and equation 730-1. As can be seen from Table 11-1, the range of calculated surface water cleanup levels appears to fall within the range of cleanup levels calculated using these whole product BCFs.

Also note that the Method A ground water cleanup levels appear to fall within the range of surface water cleanup levels calculated using these various methods. Thus, Ecology has concluded it is protective of human health to use the Method A ground water TPH values as default surface water cleanup levels for TPH mixtures.

It should be noted that these calculations do not address potential ecological impacts, which could potentially be a concern at much lower concentrations. Those effects must be addressed separately, as provided for in Section 730.

Table 11-1: Comparison of Calculated Method B Surface Water Cleanup Levels to Method A Groundwater Cleanup Levels for Various Petroleum Products

Petroleum Product	Range of Surface Water Cleanup Levels Using Calculated BCFs* (ug/l)	Range of Surface Water Cleanup Levels Using Literature BCFs** (ug/l)	Method A TPH Groundwater Cleanup Level (ug/l)
Gasoline Range Organics	64 – 2,084		800 – 1,000
Diesel Range Organics	91 – 1,085	938 – 1,705	500

Heavy Oils	91 – 1,085		500
Mineral Oils	38 - 508		500

Footnotes:

(1) Source: Ecology, 2001a. February 1, 2001 memorandum by Pete Kmet

* = BCFs calculated using octanol-water partitioning coefficient and solubility of petroleum constituents.
** = Whole product BCFs for JP-8 jet fuel.

GQ 11.1.4

Can site-specific adjustments be made to the fish consumption rate and fish diet fraction?

(493, 811, 1141, 1154, 1271, 2112)

Several comments were received pertaining to equations 730-1 and 730-2. One commentor asked for justification of the fish consumption rate and diet fraction in the equations. Other commentors requested that site-specific adjustments to these factors be allowed. One commentor requested that the bioconcentration factor in these equations be updated to incorporate EPA's latest guidance recommending the use of bioaccumulation factors (BAFs) and biota-sediment accumulation factors (BSAFs). Still others pointed out that the fish consumption rate used in these equations may not be protective of tribal members and others that consume a lot of fish. For example, the MTCA Science Advisory Board had the following comment on this last issue:

> While we support Ecology moving ahead with the proposed revisions, we have reservations about the assumed amount of fish consumption used in the calculation of surface water cleanup levels. Several studies over the past few years have shown that certain individuals in Washington State, such as Native Americans and people of Southeast Asian origin, typically consume considerably more fish than is assumed under MTCA and other regulations. We urge Ecology to move ahead with using this information to update the assumptions used in MTCA (as well as in other agency rules) in a future rule-making.

In subsequent correspondence, the board also requested clarification if the fish consumption rate in the rule is intended to include both fish and shellfish.

Response:

Ecology is not proposing to change the fish consumption rate or fish diet fraction in this rule amendment because that is an issue that is beyond the scope of this rule-making action. The basis for the fish consumption rate and diet fraction used in these equations is provided in the 1991 responsiveness summary and will not be repeated here. In reviewing that document and the rule language, it was intended that the assumed rate include both fish and shellfish consumption.

Ecology acknowledges that the fish consumption rate used in equations 730-1 and 730-2 may underestimate the amount of fish consumed by Native Americans and people of Southeast Asian origin. This was recently confirmed by a study summarizing available data on fish consumption rates (Ecology, 1999a). With regard to the use of a bioconcentration factor in these equations, Ecology acknowledges that EPA has published guidance indicating BAFs or BSAFs should be used. However, given the complexity of this issue, we decided that changing these equations to

reflect that new guidance was beyond the scope of this rule-making. Ecology intends to pursue additional discussion of these issues with the MTCA Science Advisory Board and, if appropriate, update these values in a future rule-making. See also chapter 9 for additional discussion of the bioconcentration factor issue.

Changing these factors (fish consumption rate and fish diet fraction) on a site-specific basis is not allowed under the current rule (except through the introduction of new science). Consistent with the PAC recommendations, that is not proposed to change under this rule amendment. However, in recognition of the Lower Ehlwa and Yakama Tribes concerns on this issue, WAC 173-340-708(10) has been modified to state explicitly that Ecology has the authority to make such an adjustment when necessary to protect human health. See Chapter 9 for additional discussion of this issue.

GQ 11.1.5
What is the role of whole effluent toxicity (WET) tests in setting surface water cleanup levels?

(492, 643, 1362)

As noted earlier, the rule amendments include a provision allowing the use of whole effluent toxicity testing to demonstrate that a surface water standard is protective of aquatic life where an environmental effects-based concentration has not been established under applicable state or federal law. Three commentors expressed concern with this provision. Two objected to inclusion of this provision on the grounds that this was not part of the PAC recommendations. A third commentor noted that the WET test only addresses aquatic life, not semi-aquatic birds and mammals and may be insufficient in that regard.

Response:
The use of whole effluent toxicity testing (WET) is not mandatory, the rule simply makes it a presumed method for demonstrating a surface water cleanup level will be protective of aquatic life. The option for use of the WET test has been included to facilitate the establishment of a surface water cleanup level for substances where there is no numeric standard in applicable state or federal law, such as for petroleum contamination. Ecology believes this is appropriate given that this method is an established method for testing for aquatic toxicity under state water quality law (chapter 173-205 WAC). With regard to protection of semi-aquatic birds and mammals, Ecology acknowledges that this test is not intended to address these species. If this is an issue at a site, additional testing or research may be necessary.

GQ 11.1.6
Can a conditional point of compliance be established for surface water?

(2374)

One commentor requested that a conditional point of compliance be added to the surface water compliance monitoring provisions.

Response:
A conditional point of compliance is not allowed within surface water under the current rule and was not proposed as part of these revisions, nor was such an addition recommended by the PAC. Ecology believes it would be inappropriate to add such a provision in the final rule since such a change is beyond the scope of this rule-making. It should be noted that the provision for a mixing zone in WAC 173-340-730(6) is the water quality standards equivalent to a conditional point of compliance under MTCA.

GQ 11.1.7
What is meant by the term "mixing zone" in WAC 173-340-730(6)?

(2390)

Newlon requested the following clarification regarding "mixing zone" as used in WAC 173-340-730(6):

> Ecology needs to confirm in written response to these comments that the mixing zone referred to in paragraphs (a) and (b) of this section is in the receiving water body offshore of the upland area where groundwater exists (i.e., it does not refer to any mixing that may occur shoreward or upgradient of the surface water/sediment interface). The definition of "mixing zone in 173-201A-020 is as follows:
>
> "Mixing zone" means that portion of a water body adjacent to an effluent outfall where mixing results in the dilution of the effluent with the receiving water. Water quality criteria may be exceeded in a mixing zone as conditioned and provided for in WAC 173-201A-100.

Response:
Ecology concurs that this term is intended to apply to mixing <u>within</u> the surface water body, not in the ground water. To assure clarity on this issue, the definition of mixing zone from WAC 173-201A-100 has been added to the final rule under WAC 173-340-730(6).

GQ 11.1.8
What standard is used to determine compliance with surface water cleanup levels?

(644, 1363, 2345)

Three persons commented on the proposed revisions to the surface water compliance monitoring requirements. Two commentors questioned revisions in an earlier draft changing how measurements below the PQL were to be handled in statistical analyses. One commentor requested that the "true mean" be used as the standard for determining surface water compliance.

Response:
In the 2000 proposal the provisions changing how measurements below the PQL were to be handled was removed. The existing language was also removed because it is inconsistent with state and federal water quality procedures. If this is an issue at a site, those procedures will need to be followed.

With regard to the suggestion that a "true mean" be used to measure compliance, this revision has not been included in the final rule because it is inconsistent with state and federal requirements. For example, EPA guidance (EPA, 1991b) recommends the use of the 99th percentile for daily effluent limits and the 95th percentile for monthly average effluent limits. Other criteria are used for listing of water quality impaired surface waters under Section 303(3)(d) of the Clean Water Act (Ecology, 1997b). Rather than creating a separate standard in MTCA, Ecology believes that the standard will need to be established on a case-by-case basis in accordance with the latest state and federal procedures.

GQ 11.1.9

Other comments regarding WAC 173-340-730 are addressed in the following table:

Comment ID	Comment	Response
569, Wingard	Releases from MTCA sites must not be allowed to violate SW quality standards.	Ecology concurs. The existing and proposed rule have provisions preventing this.
569, Wingard	MTCA sites must obtain an NPDES permit when discharging to waters of the state.	Ecology concurs, except where exempt under RCW 70.105D.090.
740, POG 2423 POG	Comment on notes to reviewers.	Comment addressed in 1999 proposal.
2331, Heaton	Supports changes.	Comment noted.
(1) 276, Gillett	Change intro in (1)(d) to "Surface water cleanup levels shall be established at concentrations that do not…"	Comment addressed in 2000 proposal.
(2) 1265, Gillett	National Toxics Rule reference should be 131.36.	Ecology disagrees.
491, Allen	Suggests wording changes.	Comment addressed in 2000 proposal.
2458, SAB	Recommends adding averaging time and exposure duration to equations. Also, does "fish" mean "fish and shellfish"?	Comments addressed in adopted rule.
(6) 99, POG	Change cross-reference in (b) from (10) to (9).	Comment addressed in 2000 proposal.

Chapter 12 Soil Cleanup Standards – Unrestricted Land Use

Several amendments to WAC 173-340-740 were made for clarification purposes and to reflect changes made to other chapters, including updating several cross-references. Substantive and other changes, listed by subsection, include the following:

Subsection (1) – General considerations.
(a) Added statement that this section applies unless the site qualifies for industrial soil cleanup levels.
(b) Deleted language about treatment, removal and containment (TRC) and replaced with trigger that cleanup action being required where cleanup levels are exceeded.
(b) Deleted language on commercial and other land uses soil cleanup levels.
Moved language from later in Section to here discussing when more stringent cleanup levels can be required by the dept. Also, added dust as an example pathway and reference to Sections 702 & 708.

Subsection (2) – Method A soil cleanup levels.
(a) Added language about Method A soil cleanup levels being applied at sites qualifying under Section 704.
(b) Deleted Table 2 – moved to new Section 990, renamed as Table 740-1, with several changes to values and footnotes.
(b) Added requirement that terrestrial ecological be addressed by Method A cleanup levels.
(c) Deleted the discussion of when more stringent cleanup levels can be required by the dept.

Subsection (3) – Method B soil cleanup levels.
(a) Added language to provide for "standard" and "modified" Methods.
(b) Deleted criteria for ground water protection and the 100 times multiplier – replaced by the Equilibrium Partitioning method in new Section 747.
(b) Deleted TPH related language and replaced with a procedure on how to establish a cleanup level for petroleum mixtures using new equations for direct ingestion and dermal contact.
Lead in paragraph for direct contact added as part of reorganization of this subsection.
(b) Added averaging time and exposure duration to equation 740-1. Minor editing to other terms in equations 740-1 and 740-2, including changed the term "frequency of contact" to "frequency of exposure".
(b) Deleted provision related to protection of ambient air.
(b) Deleted the discussion of when more stringent cleanup levels can be required by the dept.
(b) Deleted language on Method C cleanup levels.
(b) Added statement on environmental protection.
(c) Added general description of Modified Method B. Provided detailed list of what changes can be made to equation default values under Modified Method B to derived site-specific cleanup levels.
(c) Added equations and default values to enable calculation of soil cleanup levels addressing the soil ingestion and dermal (skin) exposure pathways concurrently when a SSRA would result in

soil cleanup levels high enough that the dermal exposure pathway could be a significant exposure pathway.
(c) Added provisions requiring soil vapors to be addressed when a SSRA would result in soil cleanup levels high enough that vapors could be a significant exposure pathway. Includes specific circumstances when soil vapors must be evaluated as well as acceptable methods for evaluating the vapor pathway.
(d) Added a statement that other adjustments to the reasonable maximum exposure scenario and default assumptions can be made when using a quantitative SSRA to demonstrate the protectiveness of a remedy.

Subsection (4) – Method C soil cleanup levels.
Added a statement that this section no longer provides procedures for a Method C soil cleanup level.

Subsection (5) – Adjustments to cleanup levels.
Reworded statement on when cleanup levels found under applicable laws must be adjusted.
Added statement on how PQLs and natural background get factored into cleanup levels.

Subsection (6) – Point of compliance.
(c) Added description of the point of compliance for soil vapors.
(d) Modified to explain that the 15 foot depth applies as a point of compliance to any exposure pathway that requires contact with the soil to complete the exposure pathway.
(d) Added reference to eco provisons for point of compliiance related to these provisions.
Added list of conditions that must be met for sites using containment as the selected remedy addressing soil contamination.

Subsection (7) – Compliance monitoring.
(b) Added statement that soil sampling is to be done to determine compliance with soil cleanup levels.
(c) Reorganized this subsection and added provisions to make this consistent with the department's statistical guidance. Including:

- An assumption that sampling data are lognormally distributed and citation of various statistical methods for rejecting this assumption and determining the upper confidence limit.
- Allowing for direct comparison of soil test results to the cleanup level in some circumstances.
- Allowance for exceedance of the 2 times and 10% rule when the cleanup level is based on background to control false positive error rates at 5%.
- New methods for handling data sets with a lot of values below the PQL.

12.1 General

GQ 12.1.1
Why has dust been added as a potential pathway of concern under WAC 173-340-740(1)(c)?

(1372)

Response:
In WAC 173-340-740(1)(c), dust exposure has been included as a potential pathway of concern. This is included in the list of reasons the department could require a more stringent soil cleanup level because of potential public health concerns related to the inhalation of dust at contaminated sites. Depending on the contaminants and characteristics of the site, dust inhalation may pose a problem to on-site workers, or to populations residing on or around a site. For some contaminants, such as hexavalent chromium, dust inhalation may present a greater hazard than exposure due to soil ingestion (see 1991 RS, p. 238).

GQ 12.1.2
How does Ecology propose to address the widespread use of pesticides and herbicides and their lasting effects on soil?

(2352, 2353)

Response:
Ecology acknowledges that the historic use of pesticides and herbicides has resulted in soil and ground water contamination in Washington State. Some of these chemicals can remain in the soil and ground water at concentrations well in excess of cleanup levels for decades after their use has stopped. For example, elevated concentrations of arsenic and lead have been found in orchards due to the use of lead arsenicals prior to the introduction of DDT in 1945. Developers have taken independent cleanup actions at several eastern Washington sites including the removal and disposal of contaminated soil. The department encourages these independent cleanup actions. To date, because of resource limitations, the department's focus has been on obtaining more data on the extent and concentrations within the affected areas and on the education of local governments and developers about the potential health risks resulting from conversion of these properties to other uses where exposure could be increased. Ecology intends to continue these efforts in the future.

GQ 12.1.3
Does meeting the Method A soil cleanup levels throughout the site adequately address potential soil vapor concerns?

(100, 2261)

Response:
Ecology expects that sites that meet the Method A soil cleanup levels throughout the site will also adequately be addressing potential vapor exposures under most circumstances. It is not necessary to add a statement to this effect to the rule because an evaluation of the vapor pathway is unlikely under Method A except as provided for under WAC 173-340-740(1)(c). Under Methods B or C it is similarly not necessary to add such a statement to the rule because, if the outcome of the site-specific analysis results in a cleanup level that is the same as under Method A, there would be no "significant increase" and evaluation of the vapor pathway would not be necessary except as provided for under WAC 173-340-740(1)(c).

GQ 12.1.4
What is the basis for the soil ingestion rate of 200 mg/day?

(499, 505)

Response:
The 200 mg/day soil ingestion rate used in equations 740-1 and 740-2 is the same rate used in the equations in the current rule. To provide consistency with these existing equations, this soil ingestion rate was also used in the proposed new equations in Section 740. The commentor that questioned the basis for the current soil ingestion rate of 200 mg/day, cited a 1994 draft EPA guidance document (EPA, 1994) as the basis for suggesting this value be changed to 114 mg/day.

Ecology has reviewed this and other EPA guidance documents with information pertaining to soil ingestion. The cited document provides an age-adjusted soil ingestion rate of 114 mg-yr/kg-d, based on a child's exposure for 6 years and an adult exposure for 24 years, providing for a total exposure duration of 30 years. A soil ingestion rate of 200 mg/day for a child of age 1-6 is used in EPA's age-adjusted calculations. This is consistent with the soil ingestion rate used in the MTCA equations.

A more relevant and up-to-date publication on soil ingestion is EPA's Exposure Factors Handbook (EPA, 1997c, d, & e). Volume 1 Chapter 4 is dedicated to soil ingestion and pica. This handbook provides detailed documentation for soil ingestion among children and limited documentation of soil ingestion among adults. The mean soil ingestion values among children ranged from 39 mg/day to 271 mg/day. That handbook further notes that "…this group of mean values is consistent with the 200 mg/day value that EPA programs have used as a conservative mean estimate."

Furthermore, the 200mg/day soil ingestion rate for a residential child is consistent with EPA's Region 10 human health risk assessment guidance. That guidance document notes that although 200 mg/day is a conservative estimate of the mean, an upper percentile recommendation for children is 400 mg/day.

For these reasons Ecology sees no reason to change the current default value of 200 mg/day in the existing equations or deviate from this value in the new equations.

GQ 12.1.5
What is the basis for 16 kg as the average body weight for a child in the soil direct contact equations?

(503)

The current rule uses a 16 kg average body weight for children and this is not proposed to change in the rule amendments. One commentor suggested that a 15 kg body weight should be used, since that is the body weight used in EPA's guidance.

Response:
Review of EPA's Exposure Factors Handbook (EPA, 1997c) confirms that a 15 kg average body weight is recommended for EPA conducted risk assessments. However, since this is an existing default value and there was no deliberation by the Policy Advisory Committee or the Science Advisory Board regarding the default body weights used in the MTCA rule, at this point in the rule-making process, Ecology believes it would be inappropriate to make this change.

GQ 12.1.6
Why is a child used as the basis for carcinogen exposure calculations in the soil direct contact equations?

(755, 2409)

The current rule uses child exposure as the basis for calculating dose for both noncarcinogens and carcinogens. One commentor questioned this approach for carcinogens, suggesting that both childhood and adult exposure should be taken into account when setting cleanup levels for carcinogens.

Response:
The use of a six-year childhood duration in the equations for deriving soil cleanup standards for direct contact is discussed in Ecology's Responsiveness Summary for the cleanup regulation (Ecology, 1991). As stated in that document, Ecology believes that this approach, in combination with other exposure parameters and with a relatively strict limit on acceptable risks, results in protective soil cleanup levels.

Basing the calculation on only childhood exposures should not be misinterpreted as meaning that adult exposures are of no concern to Ecology or have no potential for adverse consequences. Ecology acknowledges that the childhood-only exposure scenario, using the selected exposure parameters, accounts for about 70 percent of the total exposure in EPA's standard default exposure equation, which assumes a 30-year total exposure. However, even assuming a longer period of exposure as in EPA's default equation, the majority of lifetime exposure still occurs in the childhood period that represents only a small fraction of a total exposure duration.

Given these reasons and that this issue was not raised during the PAC process or the MTCA Science Advisory Board's review of the regulation, Ecology does not believe it would be appropriate to make this change at this stage of the rule-making process.

GQ 12.1.7
Why isn't snow cover factored into the direct soil contact equations?

(889)

Response:

One commentor suggested that the direct contact equations be altered to account for snow conditions that may afford a barrier to exposure from contaminated soils. Ecology disagrees that snow may afford an appropriate barrier from exposure to contaminated soils in Washington State.

Washington's weather is complex, variable and at times unpredictable. Eastern Washington has colder winters and warmer summers than western Washington. Generally across Washington state, at lower elevations, snowfall is light with heavy snowfall at higher elevations. Along the coast of Washington the average annual snowfall is about 5 inches, and many years with no snow cover. In contrast, Mount Rainier may receive 50 to 75 inches on its lower slopes and over 500 inches in higher elevations. East of the Cascades, summers are warmer, winters are colder and precipitation is less than in western Washington. Annual precipitation ranges from seven to nine inches near the confluence of the Snake and Columbia rivers, 15 to 30 inches along the eastern border, and 75 to 90 inches near the summit of the Cascades. Snow cover in these areas is often very limited. (Clements, 1995; Yates, 1995; World Book, 1994)

Meteorological conditions may play a role in reducing selected exposures to contaminated soils for states where winter temperatures are much colder, winter snow pack is much more common and prolonged, and frozen ground is more likely than in Washington, particularly the Puget Sound region. Washington's complex and variable weather patterns preclude the application of a suitable exposure variable that would account for reduced exposures during winter snowfalls. The limited snowfall that does occur in most populated areas of the state turns to rain or quickly melts and creates very muddy conditions. These conditions exacerbate exposure patterns to contaminated soils, not reduce the exposures. Children still play outside during the winter and are potentially exposed to contaminated soil. Also due to the wet weather, mud is often tracked into the homes. The wet soil dries and then becomes part of the household dust, resulting in exposure to soil contaminants.

GQ 12.1.8
Do the standard Method B and C equations adequately address acute health risks and other populations?

Two commentors questioned whether the default exposure assumptions in the direct contact equations adequately protect from acute exposures and for other exposed populations than a child 0 to 6 years of age. For example, Allen expressed the following concern:

> We recommend adding age groups, and associated surface area and body weight, to the list of exposure factors that may be modified. Skin surface areas and body weight are not listed under the allowable modifications. The skin surface area is specified as 2,200 cm2, the EPA default for children aged 0 to 6 years in a residential exposure scenario (U.S. EPA, 1991d, and 1993). There is no mention in the "allowable modifications" that skin surface area or age group could be altered. However, in Section (3)(d) of 708, the text states that a "child trespasser" scenario could be considered at a capped commercial site. Children aged 0 to 6 are rarely trespassers; an appropriate trespass scenario for many sites would be elementary school children (age 4 to 11) or teens (12 to 18). If an older age group is evaluated then both skin area and body weight would need to be adjusted. EPA's Exposure Factors Handbook (1997a) lists skin surface areas and body weights for many age groups. These values are easily obtained from tables in

> this reference. To restrict the allowed populations to either all children aged 0 to 6 years or all adults would be over-protective in some cases and under-protective in others.

And Glass,

> For protection of human health, both acute (short-term exposures) and chronic (long-term exposures) threats are to avoided. The MTCA Cleanup Regulation includes general language to that effect (see, for example, 173-340-740(3)(b)(iii)(B)), but does not recognize that the equation for deriving cleanup levels based on noncarcinogenic threats (see Equation 740-1) does not appropriately reflect parameter values representative of acute (short-term) exposure scenarios. The single equation for calculating cleanup levels for noncarcinogenic threats may not be protective for both acute and chronic threats (see Calabrese et al., 1997; see also the derivations of acute-threat cleanup levels for the Everett Smelter Site, based on the paper by White, 1999). Where applicable, a separate evaluation of potential acute health threats should be performed. That evaluation should consider types of acute threats (e.g., mortality differs from mild and reversible gastrointestinal upset) and tolerable risks (e.g., practically zero tolerable risk for mortality but some non-zero acceptance of mild, reversible erects) when making choices for assigning parameter values (e.g., one-day or single event soil ingestion rates, absorption fractions, and so on). In the current rule there appears to be an assumption that protection against chronic effects will also provide protection against acute effects. Calabrese et al. (1997) demonstrate that this is not necessarily the case, since chronic exposure scenarios consider long-term average conditions for exposure that do not account for short-term higher exposure conditions. Equation 740-1 reflects only the longer-term average scenarios. I recommend that the Cleanup Regulation take note of this fact and not imply that the single equation for noncarcinogenic threats is necessarily protective against acute threats.
>
> Similar comments may be relevant for sections of the Cleanup Regulation addressing other contaminated media.

Response:

Standard MTCA Method B / C are designed to protect individuals, including sensitive people defined as children, from adverse health effects due to long term low dose exposures from environmental contaminants. Protection of people from effects due to chronic exposures is consistent with available toxicity information used to derive the MTCA cleanup levels. The toxicity information, reference doses and cancer potency factors, developed by EPA are designed to protect people from adverse effects over a lifetime. Potential adverse effects resulting from acute exposures (14 days or less) to hazardous chemicals must be evaluated on a chemical and site-specific basis. Ecology acknowledges that the default equations assuming long-term exposure under Method B and C may not always be protective of acute risks from high dose short-term exposures (Calabrese et al., 1997a; Calabrese et al., 1997b; White, 1999).

Adverse health effects from acute exposures are evaluated differently than effects from chronic exposures. For example, not only is the exposure duration altered but it is also typical to assume a much higher exposure rate, such as a pica child exposure to soil. If this is an issue at a site, Ecology has the authority under WAC 173-340-740(1)(c) to require more stringent soil cleanup levels on a site-specific basis. The language clarifying this authority in WAC 173-340-708(10) has been modified in the final rule. See Chapter 9 for further discussion of that change.

As noted by Allen, when evaluating the protectiveness of a remedy that leaves contamination behind in excess of these cleanup levels, it may be necessary to alter several variables in these equations to account for other exposed populations or reasonable maximum exposure scenarios.

Changes such as this are allowed when evaluating alternative exposure scenarios as provided for in the opening paragraph in WAC 173-340-708(10)(b).

Note: The descriptors applied to exposure durations usually use terms such as acute/short term, intermediate/subchronic or chronic/long term exposures. By convention, the duration of an acute exposure is usually defined in terms of days, usually 14 days or less. Intermediate/subchronic exposures are usually defined as a period of months, up to one year. Chronic exposures are usually defined as lasting one year or more and may last over a lifetime.

GQ 12.1.9
Why is the term "unrestricted land use" used to describe Method A soil cleanup levels in Method A?

(645)

Response:
The title to the Method A soil cleanup levels was changed to "unrestricted land use" to better convey the meaning of these values (vs. industrial soil cleanup levels). The use of the term "unrestricted land use" does not change the meaning of the Method A values from their meaning under the current regulation. Contrary to the commentor's assertion, there was no specific PAC recommendation on whether to change this term.

GQ 12.1.10
Does Ecology expect that the proposed regulation will result in higher, lower, or about the same percentage of cleanups to fully unrestricted land use levels?

(363, 2622)

Response:
See discussion of land use in the final EIS.

GQ 12.1.11
What level of risk is to be used when evaluating the protectiveness of remediation levels?

(379)

Response:
See Chapter 5 of the CES for a discussion of this issue.

GQ 12.1.12
Why has Method C been eliminated as an option for setting cleanup levels for non-residential land uses (except industrial)?

(165, 282, 587, 807, 1107, 1119, 2183, 2227, 2354)

Response:
See Chapter 9 of the CES for a discussion of this issue.

GQ 12.1.13
Is modified Method B intended to be used to develop less stringent cleanup levels for land uses other than residential?

(379, 390)

Response:
Although use of modified Method B may result in less stringent cleanup levels, this is not because of land use, it's because chemical or site-specific information would indicate a less stringent cleanup level will be protective, regardless of land use. Based on a PAC recommendation, residential land use is to be used to derive Method B soil cleanup levels, however, other land uses can be used to assess the protectiveness of remediation levels, as discussed in Chapter 9.

GQ 12.1.14
Do soil cleanup levels need to take into consideration the potential for soils below the water table to contaminate ground water?

(754, 1274, 1373, 2430)

Response:
Contaminated soils and waste materials disposed of below the water table can be a significant source of ground water contamination, especially since they are in direct contact with the ground water. For this reason, WAC 173-340-747 does include provisions addressing modeling of soil contamination below the water table, should this be an issue at a site.

GQ 12.1.15
Why was 15 feet selected for the point of compliance for soil direct contact? Was soil mixing taken into account when the point of compliance for soils was established for direct contact?

(507, 892, 2355)

Response:
The comments refer to an existing regulatory requirement and address an issue beyond the scope of the rule-making actions – the basis for the specified point of compliance for the direct contact pathway. See the 1991 Responsiveness Summary for a discussion of the reasons for this depth.

Soil mixing during excavation was not considered when the point of compliance for direct contact with soil was established. Ecology's experience from sites that have been developed after soil contamination occurred is that often insufficient soil mixing occurs during construction activities to eliminate the hazards posed by contaminated soil. For shallow soils, some natural mixing can occur over a long period of time due to biological perturbation. This has been

acknowledged in the point of compliance provisions pertaining to terrestrial ecological risk and may also need to be considered when evaluating the long-term effectiveness of soil caps.

12.2 Dermal Exposure Pathway

GQ 12.2.1
Why have equations addressing potential dermal exposure been added to the soil cleanup level calculations?

(49, 50, 60, 103, 500, 501, 591, 814, 875, 2228, 2264)

Several commentors expressed concern about the addition of equations addressing the dermal contact pathway. For example, K. Johnson stated the following:

> There is little if any technical justification for including dermal exposure as a default MTCA equation for all chemicals. Ecology should not add these routes of exposure based on brief technical discussions by the SAB. In addition, there has been no forum for discussing the policy issues associated with adding dermal exposure to MTCA (e.g., the threshold question on when should it be evaluated). There is also clearly not enough scientific information for dermal exposure to meet the "quality of information" requirements identified in -702. For example, there currently is not one dermal toxicity value in IRIS or HEAST. As a result, in addition to all of the exposure factors, every proposed dermal toxicity value must be reviewed and approved by the SAB, DOH, and EPA. Furthermore, the discussion during the PAC process focused on evaluating other routes of exposure in certain situations when performing a site-specific risk assessment. There was never a discussion on the merits of adding dermal as a default route of exposure in the rule.

In contrast, several commentors suggested that inclusion of the dermal pathway was not only consistent with the PAC recommendations, but also urged Ecology to include this exposure pathway as a default exposure pathway under standard Method B for all chemicals. For example Allen stated the following:

> We recommend that Ecology make consistent use of dermal exposure factors in the risk calculation formula. For petroleum mixtures, dermal contact is included in the standard method, but it is not included in the standard method for non-petroleum compounds. Dermal contact is included in the modified method for non-petroleum compounds. For some chemicals, such as dioxins, the dermal pathway can account for risks almost equal to the ingestion pathway. This would be a situation where use of the standard method could result in an underestimation of the protectiveness of a cleanup level.

And Goold:

> The routes of exposure considered in this regulation are not clear. For example the development of soil concentrations for unrestricted land use, (WAC 173-340-740, Equation 740-1) only includes the ingestion of soil. The equation should be modified to include the exposures due to the ingestion of soil, inhalation of vapors and particulate, and dermal contact with the soil.

And Valeriano:

> With regard to soil vapors and dermal language, we strongly disagree with business comments indicating those provisions here and in sections 745 and 750 are beyond the PAC recommendations. The PAC specifically recommended that other pathways be considered as part of the site-specific risk assessment discussions. This was included in the recommendations on Section 708. In addition, these specific pathways were used as examples during the risk assessment subcommittee discussions.

Response:
The dermal exposure pathway has been included in the direct contact equations for petroleum mixtures because this was a POG recommendation and is consistent with the PAC decision to defer decisions regarding petroleum cleanup levels to the POG. The POG made this recommendation because of scientific information indicating that the dermal exposure pathway could be a significant exposure pathway for petroleum contamination.

For other hazardous substances, the dermal exposure pathway has been included under modified Method B as a pathway that needs to be addressed when a site-specific risk assessment results in significantly higher direct contact concentrations than would be calculated using the standard Method B equations.

Ecology acknowledges the concerns of commentors that this approach is somewhat cumbersome, however, it has been structured this way because that was the approach recommended by the PAC. As noted by Ms. Valeriano, a member of the PAC, this is consistent with the PAC's recommendations.

See the next question for responses to additional issues raised by K. Johnson.

GQ 12.2.2
Is there sufficient scientific information available to evaluate the dermal exposure pathway?

(53, 591, 648, 1369)

In addition to the comment discussed in the previous generalized question, K. Johnson further questioned adding of dermal exposure to the direct contact equations, indicating that the quality of information requirements in WAC 173-340-702(16) had not been met.

Response:
Note that in rule-making, Ecology is obligated to meet the standards for review under the Administrative Procedures Act. However, because of the level of concern raised about the addition of the dermal pathway to the rule, Ecology has addressed the quality of information criteria in WAC 173-340-702(16).

Where applicable, Ecology used national and state guidance to develop dermal default exposure parameters. In addition, Ecology used considerable additional information during the evaluation of the dermal exposure pathway. Numerous documents, technical memoranda and peer-reviewed publications are in the rule file regarding the assessment of dermal exposure to contaminants in soil. Topics addressed by these documents include quality of information issues, uncertainty,

default exposure parameters, and the use of toxicity information to evaluate the dermal exposures.

To ensure technical consistency and accuracy with national guidance and new scientific trends Ecology assembled a 4-member technical team that presented to the MTCA Science Advisory Board the technical rationale for the evaluation of the dermal exposure pathway as part of Washington's cleanup standards. The 4-member technical team that assessed the dermal exposure pathway for inclusion into the proposed amendments to the Model Toxics Control Act represented federal and state agencies with affiliations with the University of Washington. Two members of the technical team have received advanced degrees from the University of Washington on topics related to assessing the dermal exposure pathway. Another representative from the U.S. Environmental Protection Agency was responsible for advancing federal guidance that included assessments of the dermal exposure pathway for EPA's Region 10. This team of technical experts provided Ecology with technical advice and support, ensured critical federal and state regulatory science-policy integration, and provided responses to the Science Advisory Board's technical and policy questions.

This work culminated in a technical memorandum to the MTCA Science Advisory Board dated January 25, 1999. The quality of information criteria in WAC 173-340-702(14) were noted and detailed responses for all criteria were provided to the Science Advisory Board. After considerable deliberation, the Board concluded that the available technical information was of sufficient quality to recommend that the dermal exposure pathway be evaluated at MTCA sites. Furthermore, in a letter commenting on the 1999 proposal, EPA and the Department of Health noted that "…support documentation for the evaluation and inclusion of the dermal exposure pathway in the proposed amendments meets and exceeds technical standards for peer reviewed guidance, documentation and technical information."

Thus, Ecology believes that, in comparison with evaluations for other routes of exposure and chemical assessments, the uncertainties associated with the dermal route of exposure are well within the realm of technical acceptability.

To enable calculations of dermal exposure, the 2000 proposal included default factors to facilitate conversion of oral reference doses (RfD) and cancer potency factors (CPF) to dermal toxicity factors. Thus, there is no need to have to go the cumbersome approval process asserted by K. Johnson unless one chooses to develop a site-specific RfD or CPF.

GQ 12.2.3
What would be a significant enough change in the direct contact equations to require an evaluation of the dermal pathway?

(54, 58, 59, 876, 950, 1368, 1378, 2036, 2037)

Response:

As discussed in Chapter 9, the level of increase that will likely trigger the need to evaluate the dermal pathway will depend on several factors and for this reason has not been defined in the rule. See Chapter 9 for a discussion of this issue as it pertains to dermal contact.

GQ 12.2.4
Does the dermal pathway need to be evaluated for PAHs?

(654)

Response:
Based on the extensive information on file, national and state guidance documents reviewed by the 4-member technical team described above, and extensive oversight by Ecology's Science Advisory Board, Ecology is not aware of any documentation that would indicate dermal exposure should not be assessed for PAH contaminated soil. Indeed, clear documentation exists to the contrary and both national and state guidance documents recommend dermal absorption factors for soil for PAHs (Johnson and Kissel, 1996).

GQ 12.2.5
Why have default values been provided for exposure frequency and exposure duration in the dermal equations?

(649)

Response:
The default values for exposure frequency and exposure duration are provided in these equations to enable calculation of cleanup levels for petroleum mixtures, as recommended by the POG. Including these defaults also provides a reference point for adjustments for other hazardous substances, should changing these parameters result in the need to evaluate the dermal exposure pathway, consistent with PAC recommendation.

GQ 12.2.6
How can dermal exposure parameters that vary on a site-specific basis be taken into account when evaluating the dermal exposure pathway?

(52)

Response:
Ecology recognizes that selected dermal exposure parameters may vary over time, with different site-specific conditions, varying meteorological conditions across Washington state and peoples behaviors. As previously described in this Concise Explanatory Statement and detailed in numerous technical memoranda in the rule file Ecology used national and state guidance to develop dermal default exposure parameters. Furthermore, the previously described 4-member technical team assembled by Ecology had unique technical expertise that afforded the best expert advice to help identify the exposure parameters which were well supported from guidance and literature. However, Ecology recognizes that these parameters may vary over time or under

certain types of site-specific conditions. The regulation allows for the modification of the default assumptions in the standard direct contact equations. For dermal contact, the adherence factor, dermal absorption fraction and gastrointestinal absorption conversion factor may be modified if the requirements in WAC 173-340-702(14), (15), (16) and 173-340-708(10) are met. WAC 173-340-740(3)(c)(ii)(C) and 173-340-745(5)(c)(ii)(C). Furthermore, Ecology will continue to solicit advice and support from the 4-member technical team to ensure responsible parties and the concerned public the best possible site-specific assessments that may account for dermal exposures.

GQ 12.2.7
Why are oral toxicity factors adjusted for the dermal exposure pathway?

(51, 654)

The equations in the rule providing for evaluation of the dermal exposure pathway include an adjustment factor for the oral reference dose and oral cancer potency factor. The reason for this adjustment is explained in support documents in the rule file and. EPA's Region 10 Interim Final Guidance: Developing Risk-Based Cleanup Levels At Resource Conservation and Recovery Act Sites in Region 10 (U.S. EPA, 1998b) provides the following explanation of this adjustment:

> Exposure via the dermal route are calculated and expressed as absorbed doses. An administered dose is the dose that is presented to a persons "exchange surfaces" or points of contact with the external world, including the mouth, skin, and nose. An absorbed dose in the portion of the administered dose that actually enters the general circulation of the body. For example, because the skin is an effective barrier to many chemicals, only a portion of the dose administered on the skin's surface will be absorbed through the skin into the blood stream. When evaluating dermal exposure to contaminants in water or soil, it may be necessary to adjust an oral toxicity value based on an administered dose to one based on an absorbed dose using a chemicals oral absorption efficiency. This section discusses the method for making this adjustment. If the oral toxicity factor is used unadjusted, the resulting risk or hazard estimates will be less conservative because adjusted values are more protective than unadjusted oral values.

12.3 Vapor Exposure Pathway

GQ 12.3.1
Why has language addressing soil vapors been added to the rule?

(592, 647, 650, 2228)

Response:

Provisions addressing soil vapors have been added to the rule to implement a PAC recommendation that other exposure pathways be evaluated when a site-specific risk assessment results in significantly higher soil cleanup levels. These provisions also address a recommendation from the MTCA Science Advisory Board that the vapor pathway be included in site-specific evaluations. Ecology agrees it is appropriate to include specific provisions addressing the vapor exposure pathway to insure this pathway is not ignored at sites.

GQ 12.3.2
When do soil concentrations become high enough that exposure to soil vapors needs to be evaluated?

(110, 549, 876, 950, 1370, 2036, 2037, 2089, 2271)

Response:
Similar to the dermal exposure pathway, for other than diesel fuel, a specific trigger has not been provided indicating when the vapor exposure pathway needs to be evaluated. The diesel fuel trigger was included at the recommendation of the POG. For other substances, the concentration in the soil that will likely trigger a vapor evaluation will vary considerably depending on the contaminant and the site characteristics and specific triggers have not been provided in the rule. One commentor suggested that an "order of magnitude" increase should be the trigger for evaluating vapors. Ecology disagrees that this should be the trigger in all cases. The amount of increase that will trigger the need to evaluate soil vapors will vary considerably based on many factors including, the volatility of contaminants at a site, the baseline concentration, soil characteristics and other factors.

The proposed rule uses the 3-phase model, along with other criteria, for establishing the baseline for determining when a cleanup level is "significantly higher" and thus requiring evaluation of the vapor pathway. One commentor questioned the appropriateness of this as the baseline and many others expressed concern about the complexity and inconsistencies in the proposed language.

This complexity is due in part to drafting these provisions to conform to the PAC recommendations. In order to determine what is a "significant increase" a baseline concentration must be established from which the increase can be measured. Ecology chose the 3-phase model as one of the baseline criteria because this value can be readily determined for most chemicals. For gasoline mixtures the baseline is that concentration established using the 4-phase model, since it is expected most gasoline contaminated sites will have non-aqueous phase liquid present in the soil. For diesel range organics, a soil concentration of 10,000 mg/kg is used as the baseline requiring the evaluation of vapors. Modified Method B includes a further baseline of cleanup levels derived using the standard soil ingestion equations, although it is unlikely this will be the controlling baseline at most sites.

Because of ongoing concerns with complexity, the final rule has been further revised to reorganize and simplify these criteria describing when soil vapors must be evaluated. For standard Method B, the amendment has been revised to state the following:

The soil to vapor pathway shall be evaluated for volatile organic compounds whenever any of the following conditions exist:

(I) For gasoline range organics, whenever the total petroleum hydrocarbon (TPH) concentration is significantly higher than a concentration derived for protection of ground water for drinking water beneficial use under WAC 173-340-747(6) using default assumptions;
(II) For diesel range organics, whenever the total petroleum hydrocarbon (TPH) concentration is greater than 10,000 mg/kg;
(III) For other volatile organic compounds, including petroleum components, whenever the concentration is significantly higher than a concentration derived for protection of ground water for drinking water beneficial use under WAC 173-340-747(4).

WAC 173-340-740(3)(b)(iii)(C). For modified Method B, the amendment has been revised to state the following:

The soil to vapor pathway shall be evaluated for volatile organic compounds whenever any of the following conditions exist:

(I) For other than petroleum hydrocarbon mixtures, the proposed changes to the standard Method B equations (Equations 740-1 and 740-2) or default values would result in a significantly higher soil cleanup level than would be calculated without the proposed changes;
(II) For petroleum hydrocarbon mixtures, the proposed changes to the standard Method B equations (Equations 740-3, 740-4 and 740-5) or default values would result in a significantly higher soil cleanup level than would be calculated without the proposed changes;
(III) For gasoline range organics, whenever the total petroleum hydrocarbon (TPH) concentration is significantly higher than a concentration derived for protection of ground water for drinking water beneficial use under WAC 173-340-747(6) using default assumptions;
(IV) For diesel range organics, whenever the total petroleum hydrocarbon (TPH) concentration is greater than 10,000 mg/kg;
(V) For other volatile organic compounds, including petroleum components, whenever the concentration is significantly higher than a concentration derived for protection of ground water for drinking water beneficial use under WAC 173-340-747(4).

WAC 173-340-740(3)(c)(iv)(A).

Ecology acknowledges that there is a need for additional specifics on when the vapor exposure pathway will need to be evaluated. Ecology intends to address this issue in more detail in the future in guidance.

GQ 12.3.3
Does the soil ingestion rate need to be lowered when evaluating indoor vapor exposure?

(506)

One commentor suggested that if exposure to vapors is included in a risk assessment there should be less exposure to contaminated soil assumed, since vapor exposure is likely to occur indoors.

Response:
Ecology disagrees that a reduced soil ingestion rate should be used at sites adding vapor exposure. Multiple exposures to different chemicals by different routes do not justify an arbitrary reduction or elimination of one route of exposure over that of another (U.S. EPA, 1992).

Just because a person is exposed to indoor air vapors doesn't mean that less soil exposure will occur. Outdoor soil exposure doesn't have to occur equally throughout the day to ingest the amount of soil assumed in the MTCA equations. Also, soil may be tracked into a building by the persons who live there or by a family pet, resulting in direct contact with soil contaminants inside the home or business.

GQ 12.3.4
Does the vapor pathway have to be "complete" to trigger an evaluation?

(104, 108, 2265, 2269)

One commentor suggested a provision be added to the rule stating that the vapor exposure pathway does not need to be evaluated unless there is a complete exposure pathway.

Response:
MTCA requires remedial actions to address both actual and potential threats posed by hazardous substances. At many sites, actual exposure is not occurring because the site is abandoned or occupants are aware of the contamination and take precautions to avoid exposure.

When setting cleanup levels and evaluating the protectiveness of a remedy, it is not sufficient to assume that current exposure conditions will prevail over the long term. In fact, it has been the department's experience at contaminated sites that once the persons involved in the cleanup move on, new tenants or employees (and sometimes even new owners) are unaware of the contamination and fail to take similar precautions. This is especially true because of rapidly changing land use patterns. Thus, it is very important that potential exposure pathways be taken into consideration when evaluating vapor exposure.

GQ 12.3.5
What is the appropriate trigger for evaluation of the vapor pathway for diesel range organics?

(105, 2229, 2266)

The 2000 proposal proposed that diesel vapors be addressed whenever the soil concentration is greater than 10,000 mg/kg within one foot of a structure and the diesel contains less than 8% volatile organics. Two specific comments were received on this provision. For example, POG indicated the following:

> The requirement to evaluate soil vapors when TPH containing less than 8% volatiles by weight is present in soil at levels exceeding 10,000 mg/kg and which meet certain building proximity stipulations was retained from the December 1998 draft proposed amendments. However, there now is no language explaining that, in the presence of more than 8% volatiles, soil cleanup levels will be determined on a site-specific basis. It is recommended that language addressing sites where TPH in soil exceeds 8% volatiles by weight be specifically included in the rule.

And Valeriano, stated the following:

> One concern we have with the vapor provisions here and in 745 is the requirement that diesel fuel vapors be looked at only if the soil concentration exceeds 10,000 ppm within one foot of a structure. Tying a cleanup level to future land use like this is inconsistent with PAC recommendations stating that land use is to be considered in the remedy selection process. What guarantee is there that a building will not be present on a site at some time in the future? This provision does not require institutional controls to be in-place to assure the site conditions considered at the time of the evaluation will remain in place in the future. Even if this was the case, there is no supporting data provided indicating soil borings are that accurate or even possible to install with confidence that close to foundations or sewer and water lines. Our recommendation is to make this requirement concentration based, not subject to a location requirement that could change in the future or will be impossible to verify.

Response:
After careful consideration of these comments Ecology has decided to simplify the related provisions in the final rule. Ms. Valeriano's reasoning is persuasive and for those reasons and those cited in the above response, the one-foot criterion has been removed from the final rule. As for the 8% volatiles criterion, Ecology believes keeping this criterion and adding even more explanation will add more confusion than clarity. It is difficult to make a logical connection between a specific standard for diesel fuel with minimal volatiles content and yet have no specific standard for diesel fuel with more than 8% volatiles content. Thus, for simplicity we have modified the criterion to simply state that vapors must be evaluated for soils contaminated with diesel range organics whenever the soil TPH concentration is greater than 10,000 mg/kg.

If a site with lower diesel fuel concentrations in the soil is manifesting vapor problems, Ecology can use its general authority under WAC 173-340-740(1)(c) to require evaluation of the vapor pathway.

GQ 12.3.6
Why doesn't WAC 173-340-740(3)(c)(iv)(B)(I) include consideration of the point of compliance?

(109, 2270)

Response:

This particular criterion states that if the vapor concentration measured in the soil is below vapor cleanup levels, no further evaluation of the vapor exposure pathway is needed. This criterion is intended to provide an easy, straight-forward method for determining if vapors are a potential problem at a site or not. Assuming a representative sample of the soil vapors can be obtained, if the vapors in the soil do not exceed cleanup levels, then there should be no potential for a vapor problem and further evaluation of the vapor pathway should be unnecessary. Point of compliance considerations are taken into account in modeling under WAC 173-340-740(3)(c)(iv)(B)(III).

It should be noted that there are many factors that can influence near surface soil vapor measurements. These include making sure the probe is adequately sealed from the atmosphere and sampling during times of steady, or preferably, falling barometric pressure.

GQ 12.3.7
For the soil vapor pathway, can the point of compliance be changed depending on site-specific conditions?

(2090)

The point of compliance for soil vapors is established in the rule amendments as the soil vadose zone (the zone between the water table and ground surface). This was based on earlier comments suggesting this as an appropriate point of compliance. One commentor questioned this provision, suggesting that very deep soils do not pose the same threat as shallow soils.

Response:
Ecology acknowledges that very deep soil contamination will not necessarily pose the same vapor threat as shallower soils, however this may not be the dominant factor in determining the vapor hazard posed by the soils. How much the threat will be reduced at the ground surface will depend on many factors including how far the vapors have to migrate to reach locations where structures could be located, the soil stratigraphy and texture, the soil moisture content, the ground surface conditions and the presence of migration pathways. For this reason, altering the point of compliance is not allowed. However, the rule does not limit the ability to develop different soil cleanup levels for the vapor pathway for shallow and deeper soil layers if this can be demonstrated to be a controlling factor at a site.

12.4 Other Comments

GQ 12.4.1
Other comments regarding WAC 173-340-740 are addressed in the following table:

Comment ID	Comment	Response
760, Newlon 2435 Newlon	Notes earlier comment pertaining to remediation levels addressed.	Comment addressed in 1999 proposal.
779, Newlon	Comment on earlier proposal concerning flow-	The flow chart is not in the adopted rule.

2449 Newlon	chart--implies dermal and vapor must always be evaluated.	
1364, McCain	Need to provide a clear explanation of remediation levels to (1).	Comment addressed in 2000 proposal.
1365, McCain	Statement that all areas above cleanup levels must be addressed is misleading. For example, it ignores the 15-foot POC for direct contact.	Comment addressed in 2000 proposal.
1366, McCain	The description of the eco risk provisions is misleading.	Comment addressed in adopted rule by change in Section 704.
1373, McCain	The point of compliance for vapors should not extend below the water table.	Comment addressed in 2000 proposal.
(3) 101, POG 2262, POG	In (3)(b)(iii)(B) delete the phrase "other than petroleum".	Addressed by deleting this phrase in 2000 proposal.
501, Allen 2458, SAB	Should modify standard equations to use terms consistent with the petroleum equations.	Comment addressed in adopted rule.
504, Allen	Age groups and associated surface area and body weight should be added to the list of factors allowed to be changed. Cites example of child trespasser scenario.	This is allowed under 708(10)(b) if a different exposed population is being used to assess to the protectiveness of a remedy.
756, Newlon 2431, Newlon 758, Newlon 2433 Newlon	Notes earlier comment pertaining to defining terms in equations addressed.	Comment addressed in 1999 proposal.
757, Newlon 2432 Newlon	Need to define GI absorption efficiency.	Addressed by adding definition in 2000 proposal.
1275, POG 1276, POG	Notes earlier comment addressed.	Comment noted.
61, Bailey	See above comments.	Comments regarding dermal exposure were responded to in Appendix C of final EIS.
(TPH equation-specific comments)		
73, POG	Definition of "n" –add "noncarcinogenic" to volatile hazardous substances.	Comment addressed in 2000 proposal.
74, POG	Definition of F(i) inconsistent with 720-1. Likes the definition in 740-1.	Change made.
106, POG 2267 POG	Add statement that ambient air vapors need not be addressed where the indoor air is shown to be the more protective point of exposure.	Comment addressed in 2000 proposal.
107, POG 2268, POG	Insert "other than total petroleum hydrocarbons" into statement.	Comment addressed in adopted rule.
111, POG 2272, POG	The reference to 720(8) should be 720(7).	Comment addressed in 2000 proposal.
281, Gillett	Not clear what is meant by expansion of the conceptual site model to "consider" the soil to air pathway. This should only be necessary if	Language removed in 2000 proposal. See discussion of conceptual site model in GQ 9.1.2.

	the vapor pathway is complete.	
761, Newlon 2436 Newlon	Notes earlier comment pertaining to active vapor control systems has been addressed by removal of language in November 1999 proposal.	Comment addressed in 1999 proposal.
1277, POG	Soil vapor language is unclear.	Comment addressed in subsequent proposals and adopted rule.
2311, POG	(3)(c)(iv) conflicts with (3)(a)(iii).	Comment addressed in adopted rule.
102, POG 2263 POG	Change (3)(c)(iii) to include "chemical specific".	Comment addressed in adopted rule.
1155, Kenefick	The GI conversion factor needs to be added to the equation.	Comment addressed in 2000 proposal.
1275, POG 1276, POG	Notes earlier editorial comments addressed.	Comment addressed in 1999 proposal.
(4) 646, K. Johnson	Statement in (4) is misleading because can use remediation levels for non-industrial sites.	Comment addressed in 2000 proposal by adding cross reference to 708(3).
1374, McCain	The statement that containment sites can be determined to comply with cleanup standards is confusing. The requirement for a SSRA is confusing.	Comment addressed in 2000 proposal.
(7) 391, Dept. of Energy	(d)(i)(B) change "is" to "are".	Comment addressed in 2000 proposal.
2393, Newlon	Monitoring of soil may not always be necessary to establish compliance. For example for vapors could monitor air, for leaching, could monitor ground water. Suggests adding language to allow demonstration of compliance be monitoring receiving medium.	While monitoring of receiving medium may be appropriate, testing of the soil to confirm that soil related standards have been met is still necessary.
1400, McCain 1401, McCain	Point of compliance in "all areas" is inappropriate below the water table.	Addressed in Section 740 in 1999 proposal.

Chapter 13 Soil Cleanup Standards – Industrial Land Use

Several amendments to WAC 173-340-745 were made for clarification purposes and to reflect changes made to other chapters, including updating several cross-references. Substantive and other changes, listed by subsection, include the following:

Subsection (1) – Applicability
Eliminated (b) and (d) and consolidated these paragraphs under (a).
Modified (a)(iii)(D), to incorporate terrestrial ecological risk provisions.

Subsection (2) – General considerations.
(a) Added statement indicating when remedial action is necessary.
(c) Editing changes.
Former (g) deleted.
(d) Moved language from later in Section to here discussing when more stringent cleanup levels can be required by the dept. Also, reference to Sections 702 & 708 added.

Subsection (3) – Method A industrial soil cleanup levels.
Added statement that only sites that qualify for use of Method A under Section 704 can use this method.
Deleted table 3--moved to new Section 990 and renamed as Table 745-1, with several changes to values and footnotes.
(b) Editing changes.
(c) Deleted the discussion of when more stringent cleanup levels can be required by the dept. (moved to subsection (1)).

Subsection (4) – Method B industrial soil cleanup levels.
Added statement that use of Method B is optional at industrial sites and how a standard would be established if this option is chosen.

Subsection (5) – Method C industrial soil cleanup levels.
(a) Added provision providing for "standard" and "modified" Methods.
(b)(ii) Added statement on environmental protection.
(b)(iii) Lead in paragraphs for human health and direct contact (B) added as part of reorganization of this subsection.
(b)(iii)(A) Deleted criteria for ground water protection and the 100 times multiplier--replaced by the methods in new Section 747.
(b) Deleted the discussion of when more stringent cleanup levels can be required by the dept. (moved to subsection (1))
(b) Deleted TPH related provision and replaced with provisions describing how to derive cleanup levels for petroleum mixtures using new equations for direct ingestion and dermal contact.
(b) Added averaging time and exposure duration and default value of 20 years along with several editing changes to equations 745-1 and 745-2.

(b)(iii)(C) Added provisions requiring soil vapors to be addressed when a SSRA would result in soil cleanup levels high enough that vapors could be a significant exposure pathway. Includes specific circumstances when soil vapors must be evaluated as well as cross reference to provisions describing acceptable methods for evaluating the vapor pathway.
(c) Added general discussion of Modified Method C. Also, provided detailed list of what changes can be made to equation default values under Modified Method C to derive site-specific cleanup levels.
(c) Added equations and default values to enable calculation of soil cleanup levels addressing the soil ingestion and dermal (skin) exposure pathways concurrently for petroleum mixtures and when a Modified Method C site-specific risk assessment would result in soil cleanup levels high enough that the dermal exposure pathway could be a significant exposure pathway.
(c) Added criteria that trigger evaluation of vapors when using a site-specific risk assessment under Modified Method C and a description of methods for conducting this evaluation.
(c) Added statement that other adjustments to the reasonable maximum exposure scenario and default assumptions can be made when using a quantitative site-specific risk assessment to demonstrate the protectiveness of a remedy and provide cross-references to appropriate provisions.

Subsection (6) – Adjustments to industrial soil cleanup levels.
(b) Reworded statement on when cleanup levels found under applicable laws must be adjusted.
(c) Added statement on how PQLs and natural background get factored into cleanup levels.

Subsection (7) – Point of compliance.
Minor editing changes.

Subsection (8) – Compliance monitoring.
Minor editing changes.

NOTE: *The following generalized questions and responses only address issues unique to industrial soil cleanup levels. Issues that apply to both WAC 173-340-740 and 173-340-745 are addressed in Chapters 9 and 12 of the CES.*

GQ 13.1.1
Why does the rule provide for soil cleanup standards for industrial facilities?

(2226)

Response:
The rule provides for industrial soil cleanup standards because the statute specifically authorizes it. By definition, only sites meeting the qualifications in this section can use industrial soil cleanup standards. The criteria in this section are intended to minimize the chances that the land cleaned up to an industrial standard will be converted to non-industrial land uses, such as

recreational or residential. Where such conversions are planned, the property would not be eligible to use an industrial soil cleanup standard.

GQ 13.1.2
For industrial properties, what is the relationship between land use decisions under MTCA and local land use planning under the Growth Management Act (GMA)?

(361, 2620)

One comment was received regarding this issue from the Department of Energy:

> Land use is an important factor in implementing MTCA cleanup actions, particularly with regards to establishing cleanup levels for industrial-zoned properties. The current and proposed regulation acknowledges the authority of cities and counties in land-use planning. To clarify for the regulated community, does Ecology assert any independent land-use planning authority in making MTCA cleanup decisions, or will Ecology always accept local land-use planning efforts? E.g., if a city planning pursuant to the Growth Management Act (GMA) zones a property as industrial, does Ecology nevertheless reserve the right to require cleanup to a residential standard? If so, what criteria would Ecology use to reject the city's GMA authority?

Response:
The MTCA statute provides several criteria for determining what properties are eligible for use of industrial property soil cleanup levels. Specifically, MTCA defines the term "industrial properties" as follows:

> Properties that are or have been characterized by, or are to be committed to, traditional industrial uses such as processing or manufacturing of materials, marine terminal and transportation areas and facilities, fabrication, assembly, treatment, or distribution of manufactured products, or storage of bulk materials, that are either:
>
> (a) Zoned for industrial use by a city or county conducting land use planning under chapter 36.70A RCW; or
>
> (b) For counties not planning under chapter 36.70A RCW and the cities within them, zoned for industrial use and adjacent to properties currently used or designated for industrial purposes.

RCW 70.105D.020(23). When deciding if a property qualifies under this definition, Ecology looks to the local zoning plans to see if the property is zoned for industrial use. However, zoning alone does not determine eligibility under MTCA, the property must also be "characterized by, or … committed to, traditional industrial uses." Because there are no state-mandated requirements for what land uses are allowed in industrial zones, Ecology looks at not only the zoning title, but also at the land uses allowed under that classification. WAC 173-340-745(1) provides criteria for making that evaluation. If a property does not meet both parts of this definition, it does not qualify for industrial soil cleanup levels. So it is possible that while a local government may view an area as "industrial", Ecology may determine that the property does not qualify for industrial soil cleanup levels.

GQ 13.1.3
Why is there a difference in the exposure frequency used in equations 745-1 and 745-2 and equations 745-3, 745-4 and 745-5?

(513, 514, 654, 2003)

Response:
Ecology acknowledges that there is a discrepancy with the default frequency of exposure terms between the standard and modified Method B equations and intends to address this discrepancy in a future rule-making. The 0.4 used in equations 745-1 and 745-2 is an existing default value that was not proposed to be changed by this rule amendment. The basis for this value is described in the 1991 Responsiveness Summary (Issue #12, p. 256-57). The 0.7 exposure frequency used in the new equations was based on EPA guidance (EPA, 1989; EPA 1998b) recommending this value for industrial site exposures. Specifically this represents exposure for 5 days per week, 50 weeks per year or 250 days/ 365 days = 0.7. The 50 weeks per year assumes no exposure occurs during two weeks of the year, representing vacation time away from the facility.

This discrepancy should not affect the cleanup strategy at most industrial sites. Under most circumstances the direct soil contact pathway does not dictate the cleanup standard or subsequent cleanup strategies for these sites, the soil to ground water pathway (determining soil concentrations that protect ground water) controls most soil cleanup decisions at industrial sites.

GQ 13.1.4
Which ground water concentrations are to be used for calculating soil cleanup levels protective of ground water uses under Method C industrial soil cleanup levels?

(392, 2649)

Response:
The ground water concentration to be used when calculating a soil cleanup level is the concentration established under WAC 173-340-720. This is determined by the highest beneficial use of the ground water and is unrelated to the land use on the ground surface. This is because industrial areas can be, and often are, underlain by highly productive aquifers. See Chapter 10 of the CES for additional discussion of this issue.

GQ 13.1.5
Other comments regarding WAC 173-340-745 are addressed in the following table:

Comment ID	Comment	Response
This summary limited to issues not already covered in Section 740.		
Overview 1376, McCain	Objects to statements that "it is expected a limited number of industrialized areas will qualify for industrial standards" and "industrial facilities typically need a plentiful source of water and thus are located over highly	Deleted in 1999 proposal. See discussion in 720.

	productive aquifers."	
1381, McCain	The point of compliance for vapors should not extend below the water table.	Comment addressed in 2000 proposal.
1415, Belcher	What does "near residential areas" mean?	Deleted in 1999 proposal.
General 652, K Johnson; 762, Newlon	Most concerns expressed in Section 740 also apply to 745.	See discussion of these issues under 740.
(1) 1415, Belcher	In (b)(iii) should not lump residential properties with schools and childcare facilities.	The comment refers to an existing regulatory requirement.
512, Allen	Should clarify that background is a statistical estimate, not a single value.	This is an existing approach under the current rule that is not proposed to change under these amendments. Under MTCA, Cleanup levels need to be compared to an absolute value for background to determine if the cleanup level is below background. This comparison would be much more difficult to do if a distribution was used to represent background. Thus, under MTCA we have selected a single value for background to enable this calculation.
(4) 653, K Johnson	This is confusing because implies the only other option is to use Method B. Add a statement that a SSRA can be used to establish a remediation level.	Addressed by adding more discussion of remediation levels in 2000 proposal and adopted rule.
(5) 1429, Belcher; 764, Newlon 2438 Newlon	Equation 745-6 is missing.	Comment addressed in 1999 proposal.
1380, McCain	Reference to 708(11) should be (10).	Comment addressed in 1999 proposal.
763, Newlon 2437 Newlon	The term "exposure" in equation 745-3 needs a better definition.	Comment addressed in 1999 proposal.
1278, POG	Noted earlier comment requesting dermal pathway be integrated into TPH equations has been addressed.	Comment noted.
2438, Newlon	Equation referenced does not exist.	Comment addressed in 1999 proposal.
284, Gillett	(6)(c) could be read to imply that Ecology may, but is not required to, set cleanup levels below the PQL or natural background, which would be inconsistent with the proposed WAC 173-340-700(6)(d). Strike "are not required to" and insert "shall not".	Comment addressed in 2000 proposal.

Chapter 14 Soil Cleanup Standards – Terrestrial Ecological Evaluation

The goal of the terrestrial ecological evaluation process is the protection of terrestrial ecological receptors from exposure to contaminated soil with the potential to cause significant adverse effects. The terrestrial ecological evaluation process is set forth in five new sections: WAC 173-340-7490 through 173-340-7494. These sections define the requirements and procedures for the following:

- Determining whether a release of hazardous substances to soil may pose a threat to the terrestrial environment;
- Characterizing existing or potential threats to terrestrial plants or animals exposed to hazardous substances in soil; and
- Establishing site-specific cleanup standards for the protection of terrestrial plants and animals.

Information collected during a terrestrial ecological evaluation will also be used in developing and evaluating cleanup action alternatives and in selecting a cleanup action under WAC 173-340-350 through 173-340-390.

The following provides an overview of the rule amendment:

- WAC 173-340-7491(1) sets forth the requirements and procedures for determining whether a site qualifies for an exclusion.
- WAC 173-340-7491(2) sets forth the requirements and procedures for determining whether a site qualifies for a simplified terrestrial ecological evaluation.
- WAC 173-340-7492 sets forth the requirements and procedures for conducting a simplified terrestrial ecological evaluation.
- WAC 173-340-7493 sets forth the requirements and procedures for conducting a site-specific terrestrial ecological evaluation.

The rule amendment is required to achieve the general goals and specific objectives of the statute, including the following:

- To protect the environment (see RCW 70.105D.010 and .030);
- To periodically update minimum cleanup standards for remedial actions based on new scientific information and changes to state and federal laws (RCW 70.105D.030(2)(d) and WAC 173-340-702(3));
- To require potentially liable persons to conduct remedial actions (including investigations) to remedy releases or threatened releases of hazardous substances (see RCW 70.105D.030(1)(b));
- To give preference to permanent solutions to the maximum extent practicable (see RCW 70.105D.030(1)(b));

- To require adequate monitoring to ensure the effectiveness of the remedial action (see RCW 70.105D.030(1)(b)); and
- To enforce the application of permanent and effective institutional controls that are necessary for a remedial action to be protective of human health and the environment (see RCW 70.105D.030(1)(g)).

The rule amendment will achieve these objectives by defining a tiered process for evaluating potential threats posed by soil contaminants to terrestrial ecological receptors and by establishing criteria for ecological protectiveness. The basic framework for the amendment, including the tiered screening approach, is based on a PAC recommendation and was determined by the PAC as necessary to more effectively achieve the goals and objectives of MTCA (see Final PAC Report, pp. 30-32).

14.1 Terrestrial Ecological Evaluation Procedures (WAC 173-340-7490)

GQ 14.1.1
What are the differences between the current rule and the rule as amended?

(168, 590, 920, 1179, 1226, 1228, 1229, 1383, 2263)

Response:
The comments made by several commentors seem to reflect several misconceptions regarding the existing regulatory requirements and the purpose of the rule amendments. Other commentors requested additional clarification of the rule amendments. To address these comments, a description of the current rule and a comparison of the current with the rule as amended is provided below.

Under both the current and proposed rules, all cleanup actions must meet certain minimum requirements, including protection of human health and the environment. WAC 173-340-360(2). "Environment" is broadly defined in the rule to mean "any plant, animal, natural resource, surface water (including underlying sediments), ground water, drinking water supply, land surface (including tidelands and shorelands) or subsurface strata, or ambient air within the state of Washington or under jurisdiction of the state of Washington." WAC 173-340-200.

The current rule requires, as appropriate, an investigation of the current and potential threats to plants and animals that may be posed by hazardous substances. Specifically, the current rule requires as part of the remedial investigation and feasibility study, as appropriate, "sufficient investigations to characterize the distribution of hazardous substances present at the site, and threat to human health **and the environment**," including, as applicable to the site:

> Information to determine the impact or potential impact of the hazardous substance from the facility on the natural resources and Ecology of the area such as: Sensitive environment, plant and animal species, and other environmental receptors.

WAC 173-340-350(6)(c) and (6)(c)(vi) (emphasis added). The current rule also requires, as appropriate, that the remedial investigation and feasibility study include:

> A risk assessment characterizing the current and potential threats to human health **and the environment** that may be posed by hazardous substances. This assessment may not be required when [Ecology] determines that proposed cleanup standards are obvious and undisputed and allow an adequate margin of safety for protection of human health **and the environment**.

WAC 173-340-350(6) and (6)(d) (emphasis added).

Under the current rule, Ecology may also establish cleanup levels more stringent than those otherwise required by the rule when, based on a site-specific evaluation, Ecology determines that such levels are necessary to protect human health and the environment. With respect to the terrestrial environment in particular, the current rule authorizes the following:

> [Ecology] may establish method B cleanup levels that are more stringent than those required under (a) of this subsection, when, based on a site-specific evaluation, [Ecology] determines that such levels are necessary to protect human health or environment, including the following:
>
> (i) Concentrations which eliminate or substantially reduce the potential for food chain contamination;
> (ii) Concentrations which eliminate or substantially reduce the potential for damage to soils or biota in the soils which could impair the use of soils for agricultural or silvicultural purposes;
> (iii) Concentrations which eliminate or substantially reduce the potential for adverse effects on vegetation or wildlife;
> …

WAC 173-340-740(3)(b). The current rule provides Ecology the same authority to establish more stringent soil cleanup levels under Method C. WAC 173-340-740(4)(c).

However, the current rule does not indicate how this site-specific evaluation should be conducted.

In summary, under the current rule, terrestrial ecological impacts are evaluated on a case-by-case basis. The current rule does not specify criteria for ecological protectiveness, whether a terrestrial ecological evaluation is required, or how a terrestrial ecological evaluation should be conducted.

The proposed rule amendments, in comparison, establish criteria for ecological protectiveness and define a tiered process for evaluating threats from soil contamination to terrestrial ecological receptors. The basic framework of the proposed rule amendment, including the tiered screening approach, is based on a PAC recommendation (see Final PAC Report, pp. 30-32). The terrestrial

ecological evaluation process is set forth in WAC 173-340-7490 through 173-340-7494. More specifically, WAC 173-340-7491(1) sets forth the requirements and procedures for determining whether a site qualifies for an exclusion. WAC 173-340-7491(2) sets forth the requirements and procedures for determining whether a site qualifies for a simplified terrestrial ecological evaluation. WAC 173-340-7492 sets forth the requirements and procedures for conducting a simplified terrestrial ecological evaluation. WAC 173-340-7493 sets forth the requirements and procedures for conducting a site-specific terrestrial ecological evaluation. The amendment provides significant flexibility in determining the type of ecological evaluation that is required for a particular site. In particular, the amendment provides significant flexibility in how one may conduct a site-specific evaluation. The amendment does not require the use of any particular methodology for conducting a site-specific evaluation.

Based on a comparison of the current rule and the proposed rule amendments, Ecology has made the following determinations regarding the impact of the proposed rule amendments:

- Both the current rule and the proposed rule require all cleanup actions to protect human health and the environment. See WAC 173-340-360.
- Both the current rule and the proposed rule require, as appropriate, an investigation of the current and potential threats to terrestrial ecological receptors that may be posed by hazardous substances. See WAC 173-340-350.
- Under both the current rule and the proposed rule, Ecology may establish more stringent cleanup levels, including soil cleanup levels, to protect the environment. See WAC 173-340-720 through 173-340-750.
- The current rule does not provide clear direction as to when a terrestrial ecological evaluation is required or how an evaluation should be conducted. The proposed rule amendments specify those situations where a simplified or site-specific terrestrial ecological evaluation is not required (exclusions) and, where such an evaluation is required, how such an evaluation may be conducted. See WAC 173-340-350, 173-340-740 and 173-340-745 under both rules and WAC 173-340-7490 through 173-340-7494 under the proposed rule amendments.
- Neither the current rule nor the proposed rule requires the use of any particular methodology for conducting an evaluation.
- Under both the current rule and the proposed rule, a site-specific terrestrial ecological evaluation may not be required.

GQ 14.1.2
Are the terrestrial ecological evaluation procedures set forth in the rule amendments the least burdensome alternative that will achieve the general goals and specific objectives of MTCA, including the protection of the environment?

(168, 590, 668,920, 1079, 1179, 1226, 1228, 1229, 1383, 2263, 2496)

Response:
Yes. The rule amendment is required to achieve the general goals and specific objectives of the statute, including the following:

- To protect the environment (see RCW 70.105D.010 and .030);
- To periodically update minimum cleanup standards for remedial actions based on new scientific information and changes to state and federal laws (RCW 70.105D.030(2)(d) and WAC 173-340-702(3));
- To require potentially liable persons to conduct remedial actions (including investigations) to remedy releases or threatened releases of hazardous substances (see RCW 70.105D.030(1)(b));
- To give preference to permanent solutions to the maximum extent practicable (see RCW 70.105D.030(1)(b));
- To require adequate monitoring to ensure the effectiveness of the remedial action (see RCW 70.105D.030(1)(b)); and
- To enforce the application of permanent and effective institutional controls that are necessary for a remedial action to be protective of human health and the environment (see RCW 70.105D.030(1)(g)).

The rule amendment will achieve these objectives by defining a tiered process for evaluating potential threats posed by soil contaminants to terrestrial ecological receptors and by establishing criteria for ecological protectiveness. The basic framework for the amendment, including the tiered screening approach, is based on a PAC recommendation and was determined by the PAC as necessary to more effectively achieve the goals and objectives of MTCA (see Final PAC Report, pp. 30-32).

The impact of the rule amendment on costs is discussed in the CBA. As discussed more thoroughly in that analysis, the impact depends on several factors, including the following:

- First, whether a terrestrial ecological evaluation would be required under the proposed rule, but not under the current rule;
- Second, whether the site would qualify for an exclusion from conducting a simplified or site-specific terrestrial ecological evaluation under the proposed rule;
- Third, the type of terrestrial ecological evaluation conducted under the proposed rule;
- Fourth, whether the terrestrial ecological evaluation conducted under the proposed rule would result in lower soil cleanup levels or additional remedial actions;

Based on that analysis, Ecology concluded that only if a simplified or site-specific terrestrial ecological evaluation were required under the proposed rule, but not under the current rule, and that evaluation resulted in additional remedial actions would the proposed rule result in additional cleanup costs. Considering the factors discussed above, Ecology does not expect that the proposed rule amendments will result in lower soil cleanup levels or additional cleanup actions being required at most sites. Consequently, Ecology does not expect that the proposed rule will result in additional cleanup costs at most sites. However, Ecology does expect that for a few sites, additional evaluation costs may be incurred as a consequence of conducting more involved terrestrial ecological evaluations than would have been conducted under the current rule. Most of these evaluations are expected to be simplified evaluations as opposed to site-specific evaluations. Ecology also expects that for a few sites, additional cleanup costs may be

incurred as a consequence of the proposed rule. Those costs that are incurred are not expected to be significant.

As also discussed more thoroughly in the CBA, the rule amendment is expected to reduce the regulatory burden and costs of conducting a terrestrial ecological evaluation at many sites. Examples of measures that may reduce the regulatory burden are listed in the CBA.

As discussed more thoroughly in the LBA Analysis, Ecology determined that the proposed amendment is the least burdensome alternative that will achieve the general goals and specific objectives of MTCA. Several alternatives were considered and evaluated as part of that analysis, including the following:

- ***Ecologically Based Soil Cleanup Standards***
  This alternative would require the establishment of ecologically based soil cleanup standards for each site. Consideration of this alternative was prompted by the legislature, which in ESHB 1810 required the MTCA Policy Advisory Committee (PAC) to review, provide advice, and develop recommendations on "[t]he need for adoption of and recommended levels for ecologically based cleanup standards." While the PAC considered this alternative as a stand-alone alternative, it was rejected in favor of the tiered screening approach adopted by the proposed rule amendment.

- ***Site-Specific Terrestrial Ecological Evaluations***
  This alternative would require the conduction of site-specific terrestrial ecological evaluations at every site. Under this alternative, Ecology would adopt consistent policies, including constraints, for how one could conduct a site-specific terrestrial ecological evaluation. While the PAC also briefly considered this alternative as a stand-alone alternative, it was also rejected in favor of the tiered screening approach adopted by the proposed rule amendment.

The amendment reflects the principle of constrained flexibility. Throughout the amendment, Ecology has attempted to balance the preference for flexibility to address site-specific conditions with the need to establish consistent, objective and enforceable requirements and standards that ensure the protection of human health and the environment. This principle of "constrained flexibility" is consistent with regulatory goals previously defined by Ecology for implementing MTCA:

> An important objective of the proposed amendments is to increase the efficiency of site cleanup. In particular, the proposed amendments represent an attempt to reduce the amount of flexibility in the present system which serves to heighten uncertainty rather than predictability by resolving fundamental policy issues. In doing so, Ecology hopes to create a system which focuses available funds on site cleanup and minimizes cleanup standard negotiation or litigation… In developing the proposed amendments, Ecology has tried to balance the goals of regulatory consistency and efficiency with the need to provide some flexibility to address individual site characteristics.

1991 RS, pp. 8-9. Compared to unconstrained flexibility, constrained flexibility increases the certainty that the cleanup achieves the statutory goal of protecting of human health and the environment. By resolving fundamental policy issues through the adoption of regulatory standards, constrained flexibility also increases the efficiency of site cleanup by reducing the amount of unconstrained flexibility in the present system – such unconstrained flexibility serving to heighten uncertainty rather than predictability. Compared to inflexible standards, the approach of constrained flexibility preserves the flexibility to address individual site conditions.

An example of how Ecology has attempted to provide a consistent and objective approach is in the use of indicator criteria that serve as proxies for ecological concepts that present uncertain and subjective standards for site cleanup decisions. One area where indicator criteria have been used is in defining conditions representing acceptable levels of ecological exposure (see WAC 173-340-7491(1)). Another example is the criteria for sites where a site-specific evaluation is required (see WAC 173-340-7491(2)). Also note that the site-specific terrestrial ecological procedures do not mandate the use of any particular analytical methodology.

GQ 14.1.3
Could the terrestrial ecological evaluation procedures create an incentive to cause harm through the destruction of habitat?

(406, 538, 590, 951, 1079, 1398, 2038, 2351, 2592, 2656)

Response:
Several commentors have suggested that various aspects of the terrestrial ecological evaluation procedures might create an incentive to cause harm through the destruction of environmental impact. Ecology disagrees. A cleanup action cannot be selected unless a determination is made that each of the minimum requirements in WAC 173-340-360(2) is met, including the requirements that the cleanup action protects the environment and uses permanent solutions to the maximum extent practicable. Determining whether a cleanup action is permanent to the maximum extent practicable further requires the use of the disproportionate cost analysis specified in WAC 173-340-360(3)(e). That analysis compares the costs and benefits of the cleanup action alternatives evaluated in the feasibility study. One of the criteria that must be considered as part of that analysis is the overall protectiveness of the environment. See WAC 173-340-360(3)(f). Finally, as an additional safeguard, under WAC 173-340-7490(5) Ecology "may require additional measures to evaluate potential threats to terrestrial ecological receptors…, when based on a site-specific review, the department determines that such measures are necessary to protect the environment."

GQ 14.1.4
Should the terrestrial ecological evaluation procedures set forth a framework and methods for evaluating potential threats to salmon?

(565, 897)

Response:

The terrestrial ecological evaluation procedures establish a framework and methods for evaluating potential threats from soil contamination to terrestrial ecological receptors. Potential threats to salmon are evaluated primarily through the framework and methods set forth in the Water Quality Standards Regulation, chapter 173-201A. WAC.

Consideration of Significant Adverse Effects

The rule amendments provide that "the goal of the terrestrial ecological evaluation process is the protection of terrestrial ecological receptors from exposure to contaminated soil with the potential to cause ***significant adverse effects****." WAC 173-340-7490(3) (emphasis added). The rule amendments then define what constitutes "significant adverse effects." WAC 173-340-7490(3). Several comments were received regarding how the rule defines "significant adverse effects" for the purposes of the terrestrial ecological evaluation process. These comments are addressed below.*

GQ 14.1.5
What constitutes "significant adverse effects" for the purposes of the terrestrial ecological evaluation process?

(402, 535, 536, 1385, 1165, 2654)

Response:
For the purposes of determining whether exposure to contaminated soil has the potential to cause significant adverse effects, the rule amendments distinguish species whose individuals are protected under law and from those species that are not.

Except for species protected under the Endangered Species Act or other applicable laws that extend protection to individuals of a species, "significant adverse effects" is defined in the rule to mean “effects that impair reproduction, growth or survival.” WAC 173-340-7490(3). Other harmful effects to plants and animals from exposure to contaminated soil do not require cleanup unless they are related to these endpoints.

For species protected under the Endangered Species Act or other applicable laws that extend protection to individuals of a species, “significant adverse effects” is defined in the rule to mean "an impact that would significantly disrupt normal behavior patterns that include, but are not limited to, breeding, feeding, or sheltering.” The selection of these endpoints is based on the definition of "harm" in regulations implementing the Endangered Species Act.

The rule amendments establish a different standard for species whose individuals (not just populations) are protected under law. The Endangered Species Act is the most notable. The reference to “other applicable laws" is intended to refer to any other law that protects individuals of a species. Ecology acknowledges that the U.S. Fish and Wildlife Service has interpreted protection under Migratory Bird Treaty Act to apply to individuals. Ecology has not made a similar determination. Nor has Ecology made similar a determination regarding any other law (except for the Endangered Species Act) at this time.

GQ 14.1.6
For the purposes of determining whether exposure to contaminated soil has the potential to cause significant adverse effects, should the rule define such effects based on the protection of populations or individuals?

(364, 590, 1165, 2100, 2339, 2623)

Response:
Several commentors urged Ecology to define significant adverse effects based on the protection of populations and one commentor urged Ecology to include provisions consistent with the federal natural resource damage assessment (NRDA) regulations (43 CFR 11) for evaluating the effects of a site on populations. Another commentor urged Ecology to define significant adverse effects based on the protection of individuals, not populations.

Effects on populations are necessarily the result of effects on individuals. Ecology has addressed the concept of population protection by defining "significant adverse effects" as "effects that impair reproduction, growth or survival" because these effects on individuals are generally considered to be relevant to the health of populations (e.g., EPA, 1997a). Any of these effects is necessary and sufficient evidence of an adverse effect on the health of populations in a terrestrial ecological evaluation, although some consideration for the scale of the effects is provided in the regulation (see e.g., WAC 173-340-7491(1)(c), -7492(2)(a)(i), and -7492(2)(a)(ii)). Ecology believes that this approach meets the goals of providing a practical and objective basis for cleanup decisions, and that is consistent with the statutory mandate to ensure that site cleanups will restore a healthy environment.

The federal NRDA regulations cited by one commentor provide for the use of measurements of population change in support of a Natural Resource Damage Assessment (NRDA) damage determination (43 CFR 11.71). However, it is not necessary to demonstrate such a change for an injury determination (43 CFR 11.62). The terrestrial ecological evaluation procedures were not developed for use in Natural Resource Damage Assessments and a determination that cleanup is required to protect the environment does constitute a NRDA damage determination.

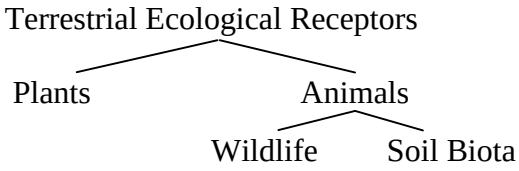
Consideration of Land Use and Receptors

The rule amendments provide that "the goal of the terrestrial ecological evaluation process is the protection of ***terrestrial ecological receptors*** *from exposure to contaminated soil with the potential to cause significant adverse effects." WAC 173-340-7490(3) (emphasis added). The rule amendments then define the categories of "terrestrial ecological receptors" that must be protected from exposure to contaminated soil. WAC 173-340-7490(3). The categories of receptors that must be protected depends on the land use. Several comments were received regarding how receptors are categorized and the requirements applicable to specific land uses.*

GQ 14.1.7
What is the relationship between the different categories of terrestrial ecological receptors?

(410, 2659)

Response:
Three categories of terrestrial ecological receptors are discussed in WAC 173-340-7490(3): "wildlife," "plants," and "soil biota." Two of these three categories are categories of "animals": "wildlife" and "soil biota." Reference to “plants and animals” in the context of a terrestrial ecological evaluation serves as a concise synopsis of the longer and more precise description of the three receptor categories formally identified in WAC 173-340-7490(3). Note that the terms "wildlife" and "soil biota" are defined in WAC 173-340-200.



GQ 14.1.8
What constitutes "industrial property" and "commercial property" for the purposes of determining the categories of terrestrial ecological receptors that require protection?

(310, 590, 656, 1386, 2101)

Response:
For industrial and commercial properties, only wildlife (not soil biota or plants) must be protected from exposure to contaminated soil, except under certain circumstances identified in WAC 173-340-7490(3)(b)(i-ii). Under those specified circumstances, not only must wildlife be protected, but soil biota and plants must also be protected. For the purposes of determining the categories of terrestrial ecological receptors that require protection, the rule amendments define what constitutes "industrial property" and "commercial property." WAC 173-340-7490(3)(c). The term "commercial property" is specifically defined to mean the following:

> Properties that are currently zoned for commercial or industrial property use and that are characterized by or are committed to traditional commercial uses such as offices, retail and wholesale sales, professional services, consumer services, and, warehousing.

WAC 173-340-7490(3)(c). Some commentors questioned the proper scope of the term "commercial property." Note that the definition has been amended to reflect the fact that the property could be currently zoned for industrial property use. The underlying rationale of the categorical exemption focuses on “designated use” rather than “intensive use.” The underlying rationale is that the properties that qualify for the exemption represent areas of land specifically designated for uses that may preclude growing plants and obviate the value of functions provided by soil biota. For example, land beneath an office building cannot be used to grow plants, and soil biota living beneath the building are assumed not to provide any benefits to plants or wildlife. In some cases, the rationale for the categorical exemption does not apply. Where the rationale for the categorical exemption does not apply, the categorical exemption does not apply. See WAC 173-340-7490(3)(b)(ii). For example, if a local government land use regulation

precludes portions of a commercial or industrial property from being used for buildings, roads and other structures and requires instead that these areas be vegetated (e.g., to fulfill landscaping requirements), then the land may be used to grow plants and soil biota living beneath those areas may provide benefits to plants and wildlife.

GQ 14.1.9
Should agricultural or recreational land uses be categorically exempt, just as "industrial" and "commercial" properties, from the general requirement that not only wildlife, but also plants and soil biota must be protected from exposure to contaminated soil?

(590, 656, 1383, 1386, 1391, 2101)

Response:
For any property that does not constitute an "industrial property" or "commercial property" as defined in WAC 173-340-7490(3)(c), all terrestrial ecological receptors must be protected from exposure to soil contamination WAC 173-340-7490(3)(b). The underlying rationale of the categorical exemption for "industrial" and "commercial" properties discussed in the previous response does not apply to properties with agricultural or recreational land uses.

Point of Compliance

For soil cleanup levels based on protection of terrestrial ecological receptors, the point of compliance is defined in WAC 173-340-7490(4). See also WAC 173-340-740(6)(e). Comments received regarding the point of compliance are addressed below.

GQ 14.1.10
Should the standard point of compliance be established in the soils throughout the site from the ground surface to fifteen feet below the ground surface?

(658, 981, 1096, 1387, 1393, 2061)

Response:
Unless a conditional point of compliance under WAC 173-340-7490(4)(a) is applicable, the amendment requires the establishment of a standard point of compliance in the soils throughout the site from the ground surface to fifteen feet below the ground surface. WAC 173-340-7490(4)(b). Some commentors raised objections to the use of fifteen feet as the standard point of compliance. As noted in the amendment, fifteen feet "represents a reasonable estimate of the depth of soil that could be excavated and distributed at the soil surface as a result of site development activities, resulting in exposure by terrestrial ecological receptors." WAC 173-340-7490(4)(b). This determination reflects the determination that formed the basis for the point for compliance for soil cleanup levels based on human exposure through direct contact. See WAC 173-340-740(6)(c) in the current rule. The rationale for selecting this depth is discussed in the 1991 Responsiveness Summary (1991 RS, Issue #13, pp. 245-247). The provision for a standard point of compliance does not conflict with the PAC "User's Guide" (*Cleaning up MTCA Sites to Protect the Environment. A Guide to the Model Toxics Control Act Environmental Evaluation Process for Soil Contamination.* November 5, 1996). The Guide formulated a six foot point of

compliance conditioned upon institutional controls (p. 11) to prevent excavation ("conditional point of compliance").

As provided in WAC 173-340-7490(4)(a), a conditional point of compliance may be established at the biologically active soil zone if institutional controls are used as part of the cleanup action to prevent excavation of deeper soils. The zone is assumed to extend to a depth of six feet. Ecology may approve a site-specific depth based on a determination that an alternative depth is more appropriate for the site. Several factors must be considered in establishing a site-specific depth (see WAC 173-340-7490(4)(a)(i-iii)).

GQ 14.1.11
Under what circumstances may a cleanup action involve containment of soils?

(2102)

Response:
A cleanup action may be determined to comply with cleanup standards even if soil cleanup levels are not met at the applicable points of compliance, including those specified under WAC 173-340-7490(4), provided the conditions in WAC 173-340-740(6)(f) are met.

Section 7490(5) – Determination of whether additional measures are required

GQ 14.1.12
Should the authority to require additional measures to evaluate potential threats to terrestrial ecological receptors based on a site-specific review be subject to the requirements of WAC 173-340-702?

(296, 2187)

Response:
WAC 173-340-7490(5) provides the following:

> The department may require additional measures to evaluate potential threats to terrestrial ecological receptors notwithstanding the provisions in this and the following sections, when based upon a site-specific review, the department determines that such measures are necessary to protect the environment.

The authority to require additional measures to evaluate potential threats to terrestrial ecological receptors based on a site-specific review is not subject to the requirements in WAC 173-340-702(14), (15) or (16). The applicability of those sections is specified in those sections. Determining whether additional measures are necessary to evaluate the potential threats to terrestrial ecological receptors does not involve the modification of default methods or assumptions specified in the regulation or the use of methods or assumptions not specified in the regulation for calculating cleanup or remediation levels. Nor does it involve the use of new scientific information.

Note that the provisions in WAC 173-340-702(14), (15) or (16) may apply under certain circumstances when establishing cleanup levels or remediation levels. Those circumstances are specified in those sections.

GQ 14.1.13
Other comments regarding WAC 173-340-7490 are addressed in the following table:

Comment ID	Section	Comment	Response
2230, Valeriano	7490 – 7493	Urge adoption of proposed amendments.	Comment noted.
77, POG 306, Warden 308, Warden 311, Warden 312, Warden 781, Newlon 2415, Newlon	7490 – 7473	Suggested different organization of the tiered analysis.	Comments noted. The rule format reflects the format recommended by the PAC. Note that there are a variety of ways to proceed through the terrestrial ecological evaluation process. The rule format need not prevent users from translating the process into tiered approaches that still meet substantive requirements of the rule.
829, Sims 2554, Sims 2555, Sims 2556, Sims	7490	"Terrestrial Ecological Evaluation" should be defined.	The purpose and goals of the terrestrial ecological evaluation procedures are described in WAC 173-340-7490.
1384, McCain	7490(1)	Suggested that language be provided clarifying how information collected during a terrestrial ecological evaluation should be used in developing and evaluating cleanup action alternatives.	Comment addressed in 1999 proposal. See WAC 173-340-7490(1)(b).
309, Warden 2609, Berry 2653, Wisness	7490(2)	Requested clarification of when one of the actions listed in 7490(2) must be taken. When must a de minimus release be addressed?	Comment addressed as appropriate in 2000 proposal. See WAC 173-340-300(2) and (3) for release reporting requirements.
657, K. Johnson	7490(3)(d)	Remove this language.	Ecology disagrees. This is an important concept that will ensure that any future land use assumptions that were factored into the selection of a remedy protecting terrestrial resources will include a completion date for such future development.
590, K. Johnson 665, K. Johnson	7492 - 7493	The terrestrial ecological evaluation portion of the rule should be subjected to criteria and standards for new information.	Ecology has complied with statutory rule-making procedures. Even though the requirements in WAC 173-340-702 are not applicable during a rule-making process, Ecology nonetheless believes that those requirements have also been met. Note that the scientific and technical aspects of the amendment were also subject to the review of the Science Advisory Board Ecological Risk Subcommittee.

14.2 Determination of Whether a Site Qualifies for an Exclusion (WAC 173-340-7491(1))

No further evaluation is required if Ecology determines that a site meets any one of the four criteria in WAC 173-340-7491(1)(a-d). These "exclusions" are intended to exclude from further evaluation under the terrestrial ecological evaluation procedures those sites that do not pose an existing or potential threat to terrestrial ecological receptors. The exclusions are primarily based on the potential for exposure. Definitions of terms used in subsection (1)(c) are defined in subsection (1)(c)(iii). Comments regarding the exclusions and associated definitions are addressed below. Comments regarding the point of compliance are addressed in the previous section.

GQ 14.2.1
What constitutes a "physical barrier" for the purposes of the second exclusion?

(319, 786, 2418)

Response:
WAC 173-340-7491(1)(b) provides for an exclusion based on the existence of a physical barrier "that will prevent plants or wildlife from being exposed to the soil contamination." Note that an elaboration of this functional standard as applied to wildlife appears in WAC 173-340-7491(1)(c)(iii): "barriers that would prevent wildlife from feeding on plants, earthworms, insects or other food in or on the soil." The criterion provides three examples of physical barriers that are likely to meet the functional standard: buildings, paved roads and pavement (e.g., a concrete sidewalk). These examples are not intended to preclude other possibilities that may meet the standard on a case by case basis. For example, a compacted gravel surface is a candidate, although its effectiveness would depend on thickness, size distribution and degree of compaction. Note that in evaluating a proposal that a specific structure at a site will provide an exposure barrier, Ecology also has a statutory obligation to "give preference to permanent solutions to the maximum extent practicable" (RCW 70.105D.030).

GQ 14.2.2
What is the scope of the third exclusion? What constitutes a "site" for the purposes of the third exclusion?

(298, 317, 659, 785, 1162, 1388, 2103, 2110, 2189, 2453)

Response:
WAC 173-340-7491(1)(c) provides for an exclusion based on the relationship of site conditions to undeveloped land. The exclusion defines two criterions, both of which must be met. The first criterion provides that:

> For sites contaminated with hazardous substances other than those specified in (c)(ii) of this subsection, **there is less than 1.5 acres of contiguous undeveloped land on the site or within 500 feet of any area of the site**.

WAC 173-340-7491(1)(c)(i) (emphasis added). The second criterion provides that:

> For sites contaminated with any of the following hazardous substances: Chlorinated dioxins or furans, PCB mixtures, DDT, DDE, DDD, aldrin, chlordane, dieldrin, endosulfan, endrin, heptachlor or heptachlor epoxide, benzene hexachloride, toxaphene, hexachlorobenzene, pentachlorophenol, or pentachlorobenzene, **there is less than 1/4 acre of contiguous undeveloped land on or within 500 feet of any area of the site affected by these hazardous substances**.

WAC 173-340-7491(1)(c)(ii) (emphasis added). The term "contiguous undeveloped land" is defined in WAC 173-340-7491(1)(c)(iii).

Both of these criterions constitute operational thresholds for limited exposure. The first criterion is conditioned on the absence of certain chemicals of particular concern, including PCB mixtures and other potentially persistent and bioaccumulative chlorinated hydrocarbons. For these chemicals, a more conservative criterion must be met.

The exclusion uses the defined term "site" instead of "area of contamination," which was used in the guidance developed during the PAC process (see *Cleaning up MTCA Sites to Protect the Environment, A Guide to the Model Toxics Control Act Environmental Evaluation Process for Soil Contamination,* Nov. 5, 1996, p. 13), to reflect the statutory definition and to provide greater specificity. Some of the commentors objected to the use of the defined term "site" instead of "area of contamination" because they perceived the change as an expansion of the area of concern beyond the area of contamination to the property boundary and, consequently, as a limitation on the applicability of the exclusion. Ecology believes the objections are based on the false assumption that the term "site" may extend to the property boundary even if the area where hazardous substances have come to be located does not extend to the property boundary. The term "site," as defined in WAC 173-340-200, does not extend to any area where hazardous substances have not come to be located. More specifically, "site" is defined in WAC 173-340-200 to mean the same as "facility," which is defined to mean the following:

> Any building, structure, installation, equipment, pipe or pipeline (including any pipe into a sewer or publicly owned treatment works), well, pit, pond, lagoon, impoundment, ditch, landfill, storage container, motor vehicle, rolling stock, vessel, or aircraft; or any site or area **where a hazardous substance**, other than a consumer product in consumer use, **has** been deposited, stored, disposed of, or placed, or otherwise **come to be located**.

WAC 173-340-200 (emphasis added). Note that the definition of "facility" reflects the statutory definition of the term in RCW 70.105D.020(4).

GQ 14.2.3
What constitutes "undeveloped land" for the purposes of the third exclusion and Table 749-1?

(318, 660, 670, 1389, 1394, 2104)

Response:
WAC 173-340-7491(1)(c)(iii) defines the term "undeveloped land" for the purposes of the third exclusion and Table 749-1. Specifically, "undeveloped land" is defined to mean the following:

> Land that is not covered by buildings, roads, paved areas or other barriers that would prevent wildlife from feeding on plants, earthworms, insects or other food in or on the soil.

WAC 173-340-7491(1)(c)(iii). Several commentors suggested that the definition should specifically exclude certain land uses or activities that would reduce the potential for wildlife exposure. Ecology disagrees. Note that consideration of land use and activity is addressed through the use of weighting factors in Table 749-1 (scoring values for lines (2) through (4)) as part of the exposure analysis defined in WAC 173-340-7492(2)(a)(ii).

GQ 14.2.4
What constitutes "contiguous" undeveloped land for the purposes of the third exclusion and Table 749-1?

(315, 783, 2451)

Response:
WAC 173-340-7491(1)(c)(iii) defines the term "contiguous" undeveloped land for the purposes of the third exclusion and Table 749-1. Specifically, "contiguous" undeveloped land is defined to mean the following:

> An area of undeveloped land that is not divided into smaller areas by highways, extensive paving or similar structures that are likely to reduce the potential use of the overall area by wildlife. Roads, sidewalks and other structures that are unlikely to reduce potential use of the area by wildlife shall not be considered to divide a contiguous area into smaller areas.

WAC 173-340-7491(1)(c)(iii). Some commentors requested additional clarification.

The following is an operational set of rules for determining the extent of contiguous undeveloped land at a site for the purposes of WAC 173-340-7491(1)(c) and Table 749-1:

1. Identify the boundary of the site.
2. Identify a 500 foot perimeter around the boundary of the site. The land within this perimeter is the focus of the analysis for the following steps.

3. Identify any areas that are covered by buildings, roads, pavement or other similar structures. The remaining area is "undeveloped land."
4. Determine whether the undeveloped land is separated into patches by highways, extensive paving or similar structures. Smaller roads, sidewalks or other structures that are unlikely to reduce potential use of the overall area by wildlife are not considered.
5. If the undeveloped land consists of more than one patch, compare the area of the largest patch with the applicable criterion. Otherwise, compare the total area of undeveloped land with the applicable criterion.
6. If any of the hazardous substances listed in WAC 173-340-7491(1)(c)(ii) are found at the site, identify a 500 foot perimeter around the boundary of the *area of the site affected by these hazardous substances*. Note that this perimeter may be different from the one described in step 2. Repeat steps 3-5 for land within this new perimeter.

GQ 14.2.5
Should other exclusions be established under WAC 173-340-7491(1)? Should the exclusions be based on different factors?

(307, 782, 982, 1192, 2024, 2062, 2416, 2482)

Response:
The criteria set forth in WAC 173-340-7491(1) for determining whether a site qualifies for an exclusion are based on considerations of exposure and are applicable to all sites. Any site that meets one of those criteria qualifies for an exclusion. Some commentors suggested that specific categories of sites (e.g., aviation facilities or high-voltage electric substations, distribution stations, and switchyards) should be categorically excluded from having to conduct a terrestrial ecological evaluation. Ecology disagrees. While many such sites may qualify for an exclusion under the specified criteria, Ecology cannot categorically determine that all such sites meet those criteria. Each site must be evaluated against those criteria on a site-specific basis. With respect to aviation facilities, note that there is no requirement to create conditions that will attract wildlife.

GQ 14.2.6
Why are institutional controls required to qualify for an exclusion under WAC 173-340-7491(1)(a) and (b)?

(297, 590, 671, 1078, 1109, 2188)

Response:
Institutional controls are required to qualify for an exclusion under WAC 173-340-7491(1)(a) and (b) to ensure the continued protection of terrestrial ecological receptors and the integrity of the remedial action. More specifically, the institutional controls are necessary to ensure the continued viability of those site conditions that allowed for the site to qualify for the exclusion.

To demonstrate that institutional controls are not necessary to protect terrestrial ecological receptors from significant adverse effects would require the demonstration that the conditions

qualifying the site for an exclusion are not necessary to protect terrestrial ecological receptors. Making such a demonstration would require conducting a terrestrial ecological evaluation. Conducting such an evaluation is always an option.

Note that institutional controls are not required to qualify for an exclusion under WAC 173-340-7491(1)(c) and (d).

GQ 14.2.7
Other comments regarding WAC 173-340-7491(1) are addressed in the following table:

Comment ID	Section	Comment	Response
1237, Gillett	7491(1)(a)	Suggested editorial correction.	Comment addressed in 2000 proposal.
1162, Herbst	7491(1)(c)	Exclusion appears to allow for unrestricted land use, regardless of the concentration of the hazardous substance at the location. What is the scientific basis for this?	The underlying premise for exclusions based on the area of undeveloped land is that the potential for ecological exposure correlates with area. The area criteria used represent acceptable levels of risk, based on low potential exposure. Ecology expects that contaminated soil within an excluded area would likely still require cleanup to address other problems, such as risks to human health, and this will further reduce any residual ecological threats.
403, Rasmussen	7491(1)(c)(iii)	Suggested editorial correction.	Comment addressed in 2000 proposal.
783, Newlon 2451, Newlon	7491(1)(c)(iii)	Provide definition of "contiguous."	Comment addressed in 1999 proposal.
2020, Morgan	7491(1)	The exclusions disproportionately favor urban areas over rural areas.	This is an inadvertent consequence of the fact that there is less potential for ecological exposure in urban areas.
2338, Newlands	7491(1)	The proposed rule does not adequately address, or allow for the characterization of sites based on habitat quality.	Habitat quality and land use are used as weighting factors for the exposure analysis exclusion in Table 749-1.
2338, Newlands	7491(1)	Habitat quality, land use, and the overall management of lands by city, county, and state governments need to be included as part of the screening to consider if ecological concerns for individual organisms are of importance for the management goals of a given property.	Management goals are considered in determining whether a simplified evaluation may be conducted – see WAC 173-340-7491(2)(a)(i). For industrial and commercial properties, ecological protection is limited to wildlife. Wildlife is the property of the state (RCW 77.12.010) and a public resource. While a land owner is not obligated to manage an industrial property for propagation of ecological organisms, the state has an interest where the release of hazardous substances poisons wildlife, regardless of property zoning.
2588, Thomas	7491(1)	Must a person document that the criteria qualifying a site for an exclusion are met?	Yes, persons must document that the criteria qualifying a site for an exclusion have been met. Ecology will be developing guidance to assist persons in

			the application of these exclusions.

14.3 Determination of Whether a Site Qualifies for a Simplified Terrestrial Ecological Evaluation (WAC 173-340-7491(2))

Sites that do not qualify for an exclusion under WAC 173-340-7491(1) must conduct a site-specific terrestrial ecological evaluation if any one of four criteria apply. These four criteria are specified in WAC 173-340-7491(2)(a)(i-iv). The purpose of the criteria is to identify those sites that are of higher ecological importance. If none of the criteria apply to the site, then either a simplified or site-specific terrestrial ecological evaluation must be conducted. Definitions of terms used in this section are defined in WAC 173-340-7491(2)(c). Comments regarding these criteria and definitions are addressed below.

GQ 14.3.1
What is the proper scope of the first criterion?

(662, 1390, 2105)

Response:
The first criterion provides that a site must conduct a site-specific terrestrial ecological evaluation if the following conditions exist:

> The site is located on, or directly adjacent to, an area where management or land use plans will maintain or restore native or seminative vegetation (e.g., green-belts, protected wetlands, forestlands, locally designated environmentally sensitive areas, open space areas managed for wildlife, and some parks or outdoor recreation areas. This does not include park areas used for intensive sport activities such as baseball or football).

WAC 173-340-7491(2)(a)(i). Two commentors expressed concern regarding the scope of the criterion. The purpose of the first criterion is to identify those sites that are located on, or adjacent to, areas that provide long-term habitat and for which ecological value will therefore increase over time with the loss of other habitat in the region. The criterion is based on the criterion developed during the PAC process, which provided as follows:

> The site is located on, or directly adjacent to, property where management or land use objectives will preserve natural or semi-natural habitat. Examples include parks, greenbelts, forestlands, military reservations, locally designated environmentally sensitive areas, or areas used for outdoor recreational activities.

Cleaning up MTCA Sites to Protect the Environment, A Guide to the Model Toxics Control Act Environmental Evaluation Process for Soil Contamination, Nov. 5, 1996, p. 12. The rule amendment uses the term "area" instead of "property" in response to concerns regarding the applicability of the criterion in situations where the area of the site is less than the area of the

property. For example, under the previous draft of the criterion, a site could be forced into a site-specific evaluation because a distant greenbelt was located on the same property as the site, even though the greenbelt was not on, or adjacent to, the site. Under the revised language, a site-specific evaluation would only be required if the site was located on, or directly adjacent to, the greenbelt. The term "habitat" was changed to "vegetation" in response to concerns that the former term was too vague.

In applying this criterion, the issue is whether there is information indicating that an area will provide long-term habitat. In such a case, a site within or directly adjacent to the area may not use the simplified evaluation procedures, which are based on a higher level of acceptable risk and assumes that the consequences of an underprotective cleanup are limited. The rule language indicates that the criterion applies to "an area where management [plans] or land use plans will maintain or restore native or seminative vegetation." Such plans are likely to be in public records and provide a reasonable expectation concerning future management of the area in question.

GQ 14.3.2
Are the species classifications in the second criterion (WAC 173-340-7491(2)(a)(ii)) mutually exclusive? How are the species classifications distinguishable?

(537)

Response:
The species classifications in the second criterion (WAC 173-340-7491(2)(a)(ii)) are not mutually exclusive. In other words, a species may be included in more than one of the species lists. The second criterion lists the following classifications:

1. Threatened or endangered species. This refers to species listed as threatened or endangered under the federal Endangered Species Act or under state law. In general, all federally listed species located in Washington State are also listed under state law; however, some state listed species may not be federally listed. The "species protected under the Endangered Species Act" in WAC 173-340-7490(3) refers only to federally listed species.
2. "Priority Species" and "Species of Concern" are categories used by the Washington Department of Fish and Wildlife. The lists of "Priority Species" and "Species of Concern" are accessible through the department's web site (http://www.wa.gov/wdfw/hab/phslist.htm).
3. For plants, the Washington Department of Natural Resources Natural Heritage Program maintains a list of plants classified as "endangered," "threatened," or "sensitive" (http://www.wa.gov/dnr/htdocs/fr/nhp/order/fsorder.htm).

Persons should contact the Washington Department of Fish and Wildlife and the Washington Department of Natural Resources to consult their databases for information regarding a particular location. Information to assist in making an enquiry is available through the following web sites:

- http://www.wa.gov/wdfw/hab/phspage.htm; and
- http://www.wa.gov/dnr/htdocs/fr/nhp/order/fsorder.htm.

GQ 14.3.3
What is the proper scope of the term "native vegetation" in WAC 173-340-7491(2)(c)?

(1305)

Response:
The first criterion in WAC 173-340-7491(2)(a)(i) excludes sites that will remain undeveloped but without native or semi-native vegetation. For the purposes of this section, the term "native vegetation" means "any plant community native to the state of Washington." WAC 173-340-7491(2)(c)(i). One commentor expressed concern regarding the definition as presented in the 1998 draft rule, stating the following:

> The term "native vegetation" is related to PAC discussions, but has been broadened in the most recent revision to include "or other scientific botanical publications approved by Ecology." This change is unacceptable because the term is used in the rules to identify which sites are required to conduct a site specific assessment. This establishes a vague and subjective standard regarding applicability (essentially a moving target) thereby raising due process concerns, and is therefore of questionable enforceability. [661]

This concern was addressed in the 1999 proposal that ties the definition to two specific authoritative publications:

> The following sources shall be used in making this determination: Natural Vegetation of Oregon and Washington, J.F. Franklin and C.T. Dyrness, Oregon State University Press, 1988, and L.C. Hitchcock, C.L. Hitchcock, J.W. Thompson and A. Cronquist, 1955-1969, Vascular Plants of the Pacific Northwest (5 volumes). Areas planted with native species for ornamental or landscaping purposes shall not be considered to be native vegetation.

WAC 173-340-7491(2)(c)(ii).

GQ 14.3.4
What is the proper scope of the term "semi-native" vegetation in WAC 173-340-7491(2)(c)?

(661, 1310)

Response:
The first criterion in WAC 173-340-7491(2)(a)(i) excludes sites that will remain undeveloped but without native or semi-native vegetation. For the purposes of this section, the term "semi-native vegetation" means "a plant community that includes at least some vascular plant species native to the state of Washington." WAC 173-340-7491(2)(c)(ii). Two commentors requested greater specificity with one of them recommending the specification of the percentage of plant species in the plant community that would have to be native to the state of Washington. Ecology believes that this issue is best addressed by providing examples in the definition of “seminative vegetation”:

> The following shall not be considered seminative vegetation: Areas planted for ornamental or landscaping purposes, cultivated crops, and areas significantly disturbed

and predominantly covered by noxious, introduced plant species or weeds (e.g., Scotch broom, Himalayan blackberry or knap-weed).

WAC 173-340-7491(2)(c)(ii). This approach was based on several considerations. First, it would be difficult to select a simple numerical criterion. For example, trees representing a small proportion of an area may nevertheless provide significant structural heterogeneity that adds more value for wildlife than if the same proportion was covered by grass. Second, it is problematic whether a management or land use plan for an area would provide a precise value for coverage by native plant species that could be compared with a numerical criterion.

GQ 14.3.5
Other comments regarding WAC 173-340-7491(2) are addressed in the following table:

Comment ID	Section	Comment	Response
896, Pierce	7491(2)	The exclusion of other than "native vegetation" in a site evaluation appears flawed.	Ecology disagrees.
316, Warden 784, Newlon 2452, Newlon	7491(2)(c)	Provide definitions of "native" and "semi-native" vegetation in section.	Comment addressed in 1999 proposal.
316, Warden 784, Newlon 2452, Newlon	7491(2)(c)(ii)	Definition should exclude areas planted for ornamental or landscaping purposes.	Comment addressed in 1999 proposal.

14.4 Simplified Terrestrial Ecological Evaluation Procedures (WAC 173-340-7492)

GQ 14.4.1
With respect to Table 749-1, Box #5, may the amount or concentration of soil contaminants present be considered?

(1064, 1418)

Response:
The item is written as recommended by the PAC Eco-group (see *Cleaning up MTCA Sites to Protect the Environment, A Guide to the Model Toxics Control Act Environmental Evaluation Process for Soil Contamination*, Nov. 5, 1996, p. 13), who did not specify a concentration. Note that if concentrations at the site are below those in Table 749-2, then the simplified terrestrial ecological evaluation could be ended using the contaminants analysis in WAC 173-340-7492(2)(c)(i).

GQ 14.4.2
Is an experienced field biologist required for the purposes of conducting an exposure analysis to end a simplified terrestrial ecological evaluation under WAC 173-340-7492(2)(a)(ii)?

(898, 934)

Response:
No. An experienced filed biologist is not required for the purposes of conducting an exposure analysis to end a simplified terrestrial ecological evaluation under WAC 173-340-7492(2)(a)(ii). However, if an experienced field biologist does not conduct the habitat evaluation required under Table 749-1, then a conservative score must be used in the table (see Table 749-1, footnote a).

GQ 14.4.3
What is the purpose of the values specified in Table 749-2? May the values be used as cleanup levels? What is the basis for those values?

(305, 590, 308, 830, 988, 991, 1419, 2066, 2557)

Response:
Several commentors misconstrued the values in Table 749-2 as ecologically based cleanup levels or that the values in Table 749-2 might be construed as ecologically based cleanup levels. Other commentors requested clarification regarding the purpose and basis of the values in Table 749-2.

The hazardous substances and values listed in Table 749-2 are used as indicator substances and screening levels respectively for the purposes of conducting a contaminants analysis under WAC 173-340-7492(2)(c) to end a simplified terrestrial ecological evaluation. Note that if none of the hazardous substances at the site are listed in Table 749-2 or exist at the site at the applicable points of compliance in concentrations that exceed the Table 749-2 values, then no further evaluation is required. Table 749-2 does not establish ecologically based cleanup levels. This fact is emphasized in "Footnote a" of Table 749-2. However, at the discretion of the person conducting the evaluation, the values specified in Table 749-2 may be used as cleanup levels as another method of ending a simplified terrestrial ecological evaluation. See WAC 173-340-7492(1)(d). Note that for sites not requiring a site-specific terrestrial ecological evaluation as determined under WAC 173-340-7491(2), Table 749-2 may be used for either stated purpose (as either screening levels or cleanup levels) to end the evaluation process at any stage in the process.

Table 749-2 was developed for use at sites where a site-specific terrestrial ecological evaluation is not required. The values specified in the table are not intended to be protective of terrestrial ecological receptors that require a site-specific terrestrial ecological evaluation, as determined under WAC 173-340-7491(2). The values specified in Table 749-2 for conducting a simplified evaluation were calculated based on a higher level of acceptable risk than the values specified in Table 749-3 for conducting a site-specific evaluation. The concentrations are based on a higher level of risk because the consequences of an underprotective cleanup are constrained by requiring a site-specific terrestrial ecological evaluation at more ecologically important sites (see WAC 173-340-7491(2)).

The values specified in Table 749-2 were developed by Ecology in consultation with the MTCA Science Advisory Board Ecological Risk Subcommittee. Allowing for a higher level of risk, plant and soil biota values are based on the 50^{th} percentile (Q_{50}) of Lowest Observed Adverse

Effect Concentrations (LOAECs) instead of the 10th percentile (Q_{10}) used to calculate values in Table 749-3. Wildlife values are the lowest of two values calculated for different wildlife groups using less conservative standardized exposure assumptions and chemical-specific threshold reference values (TRVs) and uptake factors.

The value for unrestricted land use is the lowest of the values specified for each of the three categories of terrestrial ecological receptors – plant, soil biota, and wildlife. The value for industrial and commercial properties is the wildlife value.

GQ 14.4.4
Should Table 749-2 and Table 749-3 include values for gasoline range organics and diesel range organics? What is the basis for those values?

(299, 302, 305, 540, 781, 820, 830, 988, 989, 1224, 1282, 1395, 2066, 2067, 2111, 2190, 2193, 2415, 2557)

Response:
Some commentors questioned the appropriateness of including values for gasoline range organics (GRO) and diesel range organics (DRO) in the tables. Other commentors questioned the basis for the specified values. Other commentors approved of the specified values.

With respect to whether GRO and DRO should be included in Table 749-2 as indicator hazardous substances, note that only those hazardous substances that are included in Table 749-2 must be considered if the site qualifies for a simplified terrestrial ecological evaluation. The criteria for including a hazardous substance as an indicator hazardous substance in Table 749-2 are persistence, potential to bioaccumulate, and degree of toxicity. An analysis conducted by the TPH Project Oversight Group (POG) concluded that petroleum constituents met two of these criteria (Brownfields/TPH Project Phase 2, Task 4, Subtask 4.2.1 Technical Memorandum (August 22, 1997)).

The values specified for GRO and DRO in Tables 749-2 and Table 749-3 are based an exhaustive process that included the MTCA Science Advisory Board and included the evaluation of information submitted by the TPH Project Oversight Group (POG). In early drafts of the rule amendment, including the version used in the pilot study, Ecology used the current Method A soil concentrations in Table 749-2. Based on the information available at that time, Ecology believed that these concentrations were likely to be protective and that a person need not continue a terrestrial ecological evaluation of petroleum contamination at a site where soil concentrations were below these values. In 1999, Ecology completed an analysis of relevant data and substituted risk-based values with the concurrence of the MTCA Science Advisory Board. Because Q_{50} values for soil biota and plants could not be resolved at that time, the more conservative plant and soil biota values used in Table 749-3 were also used to establish values for Table 749-2. Subsequently, Ecology received additional testing data from work conducted to develop the Canadian Council of Ministers of the Environment (CCME) Canada-wide Standards for Petroleum Hydrocarbons in Soil (June 5, 2000). From these data it was possible to calculate

Q_{50} for use in calculating the Table 749-2 numbers. Table 749-3 values were consistent with the CCME data and no change was made there.

One commentor raised technical issues relating to the soil biota values:

> In Table 749-2, the values presented for gasoline range organics (100 mg/kg) and diesel range organics (200 mg/kg) for unrestricted land use category are two orders of magnitude lower than the values for industrial or commercial land use. From information presented in Table 749-3, it appears that the petroleum values presented in Table 749-2 are based upon toxicity studies on soil biota. Saterbak et al. (1999) investigated the response of earthworms to eight different soils contaminated with petroleum hydrocarbons in a controlled laboratory experiment. They concluded that there are insufficient data and understanding of the impact of most hydrocarbon contaminants on soils to allow for the development of soil benchmark screening values. They further recommend that a 14-day earthworm survival test would be a suitable test for predicting the effects of hydrocarbon-contaminated soils on earthworms. Using the data set cited in Saterbak et al. (1999), Wong et al. (1999) calculated a 25 percent inhibitory concentration for survival of earthworms ranging from 766 to greater than 34,455 mg/kg total petroleum hydrocarbons (as determined by gas chromatographic analysis) across the various soils. Since the uncertainty associated with the petroleum values for the unrestricted land use presented in Table 749-2 appears unacceptably high, it is recommended that those values be substituted with "See note d" and bioassays as described in WAC 173-340-7492(2)(c)(ii) be used to determine potential impacts to soil biota on a site-specific basis. [540, Allen]

Toxicity of petroleum to soil biota varies with the type of petroleum product and aging of the soil contamination. Ecology limited its analysis to studies of fresh product relevant to gasoline and diesel toxicity. The publications cited by the commentor were not included for this reason. A person has the option to use bioassays to evaluate petroleum contaminated soil. A person also has the option of terminating a simplified terrestrial ecological evaluation without conducting soil bioassay studies if the soil concentrations are below the Table 749-2 values. Where the petroleum concentrations are exceeded, another option is to use these values as cleanup levels without conducting soil bioassays studies. In the absence of a value for hazardous substance listed in Table 749-2, the first and second options would not be available.

GQ 14.4.5
Is mineral oil a priority contaminant for the purposes of Table 749-2?

(2025)

Response:
No. Mineral oil is not a priority contaminant for the purposes of Table 749-2. Ecology acknowledges that diesel range organics is typically defined to include mineral oil. However, for the purposes of Table 749-2, mineral oil is not included within the definition of diesel range organics.

GQ 14.4.6
If a hazardous substance listed in Table 749-2 does not have a value listed, what options are available?

(989, 990, 2067, 2068)

Response:
Note that most sites are expected to be able to obtain an exclusion from conducting a simplified or site-specific terrestrial ecological evaluation. This conclusion is based in part on the results of the Terrestrial Environmental Evaluation Pilot Study Report (Ecology, 1999c).

Where the process cannot be ended by obtaining an exclusion under WAC 173-340-7491, then the process includes the following options under the simplified terrestrial ecological process in WAC 173-340-7492:

- the evaluation may be ended using the exposure analysis subsection (2)(a);
- the evaluation may be ended using the pathways analysis under subsection (2)(b);
- the evaluation may be ended using the contaminants analysis under subsection (2)(c)(ii), which requires a soil bioassay.

Where the process cannot be ended under the simplified terrestrial ecological process, the process includes the following options under the site-specific terrestrial ecological process in WAC 173-340-7493:

- using the concentrations specified in Table 747-3 as cleanup levels; and
- ending the process or establishing cleanup levels using a site-specific terrestrial ecological evaluation.

GQ 14.4.7
For contaminants without values for industrial or commercial sites in Table 749-2, may the values for unrestricted land use be substituted for the purposes of the contaminants analysis in WAC 173-340-7492(2)(c)(i)?

(990, 2068)

Response:
Yes, for contaminants without values for industrial or commercial sites in Table 749-2, the values for unrestricted land use may be substituted for the purposes of the contaminants analysis in WAC 173-340-7492(2)(c)(i). However, note that the reverse is not true (i.e., the values specified in Table 749-2 for industrial and commercial sites cannot be substituted for the values for unrestricted land use).

GQ 14.4.8
For contaminants with values in Table 749-2 that are below natural background levels, may the natural background levels be substituted for the purposes of the contaminants analysis in WAC 173-340-7492(2)(c) or for the purpose of establishing cleanup levels?

(989, 2067, 2340)

Response:

Yes, for contaminants with values in Table 749-2 that are below natural background levels, the natural background levels may be substituted for the purposes of the contaminants analysis in WAC 173-340-7492(2)(c) or for the purpose of establishing cleanup levels. Note that in developing safe concentrations for the hazardous substances listed in Table 749-2, Ecology attempted to insure that the values were below natural background levels. Note also that a site qualifies for an exclusion under WAC 173-340-7491(1)(d) if "concentrations of hazardous substances in soil do not exceed natural background levels, as determined under WAC 173-340-709." Furthermore, the regulation does not require the establishment of cleanup levels below natural background levels. See WAC 173-340-700(6)(d).

GQ 14.4.9
Why are the values in Table 749-2 sometimes the same for unrestricted land use and for industrial/commercial land use?

(1420)

Response:
For sites that qualify for a simplified evaluation, Table 749-2 provides concentrations that have been calculated based on a higher level of acceptable risk. The value for unrestricted land use is the lowest of plant, soil biota and wildlife values. Because of the higher level of acceptable risk, Q_{50} of Lowest Observed Adverse Effect Concentrations (LOAECs) is used to calculate plant and soil biota values, rather than Q_{10}. Wildlife values are the lowest of two values calculated for different wildlife groups using less conservative standardized exposure assumptions and chemical-specific threshold reference values (TRVs) and uptake factors. Table 749-2 values for industrial and commercial properties are the wildlife values. For those chemicals where the wildlife value is lower than the plant and soil biota values, the value for unrestricted land use will be the wildlife value. Since the industrial/commercial value is the wildlife value, the same number will apply to both land uses.

GQ 14.4.10
When are institutional controls required under WAC 173-340-7492(3) as a prerequisite to ending an evaluation under the simplified terrestrial ecological procedures? Why may institutional controls be required to end an evaluation under WAC 173-340-7491(1)(a) and (b)?

(300, 671, 831, 1078, 1109, 2191, 2558)

Response:
Institutional controls are not always required as a prerequisite to ending an evaluation under the simplified terrestrial ecological procedures. Institutional controls are only required as a prerequisite to ending an evaluation in the following circumstances:

- The evaluation is ended using one of the analyses in WAC 173-340-7492(2)(a)(ii) through (c) and Ecology determines that institutional controls are necessary to ensure that the conditions used to end the evaluation will continue to be met in the future.

- Cleanup levels are established using the concentrations listed for commercial or industrial sites in Table 749-2.

Institutional controls may be required to end an evaluation using one of the three analyses in WAC 173-340-7492(2) to ensure the continued protection of terrestrial ecological receptors and the integrity of the remedial action. More specifically, the institutional controls are necessary to ensure the continued viability of those site conditions that allowed for the evaluation to end.

Institutional controls are required when cleanup levels are established using the concentrations listed for commercial or industrial sites in Table 749-2 to prevent future exposure to plants or soil biota in the event of a change in land use.

To demonstrate that institutional controls are not necessary to protect terrestrial ecological receptors from significant adverse effects would require the demonstration that the conditions allowing for evaluation to end are not necessary to protect terrestrial ecological receptors. Making such a demonstration would require conducting a site-specific terrestrial ecological evaluation. Conducting such an evaluation is always an option.

GQ 14.4.11
Are institutional controls required as a prerequisite to ending a simplified terrestrial ecological evaluation under WAC 173-340-7492(2)(a)(i)?

(830, 831, 1223, 1225, 2557, 2558, 2586)

Response:
No. Institutional controls are not required as a prerequisite to ending a simplified terrestrial ecological evaluation under WAC 173-340-7492(2)(a)(i), which requires that "the total area of soil contamination at the site is not more than 350 square feet." Note that the applicable point of compliance is defined in WAC 173-340-7490(4). This amendment reflects concern expressed by some commentors that sites with leaking home heating oil tanks might require institutional controls to protect terrestrial ecological resources. As long as "the total area of soil contamination at the site [contaminated with home heating oil] is not more than 350 square feet," then no further evaluation is required and no institutional controls are required for protection of terrestrial ecological receptors.

GQ 14.4.12
Other comments regarding WAC 173-340-7492, Table 749-1, and Table 749-2 are addressed in the following table:

Comment ID	Section	Comment	Response
663, K. Johnson	7492(1)(b)	Clarify purpose of section to ensure consistent with statement of purpose in Section 7490.	Comment addressed in 2000 proposal. The statement of purpose in Section 7492(1)(b) is intended as a brief summary of the statement in Section 7490(3)(b), which includes protection of the ecologically important functions of soil

			biota that affect plants or wildlife.
664, K. Johnson 1392, McCain	7492(1)(d)	Provision is inconsistent with the PAC flowchart and guidance. Provision should include the options available to a PLP, including using screening levels as cleanup levels, performing a soil bioassay, and performing a site-specific evaluation.	All of the options noted by the commentor are available to a PLP. See WAC 173-340-7492(1)(a). The option for evaluating the site using soil bioassays is provided in WAC 173-340-7492(2)(c)(ii).
2587, Thomas	7492(2)(a)(i)	Suggested replacing the 350 square foot criterion with 500 square feet.	The 350 square foot criterion reflects the recommendations of the PAC. No information has been submitted to support a change from the current criteria.
313, Warden	7492(2)(a)(ii) Table 749-1	Suggested editorial correction.	Comment addressed in 2000 proposal.
315, Warden	7492(2)(a)(ii) Table 749-1	Suggested including definition of "contiguous."	The term "contiguous" undeveloped land is defined in section 7491(1)(c)(iii) for the purposes of both section 7491(1)(c) and Table 749-1.
2110, McCain	7492(2)(a)(ii) Table 749-1	Suggest reference to definition of the term "site."	The term "site" is defined in WAC 173-340-200.
934, Crell	7492(2)(a)(ii) Table 749-1	Expressed concern that rule requires use of experienced field biologist.	Use of a field biologist is not required. A conservative default score may be used as an alternative. Moreover, the Table 749-1 analysis as a whole is optional and not a requirement.
314, Warden	7492(2)(a)(ii) Table 749-1	We suggest that Ecology consider changing the scale in box 2 to list: “industrial = 5; commercial = 3; other = 1”; to reflect different development issues.	Development possibilities for industrial and commercial properties overlap considerably in how they may affect the potential for ecological exposure. Consequently, no distinction has been made in assigning a weighting factor.
314, Warden	7492(2)(a)(ii) Table 749-1	In box 2 and footnote c, we suggest clarifying whether the term “wildlife” should be understood according to the provisions of Section 7490(3)(d).	“Wildlife” is defined in Section 200 (Definitions). Definitions are provided to obviate the need to repeatedly define the same term wherever it appears in the regulation.
1419, Belcher	7492(2)(c) Table 747-2	Noted that use of the concentrations in Table 747-2 as cleanup levels may result in cleanup levels that are more stringent than required to protect human health.	Ecology acknowledges that use of the concentrations in Table 747-2 as cleanup levels may result in cleanup levels that are more stringent than required to protect human health. Note that other options are available under the process.
404, Rasmussen 539, Allen 983, Graves 1152, Kenefick 1238, Gillett	7492(2)(c)(i) & (ii)	Suggested editorial correction.	Comment addressed in 2000 proposal.
933, Crell	7492(3)	Notes that institutional controls may be required for the protection of terrestrial ecological receptors even when such controls are not required to protect human health.	Acknowledged.

14.5 Site-Specific Terrestrial Ecological Evaluation Procedures (WAC 173-340-7493)

GQ 14.5.1
For independent remedial actions, must the elements in planning a site-specific terrestrial ecological evaluation identified in WAC 173-340-7493(1)(c) be conducted in consultation with and approved by Ecology?

(984, 1396)

Response:
As provided in WAC 173-340-515(3)(b):

> When this chapter requires a consultation with, or an approval or determination by the department, such a consultation, approval or determination is not necessary in order to conduct an independent remedial action. However, independent remedial actions must still meet the substantive requirements of this chapter.

GQ 14.5.2
What is the purpose of the values specified in Table 749-3? May the values be used as cleanup levels? What is the basis for those values?

(405, 409, 414, 590, 991, 1298, 1398, 2069, 2655, 2658, 2664)

Response:
Several commentors misconstrued the values in Table 749-3 as ecologically based cleanup levels or that the values in Table 749-3 might be construed as ecologically based cleanup levels. Other commentors requested clarification regarding the purpose and basis of the values in Table 749-3.

The values for the hazardous substances listed in Table 749-3 are used to help narrow the focus of the site-specific terrestrial ecological evaluation by identifying those substances that do not need to be addressed as part of that evaluation. See WAC 173-340-7493(2)(a)(i). Note that the person conducting the evaluation may eliminate hazardous substances from further consideration where the maximum or the upper ninety-five percent confidence limit soil concentration found at the site does not exceed ecological indicator concentrations described in Table 749-3. WAC 173-340-7493(2)(a)(i). Table 749-3 does not establish ecologically based cleanup levels. This fact is emphasized in WAC 173-340-7493(2)(a)(i) and in the header of Table 749-3. However, at the discretion of the person conducting the evaluation, the values specified in Table 749-3 may be used as cleanup levels. See WAC 173-340-7493(3). Note that the values in Table 749-3 may be used for either stated purpose (as either screening levels or cleanup levels) to end the evaluation process at any stage in the process.

Ecological risk assessments typically include a step to narrow the focus of the assessment by eliminating from further consideration those site contaminants that do not exceed conservative

risk-based concentrations. If all of the site contaminants are eliminated, the risk assessment need not proceed any further. These reference concentrations are frequently described as "screening levels" or "benchmarks" (e.g., EPA, 1997a). In ecological risk assessments conducted to date under MTCA, a variety of different generic "screening level" concentrations have been used by persons at different sites in the absence of guidance from Ecology. Consequently, a priority for Ecology in developing the rule amendments was to establish a consistent policy on the use of generic ecologically based soil concentrations that Ecology will accept as safe without further evaluation of terrestrial ecological risks.

Table 749-3 was developed for use at sites where a site-specific terrestrial ecological evaluation is required or otherwise conducted. The values specified in the table are intended to be protective of terrestrial ecological receptors at any site. The values specified in Table 749-3 for conducting a site-specific evaluation were calculated based on a lower level of acceptable risk than the values specified in Table 749-2 for conducting a simplified evaluation. This is the baseline or default level of acceptable risk. A higher level of acceptable risk is allowed for conducting a simplified terrestrial ecological evaluation.

The values specified in Table 749-3 were developed by Ecology in consultation with the MTCA Science Advisory Board Ecological Risk Subcommittee. Allowing for a lower level of risk, plant and soil biota values are based on the 10^{th} percentile (Q_{10}) of Lowest Observed Adverse Effect Concentrations (LOAECs) instead of the 50^{th} percentile (Q_{50}) used to calculate values in Table 749-2. Wildlife values are the lowest of three values calculated for different wildlife groups using standardized exposure assumptions and chemical-specific threshold reference values (TRVs) and uptake factors.

The value for unrestricted land use is the lowest of the values specified for each of the three categories of terrestrial ecological receptors – plant, soil biota, and wildlife. The value for industrial and commercial land uses is the wildlife value.

The basis for the petroleum values in both Tables 749-2 and 749-3 are explained in Section 14.4 of the CES.

GQ 14.5.3
For contaminants with values in Table 749-3 that are below natural background levels, may the natural background levels be substituted for the purposes of Table 749-3?

(2340)

Response:
Yes, for contaminants with values in Table 749-3 that are below natural background levels, the natural background levels may be substituted for the purposes of Table 749-3. Note that in developing safe concentrations for the hazardous substances listed in Table 749-3, Ecology attempted to insure that the values were below natural background levels. Note also that a site qualifies for an exclusion under WAC 173-340-7491(1)(d) if "concentrations of hazardous substances in soil do not exceed natural background levels, as determined under WAC 173-340-

709." Furthermore, the regulation does not require the establishment of cleanup levels below natural background levels. See WAC 173-340-700(6)(d).

GQ 14.5.4
Should proposals for modifications to default values provided in WAC 173-340-7493 meet the requirements in WAC 173-340-702(14), (15) and (16) for new scientific information?

(1399)

Response:
Yes. WAC 173-340-7493(6) provides that:

> The department shall consider proposals for modifications to default values provided in this section based on new scientific information in accordance with WAC 173-340-702 (14), (15) and (16).

This requirement is consistent with the stated applicability of the referenced subsections. See WAC 173-340-702 (14), (15) and (16). The rationale for the requirement applies equally to both human health risk assessments and ecological risk assessments.

GQ 14.5.5
Should the substitution of receptor species and the associated values in the wildlife exposure model described in Table 749-4 be conditioned on the use of toxicity reference values based on NOAEL, use of uncertainty factors, or use of a hazard index approach, as specified in WAC 173-340-7493(7)(f) to establish a margin of safety?

(409, 2658)

Response:
The wildlife values specified in Table 749-3 represent soil concentrations that are expected to be safe for wildlife at any site throughout the state. While there can be considerable variation among species in sensitivity to a toxic chemical, there is generally insufficient scientific information to identify wildlife species that are most sensitive to specific chemicals. To account for this uncertainty, the soil concentrations have been developed using conservative exposure values to provide a margin of safety for sensitive species. Ecology does not expect that the surrogate receptors used to derive the conservative exposure values will occur at every site. However, Ecology recognizes that there has been some confusion concerning the selection of the surrogate receptors. The following clarifications should be made:

1. Empirical studies in a site-specific terrestrial ecological evaluation need not be conducted using the surrogate receptors identified in Table 749-3. For example, an evaluation of PCB levels in small mammals may be based on measurements from species that actually occur at a site.
2. Empirical studies are the most reliable method for adapting a terrestrial ecological evaluation to a particular ecoregion or habitat. WAC 173-340-7493 provides for a variety of empirical

methods, including measurements of chemical concentrations in animals at the site or in their food, biological testing (bioassays), biological indicators of exposure such as changes in blood chemistry, and studies that focus on particular chemical-specific concerns such as egg-shell thinning.

3. Table 749-3 wildlife numbers have been calculated using conservative exposure values based on data for surrogate receptors representing three wildlife groups: birds and mammals that feed on ground-dwelling or underground insects and other small animals; and small plant-feeding mammals (herbivores). This approach is intended to provide a margin of safety for sensitive species. However, if there is a concern that the numbers may not be adequately protective of species from a specific habitat or ecoregion, values calculated for other species may also be included in the selection of the lowest concentration as the wildlife number. See WAC 173-340-7493(3)(c)(ii). Less conservative exposure values based on ecoregional substitutions for the surrogate receptors are also permitted, provided a margin of safety for sensitive species is restored. See WAC 173-340-7493(7)(f). Because the wildlife calculations are sensitive to policy decisions on how uncertainties should be handled, particularly regarding species differences in sensitivities to toxic chemicals, there is no assurance that numbers calculated with the substitution method are more truly reflective of ecoregional differences. For this reason, the empirical method described above is Ecology's preferred approach for evaluating ecoregional risk in a scientifically defensible manner.

GQ 14.5.6
Should Ecology develop a different food web model specifically for Eastern Washington?

(2607)

Response:
The default exposure model was developed to be protective for any region of the state. However, a person may develop a different exposure model as provided in the regulation. See WAC 173-340-7493(3)(c).

GQ 14.5.7
Other comments regarding WAC 173-340-7493 and Tables 749-3 through 749-5 are addressed in the following table:

Comment ID	Section	Comment	Response
541, Allen	7493(1)(b)	Suggested editorial correction.	Comment addressed in 2000 proposal.
1397, McCain	7493(2)(a)(i)	Provision suffers from the same statistical problem as identified for section 709.	Ecology disagrees. See response to similar comment in Chapter 9 of the CES.
407, Rasmussen 2657, Wisness	7493(3)(b)(i)	Revise last sentence to read: "Other bioassay tests approved by the department may also be used <u>and may be preferable for ecological reasons (e.g., soil types at the site are unsuitable for the earthworms).</u>"	Suggested revision is neither necessary nor appropriate. Other bioassay tests may be used subject to department approval. Ecology acknowledges that the suitability of the soil for earthworm habitat may be considered in determining the appropriateness of a bioassay test.

542, Allen	7493(4)(a)	Substitution of the words "technically defensible" for "relevant" in the first sentence would make the intent of the section more understandable.	Relevance is evaluated with regard to the receptors of concern, the exposure pathways being considered and the whether adverse effects are "significant", as defined in WAC 173-340-7490(3). A LOAEL from a technically sound study may not necessarily be relevant. "Relevant" addresses this concern more directly than "technically defensible".
543, Allen	7493(4)(a)(iv)	The phrase "appropriate exposure duration period" as used in the fourth bullet is ambiguous. A definition of what an appropriate exposure period is should be supplied in this section.	Comment addressed in 2000 proposal.
544, Allen	7493(4)(b)	It seems an unreasonable burden to expect a PRP to supply all the information listed in this section. The PRP should only be responsible for providing the references for the toxicity reference values or soil concentrations.	Before Ecology can concur with the values proposed, the department will need to review the relevant information used in the analysis
408, Rasmussen 545, Allen	7493(7)	Suggested editorial correction.	Comment addressed in 2000 proposal.
546, Allen	Table 749-3 Table 749-5	Suggested editorial correction.	Comment addressed in 2000 proposal.
547, Allen	Table 749-5	Suggested editorial correction.	Comment addressed in 2000 proposal.

14.6 Pilot Study

GQ 14.6.1
Did Ecology conduct a pilot study of the terrestrial ecological evaluation process prior to formally proposing rule amendments? Should Ecology have conducted further study, particularly of sites that might require a site-specific evaluation?

(76, 301, 669, 672, 781, 899, 935, 1383, 2192, 2337, 2415)

Response:
The PAC recommended that the process for conducting a terrestrial ecological evaluation should be pilot tested before the process was formally proposed as part of the rule amendments. In response to this recommendation, Ecology conducted a Terrestrial Environmental Evaluation Pilot Study. The report summarizing the study and conclusions reached, as well as responses to comments made, was published by Ecology in November 1999 along with the 1999 proposed rule amendments. See Terrestrial Environmental Evaluation Pilot Study Report, Pub. #99-604 (Ecology, 1999c). Several commentors suggested that Ecology should conduct further pilot study, particularly of sites that might require a site-specific evaluation.

Ecology believes that the results of the pilot study in tandem with two formal public notice and comment periods on the proposed rule amendments provide a sufficient basis for proceeding

with the adoption of the terrestrial ecological evaluation procedures as part of the rule. Note that the rule amendment reflects changes made based upon the results of the pilot study. Ecology acknowledges that, despite concerted efforts, the pilot study did not include a site that conducted a site-specific evaluation. This fact was offset by the following considerations in deciding to proceed with adoption of the rule amendments:

1. Of the 39 sites that were evaluated, 95% qualified for an exclusion under WAC 173-340-7491(1) and the remaining 5% qualified for a simplified terrestrial ecological evaluation. No sites were required to conduct a site-specific terrestrial ecological evaluation based on the criteria set forth in WAC 173-340-7491(2). These results are consistent with the expectations of Ecology and PAC members regarding the limited necessity of conducting a site-specific terrestrial ecological evaluation.
2. The procedures for establishing an exclusion under WAC 173-340-7491(1), the procedures for determining whether a site qualified for a simplified terrestrial ecological evaluation under WAC 173-340-7491(2), and the procedures for conducting a simplified terrestrial ecological evaluation under WAC 173-340-7492 were new procedures that had not been used before under the MTCA Cleanup Regulation and therefore required the most testing. In contrast, Ecology has had considerable experience with site-specific evaluations, which have often been conducted under the federal cleanup law or under the MTCA Cleanup Regulation. The only difference is the standardization of the procedures and requirements necessary to ensure that the terrestrial environment is protected at every site.
3. Both Ecology and the Association of Washington Business made a concerted effort to recruit volunteers who would be willing to include their site in the pilot study. Both efforts were unsuccessful.
4. Site-specific terrestrial ecological evaluations are, by definition, site-specific and require the selection of approaches from among several options. Given the wide-range of possible approaches and outcomes, results would likely not be representative.

Chapter 15 Soil Cleanup Standards – Leaching

To establish soil cleanup levels that are protective of human health, consideration of several different pathways of exposure is required, including the leaching of contaminants from soil into the ground water.

15.1 Overview of the Rule Amendment

The following description of the proposed rule amendment includes a description of the current rule and a comparison of the proposed rule amendment with the current rule.

Evaluation of the leaching pathway (soil-to-ground water pathway) requires a determination that the soil concentration will not cause an exceedance of the ground water cleanup level established under WAC 173-340-720. Under the current rule, soil concentrations that meet this requirement are determined by multiplying the ground water cleanup level by 100. Under the proposed rule amendments, Ecology replaced this methodology with fate and transport models and other approaches. WAC 173-340-747. The following discussion provides a brief overview of the proposed rule amendment.

WAC 173-340-747(2) sets forth the general requirements (criteria) that soil concentrations must meet for those concentrations to be considered protective of human health. First, the soil concentrations must not cause an exceedance of the ground water cleanup levels established under WAC 173-340-720. To determine if this criterion is met, one of the methodologies specified in subsections (4) through (9) must be used. Second, to ensure that the first criterion is met, the soil concentration must not result in the accumulation of non-aqueous phase liquid (NAPL) on or in ground water. To determine if this criterion is met, one of the methodologies specified in subsection (10) must be used.

WAC 173-340-747(3) provides an overview of the methods specified in subsections (4) through (10) for deriving soil concentrations that meet the criteria specified in subsection (2). Certain methods are tailored for particular types of hazardous substances or sites. Certain methods are more complex than others and certain methods require the use of site-specific data. The specific requirements for deriving a soil concentration under a particular method may also depend on the hazardous substance. Note, however, that the proposed rule amendment does not mandate the use of any particular methodology.

WAC 173-340-747(4) through (10) specifies the procedures and requirements for establishing soil concentrations that meet the criteria specified in subsection (2) under each of the specified methodologies.

This proposed rule amendment has resulted in a different Method A soil cleanup level for many hazardous substances. Some of these hazardous substances have become more stringent and some have become less stringent. This proposed rule amendment may also result in different Method B or Method C soil cleanup levels.

The proposed rule amendment is required to achieve the general goals and specific objectives of the statute, including the following:

- To protect human health (see RCW 70.105D.010 and .030); and
- To periodically update minimum cleanup standards for remedial actions based on new scientific information and changes to state and federal laws (see RCW 70.105D.030(2)(d) and WAC 173-340-702(3)).

The proposed rule amendment will more effectively achieve these objectives by replacing the old "100x ground water" model with more accurate chemical and site-specific fate and transport models. The methodology proposed by Ecology more accurately quantifies the risk posed to ground water by hazardous substances within the soil and hence more accurately ensures the protection of human health and the environment.

The proposal to replace the old "100x ground water" model with the more accurate chemical and site-specific fate and transport models is based on an extensive review of new scientific and technical information. Although the 100x ground water model was based on the best scientific and technical information available at the time, the old model does not adequately account for site or chemical-specific factors that control the movement of hazardous substances from soil into water. The movement of hazardous substances from soil into water is primarily controlled by two factors: the soil properties and the hazardous substance water solubility.

For example, some hazardous substances like benzene are relatively soluble in water. When gasoline is released to the soil, benzene will immediately start to partition from the gasoline into water that is held within the soil pores and then flow to the ground water. The 100x ground water model does not adequately account for this mobility. Under the 100x model, all hazardous substances are treated the same, even if some are more mobile than others. This fact resulted in the following consequences:

- For hazardous substances that are relatively more mobile (e.g., benzene, gasoline, and chlorinated organics), "the 100x ground water model" will underestimate the risk to ground water. As a result, soil concentrations computed by "the 100x ground water model" will not protect ground water **(Figure 15-1; Table 15-1).**

- Conversely, for hazardous substances that are less mobile (e.g., benzo(a)pyrene, PCBs, metals and heavier petroleum products), "the 100x ground water model" will overestimate the risk to ground water. As a result, soil concentrations computed by "the 100x ground water model" are overly conservative **(Figure 15-1; Table 15-2)**.

Based on new scientific and technical information developed since the adoption of the 100x ground water methodology in 1991, Ecology adopted two leaching models to account for the way hazardous substances behave when they are released to the soil. These models apply the same principle of equilibrium partitioning used for evaluating the leaching pathway in the ASTM Risk-Based Corrective Action protocol and the U.S. Environmental Protection Agency's Soil

Screening Guidance. The three-phase model accounts for partitioning of hazardous substances between the water, air and solid phases of a soil. The four-phase model accounts for partitioning between these same phases, as well as a non-aqueous liquid phase, a phase that commonly occurs when organic chemicals such as petroleum products are released to soils. Both of these models were subject to rigorous review by the MTCA Science Advisory Board and it's Fate and Transport Subcommittee, which included members from the private consulting community and the University of Washington and Washington State University. Assumptions used in these models include extensive information extracted from the literature as well as information from contaminated sites in Washington State.

As discussed more thoroughly in the LBA Analysis, the proposed amendment is the least burdensome alternative that will achieve the general goals and specific objectives of MTCA. Several alternatives were considered and evaluated as part of that analysis.

The proposed rule amendment attempts to combine the goals advanced by the MTCA Policy Advisory Committee of creating a rule that achieves a level of simplicity combined with a level of human health and environmental protection consistent with advances in scientific information. This goal was accomplished by creating a system of constrained flexibility. The amendment, for example, does not mandate the use of any particular methodology. Instead, the amendment specifies the general criteria that must be met and the methodologies that may be used to determine if those criteria are met. Certain methods are tailored for particular types of hazardous substances or sites. Certain methods are more complex than others and certain methods require the use of site-specific data. The specific requirements for deriving a soil concentration under a particular method may also depend on the hazardous substance. The amendment also specifies the procedures and requirements for establishing soil concentrations that meet the criteria under each of the specified methodologies.

As discussed more thoroughly in the Estimates of the Probable Costs and Benefits, the probable benefits of this amendment exceed the probable costs. The impact of the amendment on costs depends in part on whether the soil cleanup level is established based on the leaching pathway and, if so, whether evaluation of the leaching pathway results in a less or more stringent soil cleanup level.

The proposed rule amendment has resulted in a different Method A soil cleanup level for many hazardous substances. Some of these hazardous substances have become more stringent and some have become less stringent. This proposed rule amendment may also result in different Method B or Method C soil cleanup levels. More stringent cleanup levels may increase the total cost of site remediation while less stringent cleanup levels may decrease the total cost of site remediation (avoided cost). Ultimately, and perhaps most significantly, the impact of the proposed rule amendment depends on the remedy selected.

15.2 Overview of the Development of the Amendment

The MTCA Science Advisory Board (SAB) was integrally involved in the development of the amendment in general and the equilibrium partitioning models in particular. The SAB is an independent panel of scientists and their function is to advise Ecology on environmental science issues. Ecology first consulted with the SAB to determine the best course of action. Upon consultation with the SAB, it was decided that the best course of action was to convene a "Fate and Transport Subcommittee." The function of this subcommittee was to advise Ecology during the development of more scientifically justifiable methodologies for deriving soil concentrations that are protective of ground water. Once the decision was made to form a subcommittee, a search was conducted to select candidates. Two criteria were used for this search: experience and background of the candidate and availability. This search resulted in the subcommittee being comprised of the following five individuals:

- Dr. Richelle Allen-King (Committee Chair), Washington State University
- Dr. Hank Landau
- Dr. Wade Hatthorn, Economic and Engineering Services Inc.
- Dr. Mark Brearley, Unocal Inc.
- Mr. William Deutsch, Woodward-Clyde Consulting Inc.

After formation of the subcommittee, meetings were held on a periodic basis. A total of twenty-four (24) meetings were held from March 27, 1996 to December 20, 1999. A number of topics and issues were discussed during this time period **(Table 15-4)**. This process resulted in the formation of a new approach that could be used to derive soil concentrations that are protective of ground water. The models themselves were subject to rigorous review by the MTCA Science Advisory Board and the Fate and Transport Subcommittee.

15.3 General

GQ 15.3.1
What is the basis for the rule amendment? Is the rule amendment the least burdensome alternative that will achieve the general goals and specific objectives of MTCA? Is the use of the equilibrium partitioning models scientifically valid?

(166, 167, 528, 812, 913, 931, 1075, 1104, 1122, 1169, 1175, 1367, 2017, 2018, 2092, 2333, 2358, 2606)

Response:
See discussion under Section 15.1 and 15.2 above. Background information on the partitioning models and the default input parameters is provided in Section 15.x and 15.x.

GQ 15.3.2
What is the difference between "soil concentrations" and "soil cleanup levels"?

(1266)

Response:
As described in WAC 173-340-747(1):

> The purpose of this section is to establish soil concentrations that will not cause contamination of ground water at levels that exceed the ground water cleanup levels established under WAC 173-340-720. Soil concentrations established under this section are used to establish either Method B soil cleanup levels (see WAC 173-340-740(3)(b)(iii)(A)) or Method C soil cleanup levels (see WAC 173-340-745(5)(b)(iii)(A)).
>
> For the purposes of this section, "soil concentration" means the concentration in the soil that will not cause an exceedance of the ground water cleanup level established under WAC 173-340-720.

Method B and Method C soil cleanup levels must be at least as stringent as concentrations that are protective of human health and the environment and concentrations established under applicable state and federal laws. Determining what concentration is protective of human health requires consideration of several exposure pathways, including direct contact (ingestion and dermal), leaching, and vapors. The concentration that is protective of ground water is compared against the protective concentrations for all other exposure pathways to help derive a soil cleanup level. See WAC 173-340-740(3)(b) and 173-340-745(5)(b).

Note that the term "cleanup level" is defined in WAC 173-340-200.

GQ 15.3.3
What methods may be used to derive soil concentrations that are protective of ground water?

(112, 285, 287, 393, 1430, 2273, 2650)

Response:
The general requirements for deriving soil concentrations that are protective of ground water are specified in WAC 173-340-747(2):

> The soil concentration established under this section for each hazardous substance shall meet the following two criteria:
>
> **(a)** The soil concentration shall not cause an exceedance of the ground water cleanup level established under WAC 173-340-720. To determine if this criterion is met, one of the methodologies specified in subsections (4) through (9) of this section shall be used; and
> **(b)** To ensure that the criterion in (a) of this subsection is met, the soil concentration shall not result in the accumulation of nonaqueous phase liquid on or in ground water. To determine if this criterion is met, one of the methodologies specified in subsection (10) of this section shall be used.

Note that WAC 173-340-747 does not establish "standard" and "modified" methods for use when deriving protective soil concentrations under "standard" and "modified" Method B or C. In other words, any of the specified methods may be used to derive protective soil concentrations under "standard" Method B or C.

WAC 173-340-747(3) provides an overview of the methods specified in subsections (4) through (10) for deriving soil concentrations that meet the criteria specified in subsection (2). Certain methods are tailored for particular types of hazardous substances or sites. Certain methods are more complex than others and certain methods require the use of site-specific data. The specific requirements for deriving a soil concentration under a particular method may also depend on the hazardous substance.

GQ 15.3.4
Several comments were made suggesting editorial changes or corrections, or changes in style and format. These comments are listed below.

(116, 119, 120, 139, 142, 411, 527, 529, 680, 766, 815, 1267, 2277, 2280, 2281, 2440)

Response:
WAC 173-340-747 underwent a substantial reorganization and rewrite to improve the clarity and usability of the rule. The 2000 proposal reflected that effort. Each of the comments have been noted and addressed as appropriate as part of that effort. Further less significant clarifications were made based on the comments on the 2000 proposal.

15.4 Partitioning Models and Input Parameters (WAC 173-340-747(4) through (6))

GQ 15.4.1
Ecology received the following comments on the fixed or default values for soil organic carbon-water partitioning coefficient (Koc), Henry's law and distribution coefficient (Kd):

- The reference source for Table 747-1 (Koc values) needs to be provided.

- The Koc value for pentachlorophenol needs to be checked – values in other EPA publications[1] are much higher than the one proposed by Ecology.

- Publishing chemical and physical "constants" in the rule can be problematic due to the variation in the literature regarding such "constants." Ecology should publish these values in guidance, not rule.

- What Koc values should be used for glycol, methanol, or methyl isobutyl ketone?

[1] EPA's Office of Drinking Water guidance that suggest Koc for pentachlorophenol in sediments between 3000 and 4000.

(25, 26, 27, 398, 2013)

Response:
Ecology does acknowledge that physical / chemical constants (e.g. Koc, Henry's law, etc.) do vary widely in the scientific literature; however, Ecology believes that EPA's review of Koc and Henry's law constant values[2] in most cases adequately accounted for this variability. For example, for nonionic organics, the geometric mean of all Koc values surveyed was used.

Ecology also added language to WAC 173-340-747(4)(c)(i)(B) for instructions on ionizing organics as follows:

> For ionizing organic hazardous substances (e.g., pentachlorophenol and benzoic acid), the K_{oc} values in Table 747-2 shall be used. Table 747-2 provides K_{oc} values for three different pHs. To select the appropriate K_{oc} value, the soil pH must be measured. The K_{oc} value for the corresponding soil pH shall be used. If the soil pH falls between the pH values provided, an appropriate K_{oc} value shall be selected by interpolation between the listed K_{oc} values.

WAC 173-340-747(4)(c)(i)(B). Lastly, the reference source for the Koc values (Table 747-1) published in the regulation was also added. Koc values from the scientific literature should be used for chemicals not published in Table 747-1.

GQ 15.4.2
What is the definition of "Henry's law constant"?

(395)

Response:
The comment was addressed by providing a definition for Henry's law constant in WAC 173-340-200.

> "Henry's law constant" means the ratio of a hazardous substance's concentration in the air to its concentration in water. Henry's law constant can vary significantly with temperature for some hazardous substances. The dimensionless form of this constant is used in the default equations in this chapter.

WAC 173-340-200.

GQ 15.4.3
For inorganics (metals), what Henry's law constant should be used in Equation 747-1?

(144, 396)

[2] EPA Soil Screening Guidance: Technical Background Document. EPA/540/R-95/128 (May, 1996).

Response:
Except for mercury, the Henry's law constant has no impact on calculating inorganic soil cleanup levels. To address the commentors' concerns, WAC 173-340-747(4)(d) was revised to provide the following:

> For all metals present as inorganic compounds except mercury, zero shall be used. For mercury, either 0.47 or a value derived from the scientific literature shall be used.

GQ 15.4.4
Should the default soil fraction of organic carbon (foc) value of 0.1% be changed to 0.2%?

(286, 2184)

Response:
Ecology's analysis of soil foc found that in nearly every case, it declines with depth, i.e. below the root zone (1 meter), the soil foc is typically closer to 0.1% and not 0.2%. Furthermore, EPA's soil foc value of 0.2% is only based on one study[3] and Ecology did not believe that one study was sufficient. A detailed explanation on how Ecology arrived at the 0.1% soil foc value has been provided later in this chapter.

GQ 15.4.5
Should a unit conversion factor (UCF) be added to Equation 747-1 so that is compatible with Equations 720-1 and 720-2?

(387, 2464)

Response:
Equation 747-1 was revised to include a unit conversion factor (UCF):

Equation 747-1: $C_s = C_w (UCF) DF \left[K_d + \frac{(\theta_w + \theta_a H_{cc})}{\rho_b} \right]$

UCF = Unit Conversion Factor (1mg/1,000 ug)

GQ 15.4.6
Should default Kd values for non-priority pollutant metals such as manganese be provided?

(394, 516)

Response:

[3] Carsel, R.F., R.S. Parrish, R.L. Jones, J.L. Hansen, and R.L. Lamb. (1998). Characterizing the uncertainty of pesticide leaching in agricultural soils. J. of Conatm. Hyd. 2:111-124.

One commentor noted that Ecology only provided default values for ten (10) metals (As, Cd, Cr, Cr+6,Cu, Hg, Ni, Pb, Se, Zn). A sentence was added to WAC 173-340-747(4)(c)(ii) to make it clear that a site-specific measurement could be used to derive Kd values for non-priority pollutant metals:

> For metals, the K_d values in Table 747-3 shall be used. For metals not listed in Table 747-3, K_d values may be developed as provided in subsection (5) of this section (variable three-phase partitioning model).

WAC 173-340-747(4)(c)(ii).

GQ 15.4.7
What are the sampling requirements for determining model input parameters? Areas with complex hydrology would require many more samples than areas with relatively homogeneous stratigraphy. Once data is collected, which statistic will be used (average, upper or upper bound)?

(401)

Response:
Ecology will provide information on sampling requirements in guidance.

GQ 15.4.8
What is an appropriate dilution factor (DF) for a smear zone resulting from a fluctuating water table?

(515)

Response:
Ecology will provide more information on dilution factor calculations for smear zones in guidance.

GQ 15.4.9
Why did Ecology select a default mixing zone thickness of 5 meters? Can other values be used?

(530)

Response:
Ecology's default mixing zone thickness of 5 meters is based on a ground water monitoring well screen length of 15 ft. Information from both EPA[4] and feedback from the Science Advisory Board fate / transport subcommittee was also considered. A deeper mixing zone thickness may be used if it can be demonstrated that it is appropriate, as described in the footnotes to Equation 747-4. The footnote provides the following:

[4] EPA Soil Screening Guidance: Technical Background Document. EPA/540/R-95/128 (May, 1996).

A = Aquifer mixing zone (m^2). The aquifer mixing zone thickness shall not exceed 5 meters in depth and be equal to a unit width of 1 meter, unless it can be demonstrated empirically that the mixing zone thickness exceeds 5 meters."

WAC 173-340-747(5)(f)(i), Equation 747-4.

GQ 15.4.10
Can direct measurement of ground water flow rate (Qa) be used to determine a dilution factor?

(2282)

Response:
An allowance for direct measurement of ground water flow rates (Qa term in Equation 747-4) was added to the rule language in WAC 173-340-747(5)(f)(i)(B):

> Direct measurement of the flow velocity of ground water using methods approved by the department may be used as a substitute for measuring the ground water hydraulic conductivity and gradient.

As for calculating NAPL migration rates, Ecology has not provided specific procedures in WAC 173-340-747(9) because a variety or combination of models, calculations and measurements could be used as part of an empirical demonstration. Ecology will provide more detailed information on empirical demonstrations in guidance.

GQ 15.4.11
Is Table 747-3 (metals Kd) going to be expanded to account for site-specific effects such as pH or soil type?

(655)

Response:
The impact of pH or soil type was considered when deriving[5] default metals Kd values (Table 747-3). Ecology will not be expanding this table to account for pH and soil type because a site-specific measurement of Kd is allowed in the regulation (see WAC 173-340-747(5)(b)).

GQ 15.4.12
Should Equation 747-4 be modified to account for background ground water concentrations?

(816)

Response:

[5] More information on how the default metals Kd values were derived is provided later in this chapter.

To address the commentor's concern, WAC 173-340-747(5)(f)(i)(A) has been revised to provide the following:

> Equation 747-4 assumes the ground water concentrations of hazardous substances of concern upgradient of the site are not detectable. If this assumption is not true, the dilution factor may need to be adjusted downward in proportion to the upgradient concentration.

GQ 15.4.13
Are the default infiltration rates of 70% and 30% reflective of site-specific conditions (i.e., surface caps / covers, vegetation and runoff rates) which may limit infiltration? Did Ecology adequately review information from the USGS on infiltration rates?

(979, 2059, 2096, 2097)

Response:
Ecology did review infiltration information from the USGS and this information was also peer-reviewed by Ecology's Science Advisory Board (SAB) fate / transport subcommittee. Ecology found that for eastern Washington, infiltration amounts were in many cases difficult to estimate because of the impact of irrigation. As for western Washington, Ecology's analysis found that actual infiltration amounts can be as high as 70%, yet, we do acknowledge that runoff and surface vegetation does influence infiltration. That's why use of the default or fixed infiltration percentages is optional, a site-specific measurement of infiltration (including runoff estimates) may also be used. As noted in the amendment, the presence of a surface cap / cover may also be considered when evaluating the protectiveness of a remedy:

> If a site-specific measurement or estimate of infiltration (Inf) is made, it shall be based on site conditions without surface caps (e.g., pavement) or other structures that would control or impede infiltration. The presence of a cover or cap may be considered when evaluating the protectiveness of a remedy under WAC 173-340-350 through 173-340-360. If a site-specific measurement or estimate of infiltration is made, then it must comply with WAC 173-340-702 (14), (15) and (16).

WAC 173-340-747(5)(f)(ii)(B).

GQ 15.4.14
Should Ecology's default distribution coefficient (Kd) values for both metals and organics be based on a the non-linear Freundlich model? Are the equilibrium linear model Kd's accurate? Should Ecology allow for the use of the non-linear Freundlich model when deriving soil cleanup standards?

(2093, 2094, 2099)

Response:

Incorporating the nonlinear isotherm (e.g., Langmuir, Freundlich, BET, Langmuir two surface, competitive Langmuir isotherms, etc.) into the mass balance equation (i.e. 3-phase model) to simulate hazardous substance fate and transport will make the computation more complex and time-consuming. A linear isotherm simplifies the mass balance equation in a fate and transport model, which makes it much easier to use.

For example, Ecology's analysis of the linear assumption found that when ground water contaminant concentration are less than 50% of solubility (which is the case for most ground water systems), a linear isotherm is generally valid (Karickoff, 1984[6]). The Freundlich isotherm is an empirical formulation that was used to describe gas adsorption on solid phase. The Freundlich isotherm has two important properties[7]. The first is that the Freundlich isotherm is a very flexible equation. Considering the flexibility of two parameters, the isotherm can fit a wide range of data. The second property is that the Freundlich isotherm does not have a maximum limit for the amount of substance sorbed. Thus, the Freundlich sorption isotherm suffers from the same fundamental uncertainty problem as the linear sorption isotherm. As a result, when Ecology weighed the uncertainty of the isotherm theory against computational simplicity, we opted for simplicity.

Lastly, the regulation includes an allowance for site-specific measurement or derivation of parameters such as Kd. This could include the use of the Freundlich equation described above.

GQ 15.4.15
Is the assumption of an infinite source for water-soluble components such as TCE reasonable?

(2095)

Response:
Conservative simplifying assumptions (i.e., infinite source) were used by Ecology because the 3 and 4-phase partitioning models will be used at a wide variety of sites and conditions. The rule also allows for site-specific modification of model input parameters.

Another point to consider is that substances such as TCE have for the most part been a tremendous problem for ground water, not soil. Although conservative, the infinite source assumption for chemicals such as TCE will be beneficial because for substances like TCE and PCE, it is clear that once they are released to soil, it nearly always results in large-scale ground water problems.

GQ 15.4.16
The revised MTCA standards and formulas used to set site cleanup levels should include both (but only) the mass adsorbed to soil and the mass present in a dissolved phase because that is the

[6] Karickhoff, S.W., (1984) "Organic Pollutant Sorption in Aquatic systems,: J. Hydraulic Engineering, 1106:707-735.

[7] Sims, et al., (1986), Contaminated surface Soils In-Place treatment Techniques, Noyes Publication.

total mass that will be reported by lab analysis. The lab-reported total number is the value that will subsequently be used for comparison with the MTCA criteria.

(2098)

Response:
The total soil concentration measured by the laboratory is in fact the summation of the mass of chemical present in adsorbed, dissolved and NAPL form. The soil cleanup levels computed by 3 and 4-phase models are based on the total soil concentration including mass of chemical present in adsorbed, dissolved, vapor or NAPL.

Ecology's partitioning models (3-phase or 4-phase) do quantify the amount of mass that is present in each of these phases and the resulting soil cleanup level is based upon this mass distribution. Consequently, Ecology does not believe there is a need to adjust soil cleanup levels based upon the total value reported by the laboratory.

GQ 15.4.17
When deriving Kd, must measures be taken to prevent biodegradation and volatilization for both adsorption and desorption batch tests under WAC 173-340-747(5)(b)(iii)?

(2463)

Response:
Yes. To address the concern raised by the commentor, the amendment was revised to provide the following:

> Samples that have hazardous substances present as a nonaqueous phase liquid (NAPL) shall not be used to derive a distribution coefficient and measures shall be taken to minimize biodegradation and volatilization during testing.

WAC 173-340-747(5)(b)(iii).

GQ 15.4.18
Are the metals Kd values provided in Table 747-3 conservative and can they be used on a statewide basis?

(2663)

Response:
Ecology has determined that the metals Kd values presented in Table 747-3 are scientifically defensible and representative of most site conditions. Detailed information on how these values were derived is provided later in this chapter.

GQ 15.4.19
How are default Kd values derived for organics? How may site-specific Kd values be derived?

(25, 26, 27, 141)

Response:
WAC 173-340-747(4)(c)(i) specifies the procedure for deriving default Kd values for organics.

WAC 173-340-747(5)(b) specifies the methods for deriving site-specific Kd values. Note that subsection (5)(b)(i) was derived to provide the following:

> Site-specific measurements of soil organic carbon may be used to derive distribution coefficients for nonionic hydrophobic organics using Equation 747-2.

GQ 15.4.20
For metals not listed in Table 747-3, how may the Kd values be developed?

(143)

Response:
To address this concern, WAC 173-340-747(4)(c)(ii) has been revised to provide the following:

> For metals, the K_d values in Table 747-3 shall be used. For metals not listed in Table 747-3, K_d values may be developed as provided in subsection (5) of this section (variable three-phase partitioning model).

GQ 15.4.21
The term "foc" has two meanings under MTCA: "fraction of organic carbon" and "frequency of contact." The rule language should be revised to make it clear what the term "foc" means.

(765, 2439)

Response:
The term "foc" was eliminated from the direct contact equations so that there would be no confusion about what this term meant. The term "foc" was changed to frequency of exposure (FOE).

GQ 15.4.22
What is the protocol for measuring site-specific biodegradation rates?

(1431)

Response:
Ecology will provide more information on how to estimate site-specific biodegradation rates through guidance.

GQ 15.4.23
The POG understands that the default values in Equation 747-4 may be changed by Ecology in consultation with the SAB, prior to the finalization of the rule amendments.

(146)

Response:
Ecology did make some adjustments to some of the default values used in Equation 747-6. See Table 747-4 in WAC 173-340-900.

GQ 15.4.24
Have the solubility and toxicity of TPH mixtures in Table 747-4 been correctly derived?

(147)

Response:
It is not clear if this comment is referring to the values in Table 747-4 or the Method A cleanup levels. Assuming the comment is directed at the Table 747-4 values, the following is Ecology's response:

The sources of the values in Table 747-4 are specified in the footnotes. In light of this comment, Ecology again checked the values in the August, 2000 draft rule. As a result of that review, some additional adjustments were made to the values in Table 747-4 in the final rule, primarily to correct rounding and other minor errors. None of the changes significantly alter the cleanup levels calculated for petroleum mixtures. The basis for these changes is documented in a December, 2000 memo by Pete Kmet that can be found in the rule-making file.

FOUR-PHASE EQUILIBRIUM PARTITIONING MODEL (WAC 173-340-747(6))

GQ 15.4.25
When should the four-phase equilibrium partitioning model be used instead of the three-phase model to derive protective soil concentrations?

(113, 114, 140, 293, 528, 2274, 2275, 2460)

Response:
The overview of the three-phase model in WAC 173-340-747(4)(a) and (5)(a) provides the following regarding the applicability of the three-phase model:

> The model may be used to establish soil concentrations for any hazardous substance.

However, note that the three-phase model accounts for partitioning of hazardous substances only between the water, air and solid phases of a soil. The model does not account for partitioning

between these phases and a nonaqueous phase liquid (NAPL) phase, a phase that commonly occurs when organic chemicals such as petroleum products are released to soils. Consequently, if the three-phase model is used at a site where NAPL is present in the soil, then the three-phase model will over-predict ground water concentrations, resulting in the derivation of an over-protective soil concentration.

The four-phase model accounts for partitioning between the same three phases and the nonaqueous liquid phase. To avoid over-predicting ground water concentrations and deriving over-protective soil concentrations, persons should use the four-phase model at any site where hazardous substances are present in the soil as a NAPL. This is reflected in the overview of the four-phase model in WAC 173-340-747(6)(a), which provides the following:

> This model may be used to derive soil concentrations for any site where hazardous substances are present in the soil as a nonaqueous phase liquid (NAPL).

Ecology will be releasing a computer spreadsheet model that automatically incorporates a 3 or 4-phase partitioning solution, depending on the concentration and composition of the hazardous substances present in the soil.

GQ 15.4.26
Can the four-phase model be used for mixtures (e.g., petroleum) containing chemicals with widely different solubilities be used in fate / transport models? Will this lead to serious errors?

(117, 2278)

Response:
The four-phase partitioning model may be used to predict ground water concentrations for equivalent carbon (EC) fractions and other petroleum components (e.g., BTEX) that have a wide range of solubilities. After conducting an exhaustive review, Ecology concluded that the four-phase partitioning model was the most reliable in terms of predicting ground water concentration for mixtures containing chemicals with widely different solubilities.

GQ 15.4.27
Would the specifications for the 4-phase partitioning model in WAC 173-340-747(6) be more appropriate as guidance?

(768, 1279, 2410)

Response:
No. Given the nature and complexity of the 4-phase model, Ecology believes it was very important to provide a baseline level of information in the regulation. Ecology does acknowledge that information on input parameters will change over time – that is why an allowance was made for site-specific measurements.

GQ 15.4.28
What does the term "NAPL component" mean in WAC 173-340-747(6)?

(113, 293, 2274)

Response:
The term "NAPL component" was replaced with the term "component" in the adopted rule. The term "component" is used to describe any hazardous substance that may be present in soil as a NAPL.

GQ 15.4.29
Under "Step 1" for using the four-phase model, should concentrations of NAPL components be obtained?

(2466)

Response:
Yes. To address the commentor's concern, WAC 173-340-747(6)(d)(i) has been revised to provide the following:

> Collect and analyze soil samples and, if appropriate, samples of the product released, for each component. For petroleum hydrocarbons, see Table 830-1 for a description of what to analyze for.

GQ 15.4.30
Regarding "Step 2" for using the four-phase model, should Ecology specify the density for each NAPL component?

(2467)

Response:
Density values for each NAPL component are provided in Table 747-4 in WAC 173-340-900. Information on how density values were derived is provided in footnote 6 of that table.

GQ 15.4.31
Regarding "Step 4" for using the four-phase model, how does the model predict a soil pore water concentration?

(2465, 2468)

Response:
One commentor expressed confusion regarding the description under "Step 4" in WAC 173-340-747(6)(d)(iv) for using the four-phase model.

To address the commentor's concern and improve the clarity of the instructions, WAC 173-340-747(6)(d)(iv) was revised to provide the following:

> These equations shall then be combined with Equations 747-6 and 747-8 and the condition that $\Sigma x_i .= 1$ and solved simultaneously for the unknowns in the equations (mole fraction of each component (X_i), volumetric NAPL content (θ_{NAPL}), and either the volumetric water content (θ_w) or the volumetric air content (θ_a)."

WAC 173-340-747(6)(d)(iv).

GQ 15.4.32
Regarding "Step 7" for using the four-phase model, how can the model be used to derive a protective soil concentration?

(524, 2469)

Response:
The four-phase partitioning model can be used to derive a protective soil concentration. See "Step 7" described in WAC 173-340-747(6)(d)(vii). The use of the model for this purpose is not required. Unlike the 3-phase model, the 4-phase model does not directly calculate a soil cleanup level. Rather, the 4-phase model predicts a ground water concentration, which is based upon a site-specific measurement of the soil TPH concentration.

Ecology will be releasing a computer spreadsheet that will be encoded with the 4-phase partitioning solution. This spreadsheet will allow users to calculate soil cleanup levels by using one of two methods:

- The first and simplest method is to simply select a "back-calculate soil cleanup level" button with the spreadsheet. The spreadsheet will then automatically back-calculate a soil cleanup level that is based upon one of two criteria: 1) a specified ground water cleanup level, or 2) a predicted ground water concentration with a Hazard Index = 1.

- The second method is an iterative process that is slightly more complicated. In this method, the user will manipulate the input soil concentration until it results in a predicted ground water concentration that meets target levels, i.e. Hazard Index = 1 or a specified ground water cleanup level. For example, assume that the measured concentration is 800 ppm and it results in a predicted ground water concentration that exceeds criteria. The user would then input lower soil concentrations (e.g., 700 ppm, 600 ppm, etc.) until it results in a predicted ground water concentration that meets criteria.

GQ 15.4.33
How would you demonstrate that the effects of cosolvency have been adequately accounted for if the 4-phase model is used for alcohol-enhanced fuels?

(525, 1280)

Response:
Ecology's preliminary assessment of this issue has found that the fuel would probably have to be enhanced with a high percentage of alcohol (i.e., 50% or more) for this to be an issue. Nevertheless, this particular language was added per SAB comment and Ecology will provide more detailed information on how to address this issue in guidance.

15.5 Leaching Tests (WAC 173-340-747(7))

GQ 15.5.1
Can both the TCLP and SPLP be used for TPH and can these tests be used as part of an empirical demonstration?

(75, 767, 2441, 2442)

Response:
WAC 173-340-747(7)(a) was revised to clarify that any method, including both the SPLP and TCLP tests, can be used as part of an empirical demonstration. Ecology's review of this issue found that both the TCLP and SPLP leach tests were, for a variety of reasons, not reliable in terms of predicting ground water impacts for petroleum components (**Figure 15-3**). Nevertheless, Ecology decided to allow the use of leach tests for TPH as part of an empirical demonstration provided it can be demonstrated that the leach test results accurately predict ground water impacts. Note that the requirements in WAC 173-340-747(7)(d) must also be met. Ecology will provide additional information on how to use leach tests for petroleum contaminated soil in guidance.

GQ 15.5.2
When may leaching tests other than those specified in WAC 173-340-747(7)(b) be used?

(123, 2284, 2470)

Response:
To clarify when leaching tests other than those specified in WAC 173-340-747(7)(b) may be used, the amendment has been revised to provide the following:

> Leaching tests using the methods specified in this subsection may also be used for hazardous substances other than the metals specifically identified in this subsection, including petroleum hydrocarbons. Alternative leaching test methods may also be used for any hazardous substance, including the metals specifically identified in this subsection. Use of the leaching tests specified in (b) and (c) of this subsection for other hazardous substances or in a manner not specified in (b) and (c) of this subsection, or use of alternative leaching tests for any hazardous substance, is subject to department approval and the user must demonstrate with site-specific field or laboratory data or other

> empirical data that the leaching test can accurately predict ground water impacts. The department will evaluate the appropriateness of these alternative methods under WAC 173-340-702 (14), (15) and (16).

WAC 173-340-747(7)(d).

GQ 15.5.3
How many samples are needed for a leach test? Is Ecology going to provide guidance on this?

(399)

Response:
Ecology will provide information in guidance on how many samples are needed for a leach test.

GQ 15.5.4
If the TCLP test is used, what detection limits should be used for arsenic and cadmium? Do they need to be equal to or less than Method B ground water cleanup levels?

(400, 2652)

Response:
The analytical method that is used in the TCLP test must be "sufficiently sensitive" to detect hazardous substances at Method B ground water cleanup levels. To address this issue, the amendment was revised to provide the following:

> When using either EPA Method 1312 or 1311, the analytical methods used for analysis of the leaching test effluent shall be sufficiently sensitive to quantify hazardous substances at concentrations at the ground water cleanup level established under WAC 173-340-720.

WAC 173-340-747(7)(c).

GQ 15.5.5
What do the terms "significant biological degradation" and "low pH" mean?

(518, 519, 520)

Response:
WAC 173-340-747(7)(b)(i) and (ii) have been revised to clarify that "low pH" or "acidic conditions" are defined as pH < 6 and that "alkaline conditions" are defined as pH > 8.

To clarify the use of the phrase "significant biological degradation," an example has been provided in WAC 173-340-747(7)(b)(i):

> Underestimation of ground water impacts may occur, for example, when soils contaminated with metals are located in wood waste, in municipal solid waste landfills, in high sulfur content mining wastes, or in other situations with a pH <6.

WAC 173-340-747(7)(b)(i).

GQ 15.5.6
Is the use of the TCLP and SPLP leaching tests specified in WAC 173-340-747(7)(b) appropriate at MTCA cleanup sites? Weren't these tests designed for landfills?

(521, 655, 1149)

Response:
As part of the rule development process, Ecology evaluated available leaching test protocols for use in predicting ground water impacts of contaminated soil. The SPLP and TCLP methods were selected because there are readily available published protocols for these leaching tests and because information correlating resulting leach test concentrations with actual pore water and leachate collection system concentrations was available. The methods specified are limited to a few selected metals because these were the only substances with sufficient information for which this correlation could be made. Ecology intends to continue to review the literature for available information and expand the list of substances these tests can be used for when sufficient information can be found to correlate leaching test results with field data.

Two commentors (Allen and K. Johnson) expressed concern that applying these leaching test methods in this manner is inappropriate because these methods were developed for evaluating disposal options for waste materials, not contaminated soils. A focus of these concerns was on the TCLP test method. Ecology acknowledges that both the SPLP and TCLP leaching tests have their origins in solid waste disposal. We also acknowledge that both methods subject samples to considerable more agitation than soil would likely experience in the field, and that the low pH, highly buffered leaching fluid used in the TCLP test method is relatively aggressive to some metals compared to infiltrating precipitation. However, both test methods also use a rather large amount of fluid for a small soil sample (diluting the test results), and the sample preparation and agitation methods introduce considerable oxygen into the test fluid, both conditions that could result in under-prediction of ground water impacts. On balance, these various factors appear to offset each other, as illustrated by the comparison between predicted metals concentrations and pore water and leachate concentrations in information provided to the MTCA Science Advisory Board.

With regard to the TCLP test, this method is included because it is a very common test method, often used to determine if a waste or soil material at a site is suitable for disposal at a sanitary landfill or requires special management at a hazardous waste site. As such, it makes sense to allow the use of this test as serving the dual purpose of screening soils for potential ground water impacts. In addition, metals contamination is mixed with other biodegradable contaminants such as wood waste or petroleum residues, conditions similar to those envisioned being simulated by the TCLP test method.

GQ 15.5.7
Should leaching test concentrations for specified metals under WAC 173-340-747(7)(c) be less than or equal to … the applicable ground water cleanup levels under WAC 173-340-720?

(522)

Response:
Yes. The amendment was revised accordingly to provide the following:

> For cadmium, lead and zinc, the leaching test effluent concentration shall be less than **or equal to** ten (10) times the applicable ground water cleanup level established under WAC 173-340-720.

WAC 173-340-747(7)(c)(i) (emphasis added).

> For arsenic, total chromium, hexavalent chromium, copper, mercury, nickel and selenium, the leaching test effluent concentration shall be less than **or equal to** the applicable ground water cleanup level established under WAC 173-340-720.

WAC 173-340-747(7)(c)(ii) (emphasis added).

GQ 15.5.8
Does Ecology intend to establish methods that are pre-approved by the department?

(523, 532)

Response:
Ecology will provide appropriate guidance.

GQ 15.5.9
Has sufficient data been compiled to justify use of the SPLP and TCLP leaching tests specified in WAC 173-340-747(7)(b) in the manner specified?

(819)

Response:
In developing the leaching test provisions, Ecology compiled information from field and laboratory studies with both leaching test concentrations and actual pore water and leachate collection system concentrations. The MTCA Science Advisory Board expressed concern about the limited amount of data used as the basis for predicting ground water impacts using leaching tests. Ecology believes sufficient data has been compiled to justify use of these tests in this manner. We also believe that use of leaching tests in the manner provided for will be protective of the environment because the screening criteria were developed without taking into account the potential for mixing with ground water beneath the site.

However, we acknowledge that additional data would be helpful. Because of this, WAC 173-340-747(11) allows Ecology to require ground water monitoring on a case-by-case basis. We expect that at sites where the use of leaching tests result in large volumes of soil contamination being left in place or in areas where there are nearby wells or other potential sensitive receptors, confirmational ground water monitoring will be required until greater experience has been accumulated.

Please see previous response in this section for additional information.

GQ 15.5.10
Can leaching tests be used to screen soils for the potential to cause ground water impacts?

(1094)

Response:
The intent of specifying leaching tests is to provide a quick and relatively inexpensive method of screening soils for their potential to cause ground water impacts. If tests complying with WAC 173-340-747(7) show that the soils do not pose potential to contaminate the ground water, then this pathway may be eliminated as a pathway of concern when establishing soil cleanup levels. Other pathways such as direct contact or terrestrial ecological could then be used to determine the appropriate soil cleanup level.

15.6 Alternative Fate and Transport Models (WAC 173-340-747(8))

GQ 15.6.1
What type of alternative fate and transport models may be used under WAC 173-340-747(8)? May alternative fate and transport models be used in combination with models that describe pore-scale chemical behavior (e.g., the phase partitioning aspects of the 3-phase and 4-phase models)?

(288, 289, 817, 2461, 2471)

Response:
WAC 173-340-747(8) specifies the procedures and requirements for establishing soil concentrations through the use of fate and transport models other than those specified in subsections (4) through (6) of this section. These alternative models may be used to establish a soil concentration for any hazardous substance. Site-specific data are required for use of these models.

As provided in WAC 173-340-747(8)(b), when using alternative models, chemical partitioning and advective flow may be coupled with other processes to predict contaminant fate and transport, provided the certain conditions are met. These conditions are specified in WAC 173-340-747(8)(b)(i) through (vii).

Note that any proposed fate and transport model, input parameter, or assumption must comply with WAC 173-340-702 (14), (15) and (16). WAC 173-340-747(8)(c).

GQ 15.6.2
What are the quality of information requirements for evaluating alternative models?

(288, 289)

Response:
WAC 173-340-747(8)(c) provides the following:

> Proposed fate and transport models, input parameters, and assumptions shall comply with WAC 173-340-702 (14), (15) and (16).

15.7 Empirical Demonstrations (WAC 173-340-747(9))

GQ 15.7.1
The following comments were received on empirical demonstrations (747(9)):

- Direct measurement of ground water flow rates should be allowed as part of an empirical demonstration.

- Please clarify that empirical demonstrations may be used where approved by Ecology on a site-specific basis and that Ecology's decision shall be based on the quality of information requirements under 702.

- An empirical demonstration does not predict, it measures.

- Please make it clear that requirements have been met if you demonstrate that steady-state conditions have been achieved.

- Please clarify that the empirical demonstration must show that measured soil concentrations will not result in the accumulation of NAPL in or on the ground water.

- "The soil concentration is less than or equal to the soil value predicted by the empirical demonstration"….this sentence should be clarified to more clearly state how Ecology expects empirical demonstrations to be performed.

- The statement: "must demonstrate with empirical data that the leaching test results correlate with actual groundwater impacts" is confusing. I believe that it could be interpreted in more than one way. This needs further clarification.

- For empirical demonstrations, can the travel time for NAPL migration from soil to ground water be calculated using a Darcy Flow law?

(121, 290, 291, 292, 295, 534, 769, 2185, 2470)

Response:
Based upon the comments received, Ecology made several revisions to WAC 173-340-747(9). Ecology will provide more detailed information on how to make an empirical demonstration in guidance. The proposed regulation does allow for the use of empirical demonstrations on a site-specific basis and it also stipulates that Ecology's decision shall be based on the quality of information requirements under WAC 173-340-702 (14), (15) and (16).

With respect to the issue of demonstrating that no NAPL exists on ground water, the amendment was revised to provide the following:

> The measured soil concentration will not cause an exceedance of the applicable ground water cleanup level established under WAC 173-340-720 at any time in the future.

WAC 173-340-747(9)(b)(i).

With respect to the issue of demonstrating steady-state conditions, Ecology revised the amendment to provide the following:

> Specifically, it must be demonstrated that a sufficient amount of time has elapsed for migration of hazardous substances from soil into ground water to occur and that the characteristics of the site (e.g., depth to ground water and infiltration) are representative of future site conditions.

WAC 173-340-747(9)(b)(ii).

15.8 Residual Saturation (WAC 173-340-747(10))

GQ 15.8.1
The following comments were received on residual saturation:

- Is the subsection on residual saturation applicable to all NAPL forming chemicals?

(115, 124, 932, 2276, 2285)

- The Table 747-2 footnote needs to be changed to indicate what assumptions were made in deriving the residual saturation screening levels. Conservative or default residual saturation values for other soil types (e.g. sand, silt or clay) also need to be specified.

(122, 294, 517, 980, 1417, 2060, 2186, 2283)

- Is Ecology going to specify a standard test method for measuring residual saturation? Information on how to use residual saturation as part of an empirical demonstration is also needed.

(533, 818, 1432, 1433)

- What is residual saturation? This section needs to be clarified.

(770, 1281, 2411)

- Ecology should consider requiring the modeling or empirical demonstration performed in these sections to also verify that no non-aqueous phase liquid ("NAPL") will reach the ground water instead of tying the results from these sections to the residual saturation concentrations specified in 173-340-747 (5).

(1062, 1416)

- The logic and criteria in 747(10)(e) appears to be flawed. Please check this.

(2004)

- Editorial. Seems like residual saturation should include the term NAPL within the description/definition. This clause is only relevant to contaminants occurring as a separate oil phase.

(2462)

Response:
Residual saturation is the soil concentration at which NAPL becomes discontinuous and is immobilized by capillary forces. The magnitude of residual saturation is affected by several factors including pore-size distribution, wetting properties of the fluids and soil solids, interfacial tension, hydraulic gradients, ratios of fluid viscosities and densities, gravity, buoyancy forces, and flow rates, etc. The equation recommended by ATA (see comment #1417) to compute residual saturation is actually a formula for converting percent NAPL saturation given into the soil concentration in terms of mass concentration (mg/kg). Ecology does not believe that this is an acceptable method for calculating residual saturation values.

Ecology's default residual saturation values were obtained from a study published in the scientific literature (Mercer and Cohen, 1993; **Table 15-14**). The residual saturation values published in Mercer and Cohen (1993) are a compilation of laboratory measurements of residual saturation; however, Ecology's analysis of residual saturation found that in most cases, laboratory measurements will exceed what can be actually measured in the field. Consequently,

Ecology believes that the default residual saturation values needed to be set at more conservative levels because of the differences in field and laboratory measurements.

For example, in their study of a gasoline fuel spill, Ostendorf et al. (1991)[8] found that their field measurements of residual saturation were substantially less than those produced in the laboratory by Hoag and Marley (1986)[9]. It is Ecology's belief that the discrepancy between field and laboratory measurements of residual saturation is likely to be an artifact of preferential flow paths. Specifically, in the field, the residual fuel will always take the path of least resistance; however, in the laboratory, the soil is artificially controlled and flow paths that are present in the field may not be present in the laboratory.

Another important point about residual saturation is that partitioning (not residual saturation) will in many cases be the limiting factor in terms of soil cleanup levels. This is especially true for gasoline, i.e. once gasoline is released to the soil, soluble (and volatile) components such as benzene will immediately start to partition from the gasoline into the soil pore water **(Table 15-15)**.

Consequently, it is Ecology's opinion that the residual saturation level for gasoline will in most cases result in ground water concentration that far exceed acceptable criteria (i.e. Hazard Index = 1). Thus, it is Ecology's belief that residual saturation evaluations will in all likelihood be most useful for fuels that are less soluble in water (e.g. diesel or heavy fuel oil No. 6).

Unfortunately, there are currently no standard test methods for measuring residual saturation. Ecology will provide guidance or more information on this subject at a later date. Ecology will also provide guidance on how to use residual saturation when making an empirical demonstration.

Ecology has revised the rule language to make it clear that there are two options for residual saturation:

- Use the default (table value), or
- Site-specific measurement.

The second option (site-specific measurement) can also be used as part of an empirical demonstration.

---

[8] Ostendorf, D.W., Leach, L.E., Hinlein, E.S. and Xie, Y. (1991). Field Sampling of Residual Aviation Gasoline in Sandy Soil. Ground Water Monitoring and Remediation, Spring, pp. 107-120.

[9] Hoag, G.E., and Marley, M.C. (1986). Gasoline Residual Saturation in Unsaturated Uniform Aquifer Materials. Journal of Environmental Engineering, Vol. 112, No. 3, pp. 586-604.

Lastly, the language in 747(10)(e) was revised per comment (2004). A footnote was also added to the residual saturation table values to make it clear that these values are for gravelly soils only.

15.9 Background Information on the Three- and Four-Phase Partitioning Models

Three-Phase Partitioning Model

The term "3-phase" refers to how this model partitions chemical mass among three phases: soil pore air, soil (sorbed) and soil pore water. What follows is a brief synopsis of how Ecology derived this model.

As described in the first part of this chapter, a fundamental and predominant transport mechanism for the soil leaching to ground water is dictated by a chemical's partitioning phenomena in the soil environment. Chemical partitioning can be determined using a mass balance relationship using basic chemical and soil properties. The partitioning of solutes between phases depends mainly upon the relative affinity of a solute for the water (solvent) and soil solid (sorbent). This affinity of a chemical could be described as Kd (distribution coefficient).

Ecology's review of the scientific literature found is that for most hydrophobic[10] organics, Kd could in most cases be accurately predicted by multiplying the soil fraction of organic carbon content (foc) by the chemicals soil organic-carbon water partitioning coefficient (Koc), i.e. Kd = Koc*foc.

For metals, Ecology's review of the scientific literature found that the partitioning theory was more complicated because factors other than organic carbon control metals desorption, i.e. pH, redox potential, soil iron oxide content, soil texture, moisture content, etc. are the limiting factors. Nevertheless, Ecology's review found that with respect to Kd, there was a pH-dependent relationship for most cationic metals. For example, lead and cadmium are much more soluble at low pH (< 5).

Ecology's review of the scientific literature for metals also found that most of the priority-pollutant metals (As, Cd, total Cr, Cr^{+6}, Hg, Pb) were fairly predictable in terms of how they would partition or what factors control partitioning. For example, hexavalent (+6) chromium will nearly always be reduced back to the (+3) state and most of what will be present in the soil is in the (+3) state; copper and mercury are heavily influenced by the amount of soil organic carbon; lead and cadmium are heavily influenced by pH and arsenic is redox sensitive.

Once Ecology had completed a review of the scientific literature, meetings were held with the Science Advisory Board (SAB) fate / transport subcommittee. This process resulted in the

[10] The term "hydrophobic" in this case is used with respect to the Kd=Koc*foc relationship for hydrophobic chemicals.

approval of the 3-phase partitioning model and the simplifying assumptions (i.e., infinite source, equilibrium linear partitioning, etc.) that were used in the model.

Although the same equation is published elsewhere in the scientific literature, Ecology used Equation 22, p. 36 (metals) and Equation 24, p. 37 (organics) from EPA's 1996 Soil Screening Guidance[11] as the source of the 3-phase partitioning model. Information on how each 3-phase partitioning model input parameter was derived is provided below.

Four-Phase Partitioning Model

One of the simplifying assumptions that went into the 3-phase model is that non-aqueous phase liquids or "NAPL" are not present at the site. Early on, Ecology knew this was a significant issue because a large percentage of the petroleum sites have NAPL present in both the soil and ground water. Consequently, Ecology felt it was imperative that a model be derived for use at sites where NAPL is present in either soil or water.

Non-aqueous phase liquids or "NAPL" are the hydrocarbons that exist as a separate, immiscible phase when in contact with water and/or air. Differences in the physical and chemical properties of water and NAPL result in the formation of a physical interface between the liquids, which prevents the two fluids from mixing. When a soil sample is sent to the lab for analysis, the mass present in each of the four phases (soil, air, water and NAPL) is not quantified; all that is reported is a total soil concentration.

To address this issue, Ecology began a review of the scientific literature on how petroleum hydrocarbons partition from oil into water. What Ecology found is that when gasoline or diesel was mixed with water, dissolved concentrations could be accurately predicted using Raoult's law, i.e. multiplying the mole fraction of the each constituent in its oil phase by its water solubility (Cline et al., 1991 [12]; Lee et al., 1991[13]). Raoult's Law describes the behavior of solutes in an ideal two-phase mixture at equilibrium. At equilibrium, the chemical potential of each solute is uniform among all phases. Thus, by using Raoult's Law and assuming ideal behavior, it is possible to predict individual dissolved-phase concentrations present in the hydrocarbon-contaminated soil pore water.

Once the review of the scientific literature was completed, Ecology met with the Science Advisory Board (SAB) about the Raoult's law partitioning model. This resulted in the development of Ecology's "Interim-TPH" Policy (1997)[14], that was based on Raoult's law.

---

[11] EPA Soil Screening Guidance: Technical Background Document. EPA/540/R-95/128 (May, 1996).

[12] Cline, P.V., J.J. Delfino, and P.S.C. Rao 1991. Partitioning of Aromatic Constituents into Water from Gasoline, and Other Complex Solvent Mixtures. *Environ Sci. Technol*. 25, 914-920.

[13] Lee, L.S., M. Hagwall, J.J. Delfino, and P.S.C. Rao, 1992. Partitioning of Polycyclic Aromatic Hydrocarbons from diesel Fuel into Water. *Environ Sci. Technol*. 26, 2104-2110.

[14] Ecology Publication No. ECY97-600

Raoult's Law assumes that the mole fractions of the components in the NAPL phase are the same as those of the total soil sample; however, Raoult's Law does not account for the differences between the mole fractions in the total soil sample and those in the NAPL phase. As demonstrated by Cline *et al.* (1991) and Lee *et al.* (1992), the Raoult's Law approach for gasoline and diesel fuels is normally acceptable for most field-scale applications with high concentrations of hydrocarbons (Figure 15-4).

Because of the problems with Raoult's law at lower-range soil concentrations, Ecology decided to replace the Interim-TPH Policy (Raoult's law) model with the 4-phase partitioning model. Ecology's 4-phase partitioning model is based upon the work of both Mariner (1997)[15] and Mott (1995)[16]. Thus, Ecology's 4-phase model is merely an extended version of the 3-phase model when NAPL is present; i.e. the same basic partitioning theories that are used in the 3-phase model apply to 4-phase model well.

In 1998, Park and San Juan incorporated the 4-phase partitioning solution into a computer spreadsheet. The work by Park and San Juan (2000)[17] expands on previous work of Mott and Mariner. The 4-phase partitioning model solution has been incorporated into a computer spreadsheet (MS Excel™). This 4-phase model may be used to derive site-specific soil cleanup levels that are protective of ground water. The model uses site-specific measurements of petroleum-contaminated soil and simple soil assay information that may be easily derived at any cleanup site.

In summary, Ecology believes that the 4-phase model is the best available tool for sites with NAPL because it can be used to accurately predict ground water concentrations.

Basis for Adopting the Three- and Four-Phase Partitioning Models
Ecology adopted the 3 and 4-phase partitioning model for several reasons:

The 3-phase partitioning model theory is widely accepted by the academic community, the regulatory community and industry (e.g., Ecology SAB, ASTM Standard E1599-94, National Total Petroleum Hydrocarbon Criteria Working Group, US EPA, etc.).

---

[15] Mariner, P.E., J. Minquan, and R.E. Jackson. 1997. An Algorithm for the Estimation of NAPL Saturation and Composition from Typical Soil Chemical Analyses. *Ground Water Monitoring and Remediation.* 17, 122-129.

[16] Mott, H.V. 1995. A Model for Determination of the Phase Distribution of Petroleum Hydrocarbons at Release sites. *Ground Water Monitoring and Remediation.* 15, 157-167.

[17] Park, H.S. and San Juan, C. (2000). A Method for Assessing Leaching Potential for Petroleum Hydrocarbons Release Sites: Multiphase and Multisubstance Equilibrium Partitioning. Soil and Sediment Contamination, v. 9, Issue 6, p. 611-632.

The 4-phase partitioning model is a valid and scientifically defensible approach for sites with NAPL. The 4-phase model is merely an extended version of 3-phase model where NAPL is present - the same fundamental partitioning theory is used in both the 3 and 4-phase models.

With a limited amount of site information, both models may be used to produce scientifically defensible and reliable results without requiring excessive computation, which is cost effective.

Lastly, both models are easy to use and Ecology will be providing both of these models to the public via Internet download.

15.10 Background Information on the Default Input Parameters for the Partitioning Models

A "weight of evidence" approach was used to derive default values for each model input parameter. Specifically, information from three sources was used: the scientific literature, site data and best professional judgement. There are twelve (12)-input parameters that are used in both the 3 and 4-phase partitioning models:

- Soil volumetric water content,
- Soil volumetric air content,
- Soil porosity,
- Soil bulk density,
- Soil organic carbon,
- Soil organic carbon-water partitioning coefficient (Koc),
- Distribution coefficient (Kd),
- Aqueous solubility,
- Molecular weight,
- NAPL density,
- Henry's law constant,
- Dilution factor

A brief synopsis on how Ecology arrived at fixed (default) values for all twelve (12)-input parameters is provided below.

Soil Volumetric Water Content (θ_w)

The default value of 0.3 ml/ml was derived using information from both EPA (1996) and Baes and Sharp (1983) **(Table 15-13)**.

Soil Air Content (θ_a)

The default value of 0.13 ml/ml was derived as follows:

Soil porosity (0.43) – volumetric water content (0.3 ml/ml) = 0.13 ml/ml.

Information from both EPA (1996) and Baes and Sharp (1983) was also considered **(Table 15-13)**.

Soil Porosity (n)

The default value of 0.43 was derived as follows:

Soil porosity = 1 – [soil bulk density (1.5 kg/L) / soil particle density (2.65 kg/L)] = 0.43.

Information from both EPA (1996) and Baes and Sharp (1983) was also considered **(Table 15-13)**.

Dry Soil Bulk Density

The default value of 1.5 kg/L was calculated on a dry-weight basis. A dry[18] soil bulk density is the weighted-average of three-phases (i.e. air, NAPL, and soil):

Dry soil bulk density = (Air) $\theta_a * \rho_a$ + (NAPL) $\theta_{NAPL} * \rho_{NAPL}$ + (Solid) $\theta_s * \rho_s$ =

= 0.0013kg/l*0.13 + 0 +2.65kg/l*0.57 = **1.5 kg/l**

Information from both EPA (1996) and Baes and Sharp (1983) was also considered **(Table 15-13)**.

Soil Organic Carbon Content (f_{oc})

Ecology did propose to the Science Advisory Board (SAB) that the default fraction of organic carbon (foc) value of 0.2% proposed by EPA in their 1996 Soil Screening Guidance be used as the default. Upon review however, the SAB advised Ecology that EPA's proposed soil foc value of 0.2 % was too high for the following reasons:

- Weight of evidence: EPA's default soil foc of 0.2% is based on only one study (Carsel, 1988)[19]. Conversely, Ecology collected data from multiple sources. Consequently, Ecology decided that it was better to use a weight of evidence approach to derive a default soil foc value.

- Site data: all of the site data collected and reviewed by Ecology clearly indicated that soil foc levels decline with depth. In most cases, the mean or median values for any given data set

[18] The volumetric water content was excluded from this calculation because this is a "dry" soil bulk density, i.e. the soil is dried prior to calculating density.

[19] Carsel, R.F., R.S. Parrish, R.L. Jones, J.L. Hansen, and R.L. Lamb. (1988). Characterizing the uncertainty of pesticide leaching in agricultural soils. *J. of Contam. Hyd. 2:111-124.*

were actually closer to 0.1% and not 0.2% **(Figure 15-7; Figure 15-8; Figure 15-9; Figure 15-10)**.

- Partitioning theory: reports in the scientific literature [20] [21] also indicated that at soil foc values below 0.1%, adsorption (or sorption) to mineral surfaces were likely to be more prevalent.

- Dr. Richelle Allen-King, chair of Ecology's fate / transport subcommittee, has done extensive research on organic carbon in various aquifer solids. It was the consensus of the fate / transport subcommittee that a soil foc value of 0.1% (not 0.2%) is more typical of many aquifer soils at depth or below the root zone.

Given the SAB's advice and the weight of evidence, Ecology decided to use a default soil fraction of organic carbon value of 0.1%[22].

Soil Organic Carbon-Water Partitioning Coefficient (K_{oc})

Default values for hydrophobic (nonionic) organics are based on the geometric mean of the Koc values published in EPA's 1996 "Soil Screening Guidance: Technical Background Document" (EPA/540/R-95/128). For ionizing organics (e.g. pentachlorophenol), Ecology added a separate table of Koc values (Chapter 173-340-747 (4)(B) and Table 747-2).

For the petroleum hydrocarbon equivalent carbon (EC) fractions, Ecology used the Koc values published by the Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG)[23].

Distribution Coefficient (K_d) – Organics

For organic hazardous substances, Ecology used the following relationship to derive default Kd values:

Equation 1: Kd = Koc x foc

Where:

Koc = Soil organic carbon-water partitioning coefficient (ml/g, see (c)(i) of this subsection)

foc = Soil fraction of organic carbon (0.1% or 0.001 g/g)

---

[20] Schwarzenbach, R.P., and Westall, J. (1981). Transport of Organic Compounds from Surface Water to Ground Water. Laboratory Sorption Studies. Env. Sci. Tech. Vol 15, No.11., 1360-1367.

[21] Piwoni, M.D.and P. Banerjee (1989). Sorption of volatile organic solvents from aqueous solution onto subsurface solids. J. Contam. Hyrdrol. 4(2):163-179.

[22] Soil foc units = g organic carbon per g soil; 0.1% = 0.001 g organic carbon per g soil.

[23] Gustafson, J.B., J. G.Tell, and D. Orem 1997. Selection of Representative TPH Fractions based on Fate and Transport Considerations, TPH National Criteria Working Group, Volume 3, Amherst Scientific Publisher.

Ecology's analysis of this relationship found that Equation 1 can be used to accurately predict Kd for most nonionic organics **(Figure 15-11; Figure 15-12)**.

Distribution Coefficient (K_d) – Metals

Ecology used a "weight of evidence" approach to derive Kd values for metals. Information from EPA's MINTEQ geochemical speciation model was reviewed as well as studies on metals partitioning from the scientific literature.

A brief synopsis on how each Kd value was derived is as follows:

- Cadmium: Ecology used the mean Kd value (6.7 ml/g) from a study published in the scientific literature **(Figure 15-15; Table 15-6)**.

- Copper: Ecology used the Kd value (22 ml/g) from a study published in the scientific literature **(Figure 15-19; Table 15-9)**.

- Hexavalent chromium: Ecology used the Kd value (19 ml/g) predicted by the MINTEQ model @ pH 6.8 **(Figure 15-18; Table 15-8).**

- Total Chromium: Ecology used information from both EPA (MINTEQ model @ pH = 6.8) and Frontier Hard Chrome site data to derive a Kd value of 1,000 ml/g for total chromium **(Figure 15-16; Figure 15-17)**.

- Lead: Ecology used the Kd value (10,000 ml/g) predicted by the EPA CMTP model **(Figure 15-21; Table 15-11)**.

- Mercury (+2): Ecology used the Kd value (52 ml/g) predicted by the MINTEQ model @ pH 6.8 **(Figure 15-20; Table 15-10)**

- Nickel: Ecology used the Kd value (65 ml/g) predicted by the MINTEQ model @ pH = 6.8.

- Selenium: Ecology used the Kd value (5 ml/g) predicted by the MINTEQ model @ pH = 6.8.

- Zinc: Ecology used the Kd value (62 ml/g) predicted by the MINTEQ model @ pH = 6.8 **(Figure 15-22; Table 15-12)**.

Aqueous Solubility

For the petroleum hydrocarbon equivalent carbon (EC) fractions, Ecology used the aqueous solubility values published by the Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG, 1997). For other hazardous substances, solubility values were derived from EPA (1996).

Molecular Weight

For the petroleum hydrocarbon equivalent carbon (EC) fractions, Ecology used the molecular weight values published by the Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG, 1997).

Equivalent Carbon (EC) Fraction Density

For aliphatic and aromatic groups, the density values published by the Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG, 1997) were used. For TPH components except n-hexane and MTBE, EPA's Soil Screening Guidance (1996) was used.

Henry's Law Constant (H_{cc})

Dimensionless[24] values from Table 36 (p. 134) of EPA's 1996 "Soil Screening Guidance: Technical Background Document" (EPA/540/R-95/128) were used.

For the petroleum hydrocarbon equivalent carbon (EC) fractions, Ecology used the Henry's constant values published by the Total Petroleum Hydrocarbon Criteria Working Ground (TPHCWG, 1997).

Dilution Factor (DF)

The default value of twenty (20) was obtained from Table 7 (p. 53) of EPA's 1996 "Soil Screening Guidance: Technical Background Document" (EPA/540/R-95/128). The default value of 20 is based on a 0.5-acre source area and represents the geometric mean of 300 sites modeled.

[24] A conversion factor of 41 was used to derive dimensionless values (atm-m3/mol x 41 = dimensionless H').

15.11 Figures

Figure 15-1: Impact of Using the 100 Times Ground Water Model.

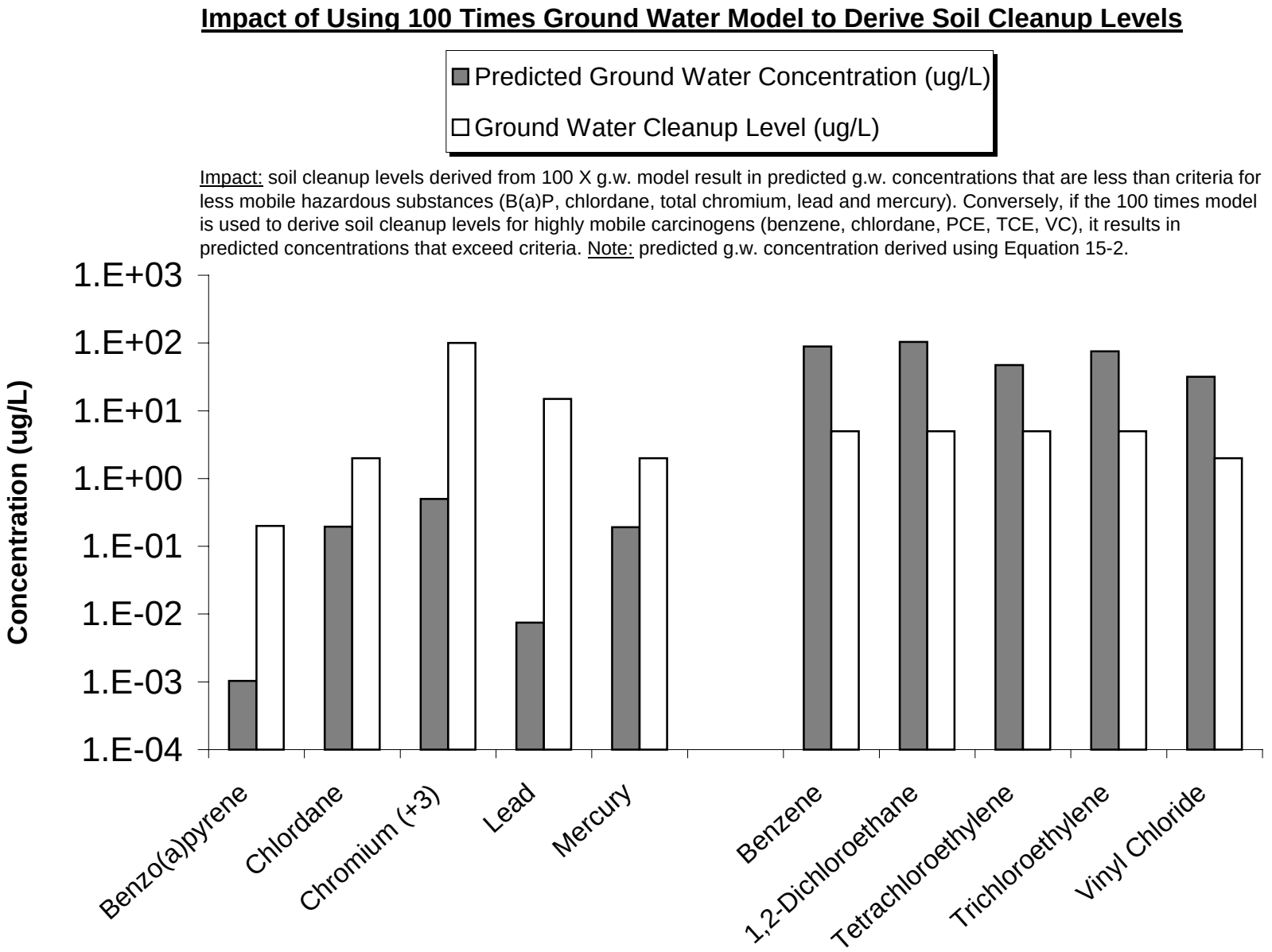


Figure 15-2: Impact of 100 Times Ground Water Model on Risk.

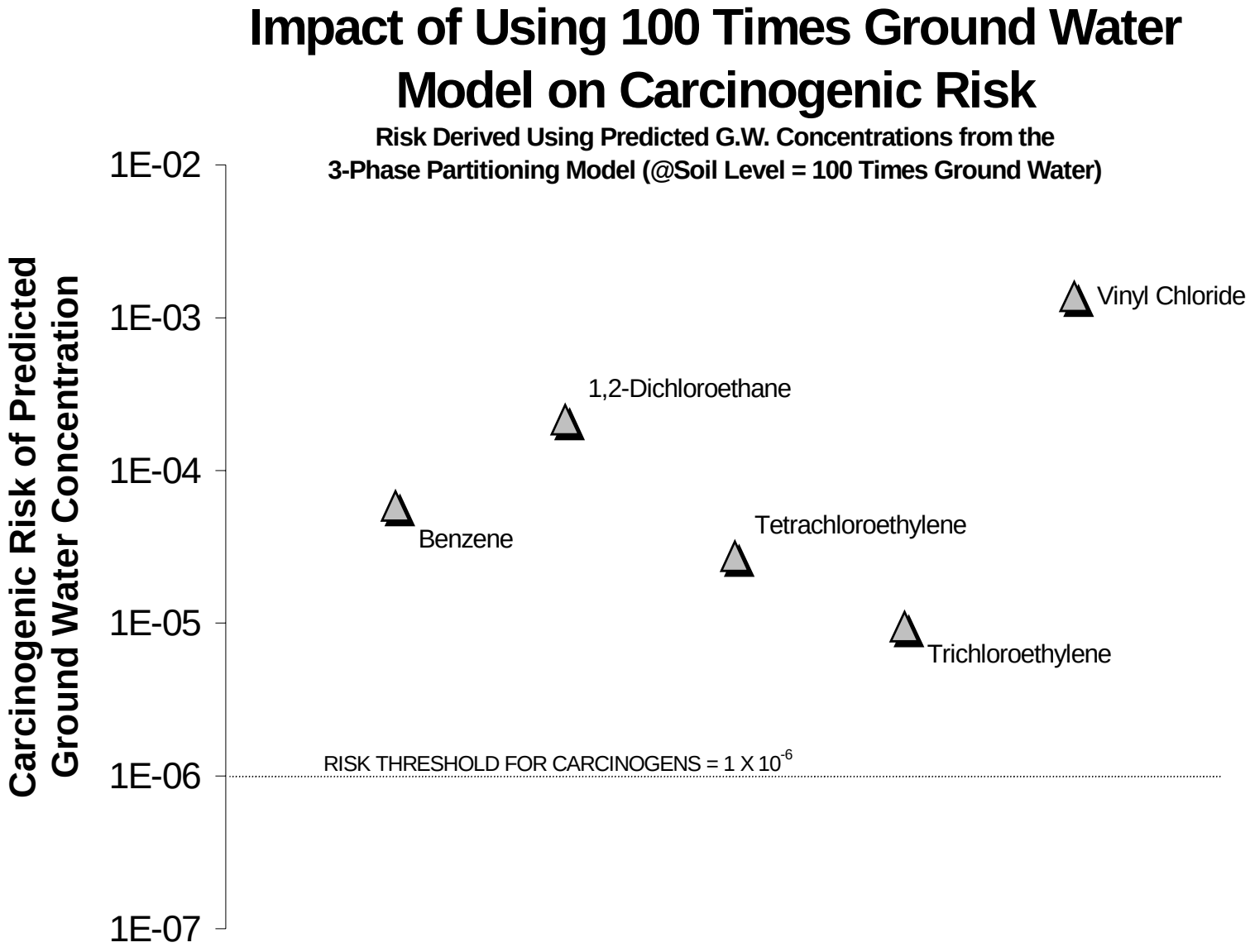


Figure 15-3: TCLP and SPLP Leach Test Results.

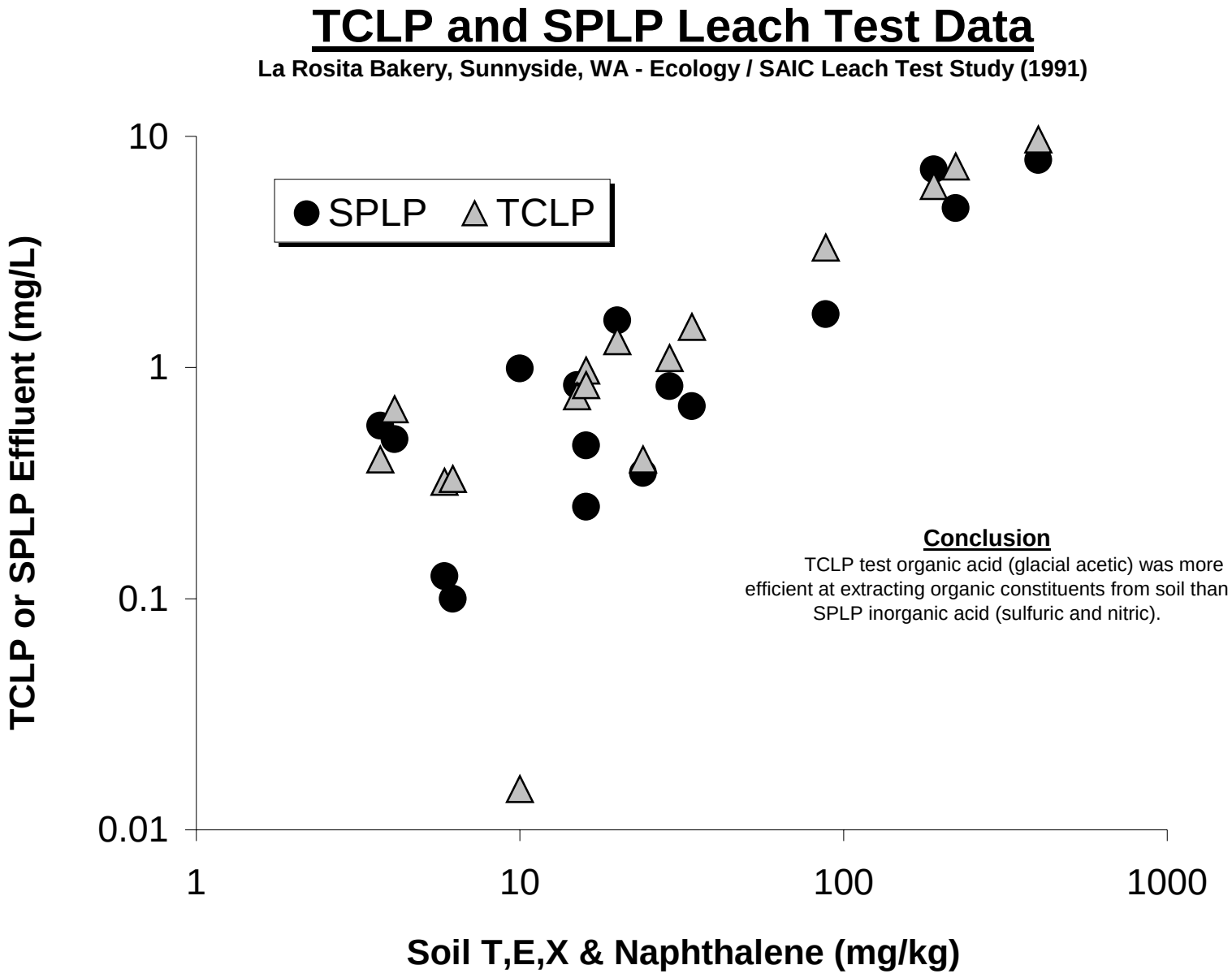


Figure 15-4: 3-Phase vs. 4-Phase Model Predicted Ground Water Concentrations.

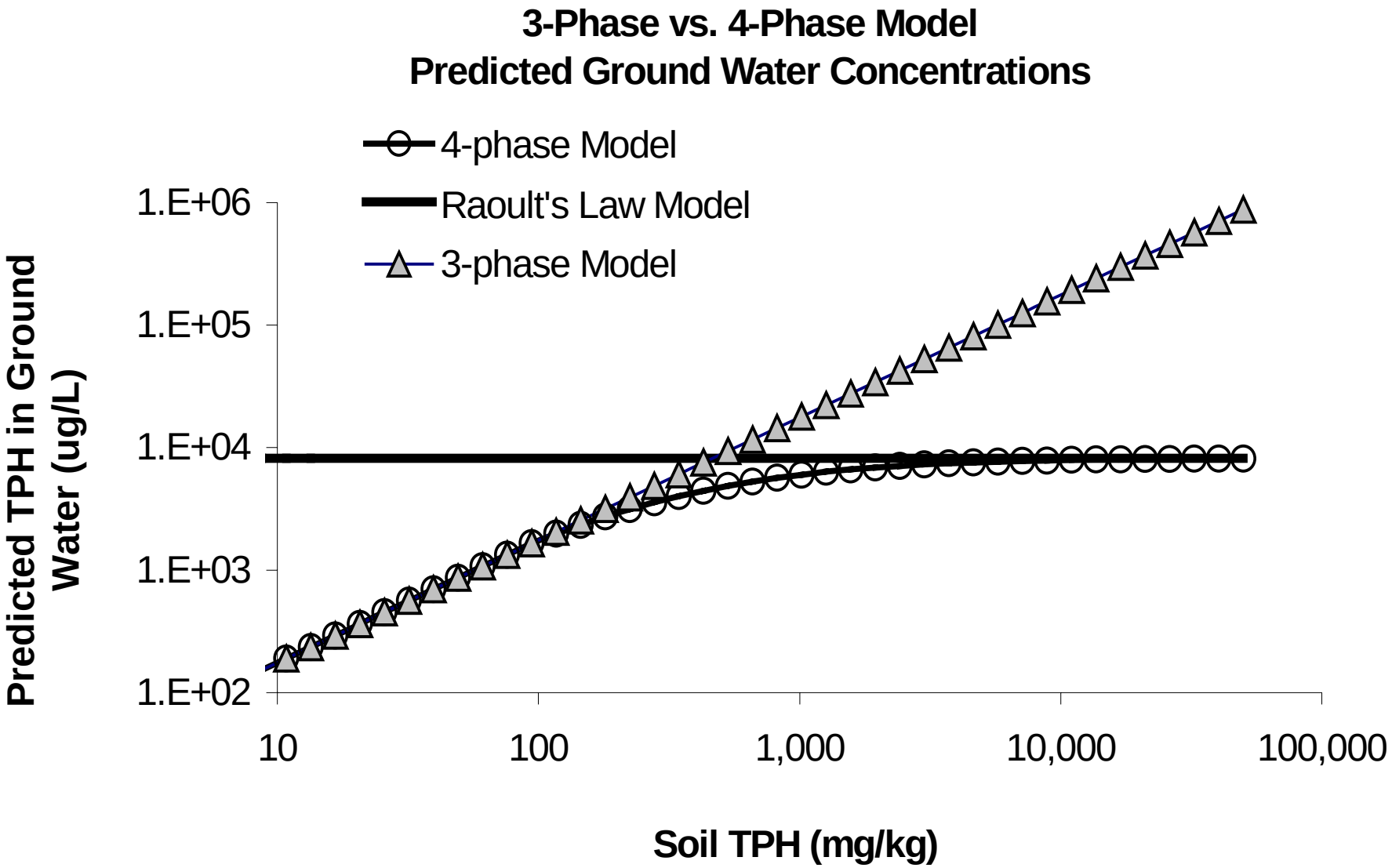
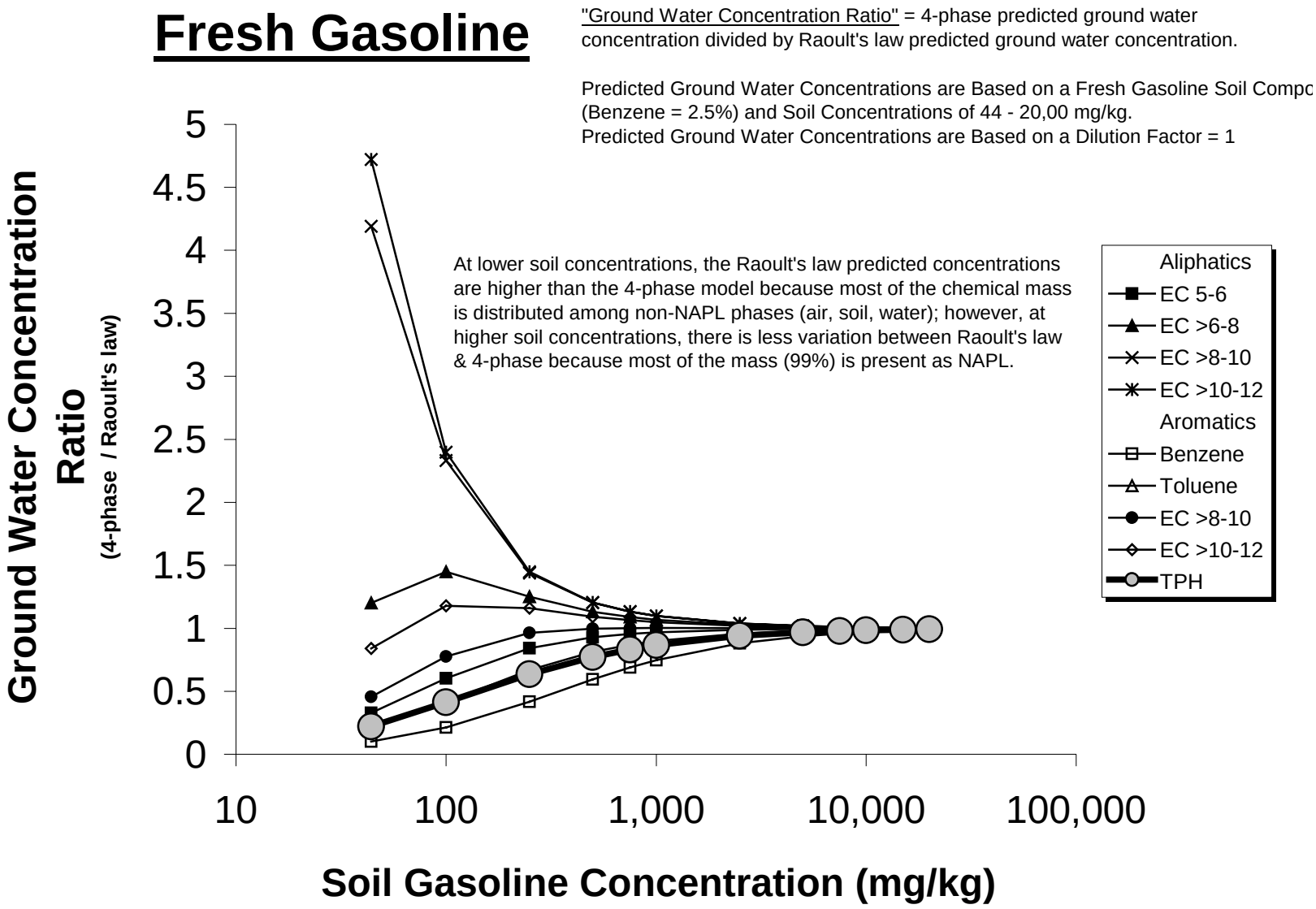


Figure 15-5: Fresh Gasoline Partitioning.



Source: R.M. King and Roberts (1998).

Figure 15-6: Raoult's Law vs. 4-Phase Model Predicted Ground Water Concentrations.

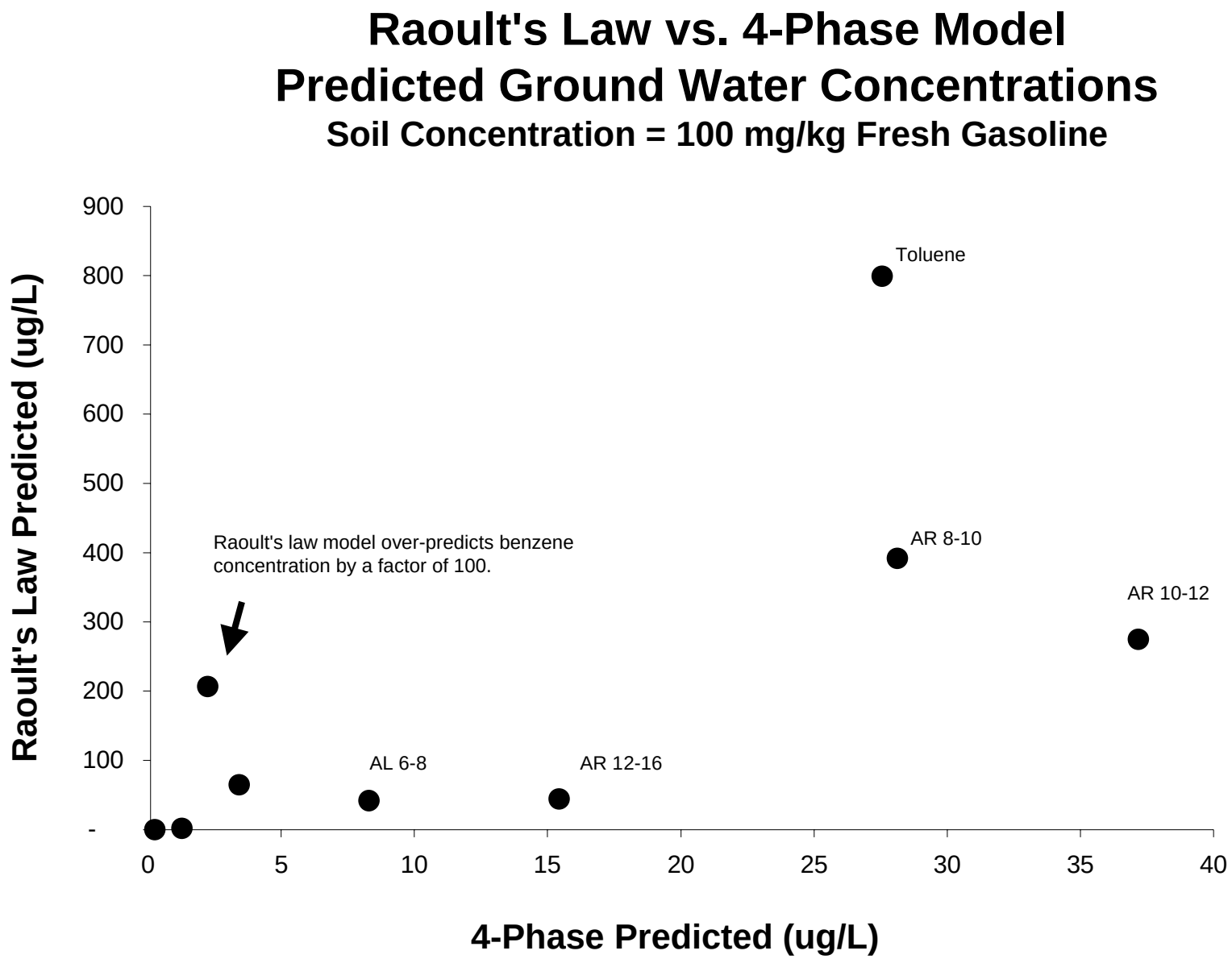


Figure 15-7: Yakima Railroad Soil Fraction of Organic Carbon (foc).

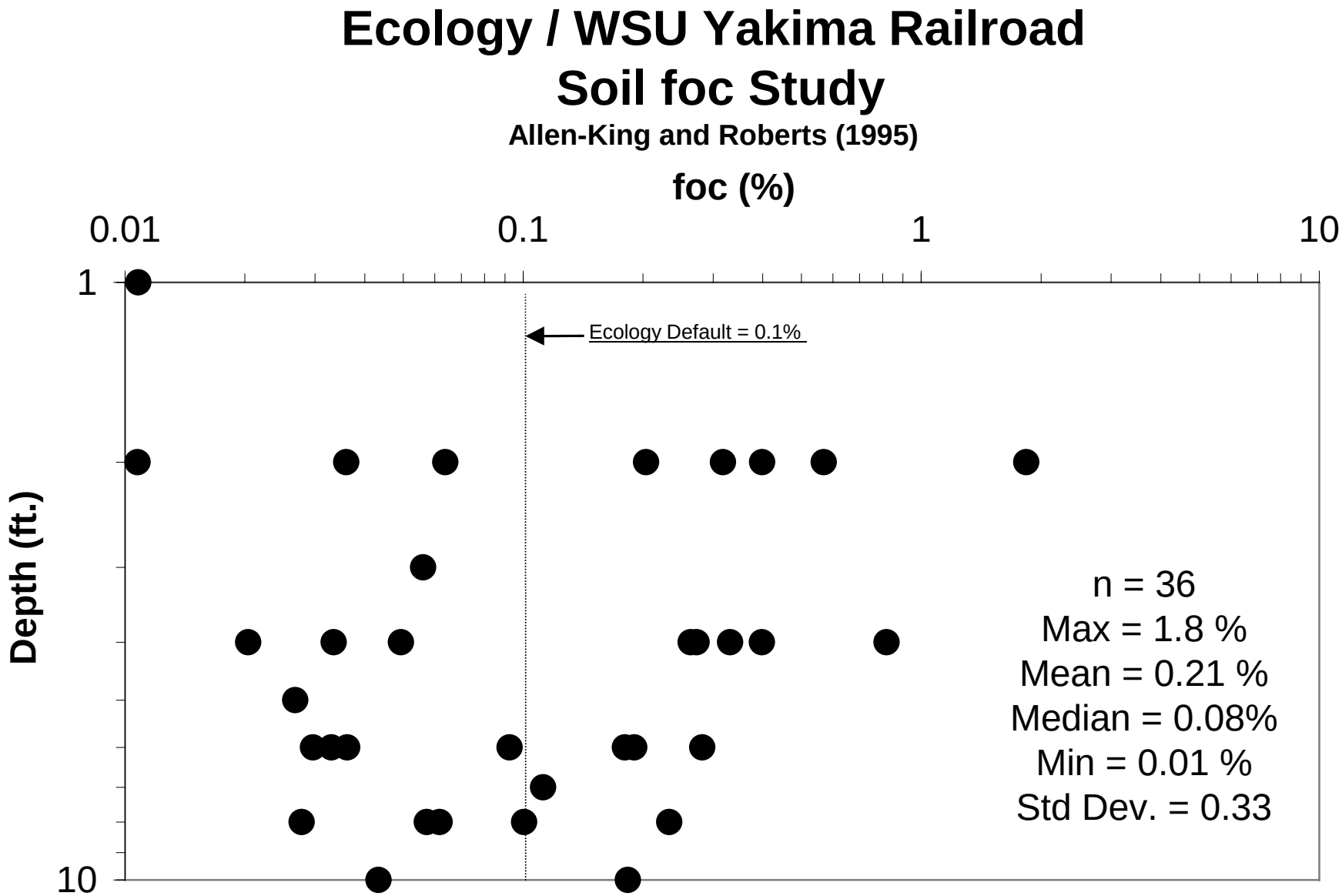


Figure 15-8: Hanford Fraction of Organic Carbon (foc).

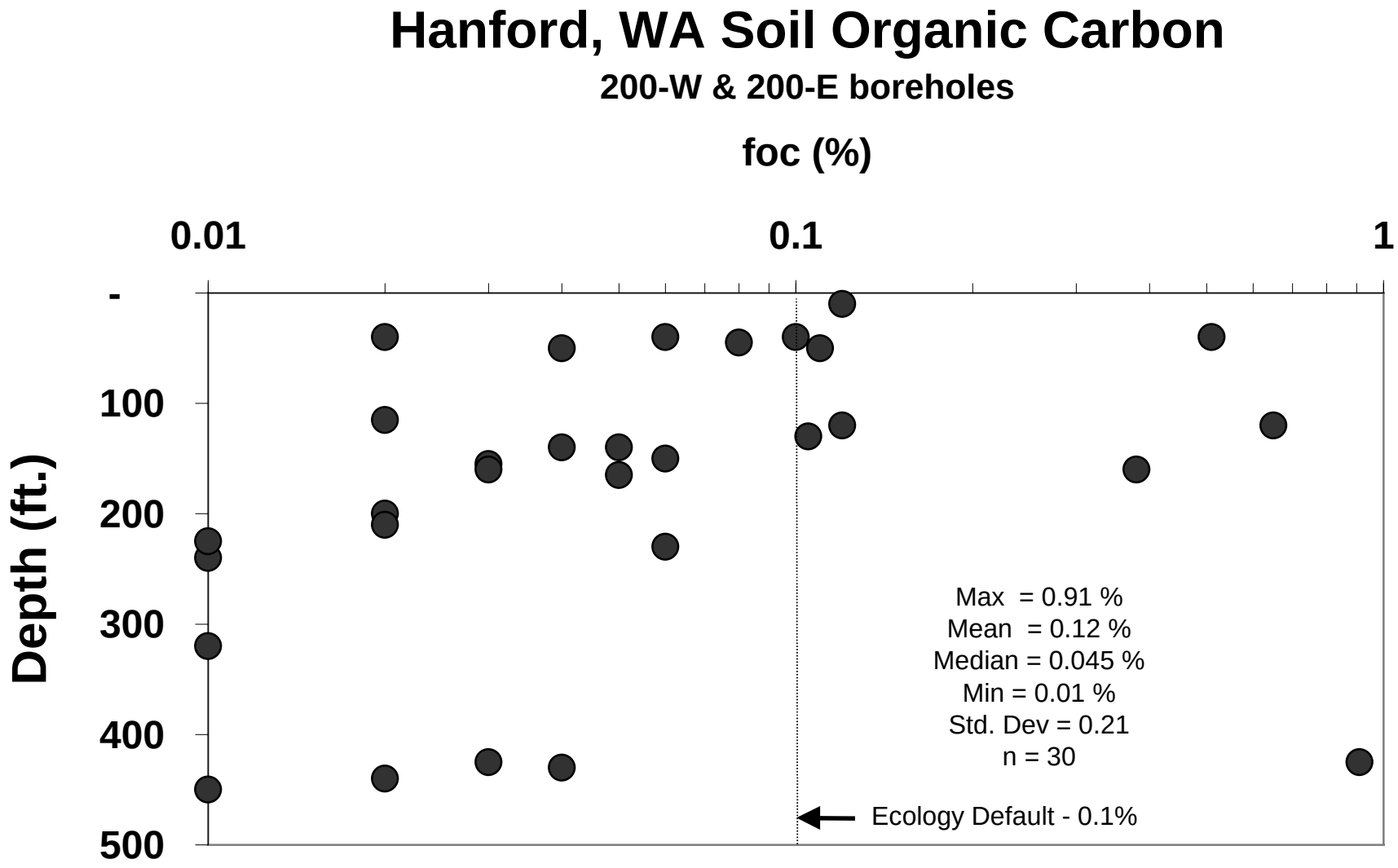


Figure 15-9: Port of Pasco Soil Fraction of Organic Carbon (foc).

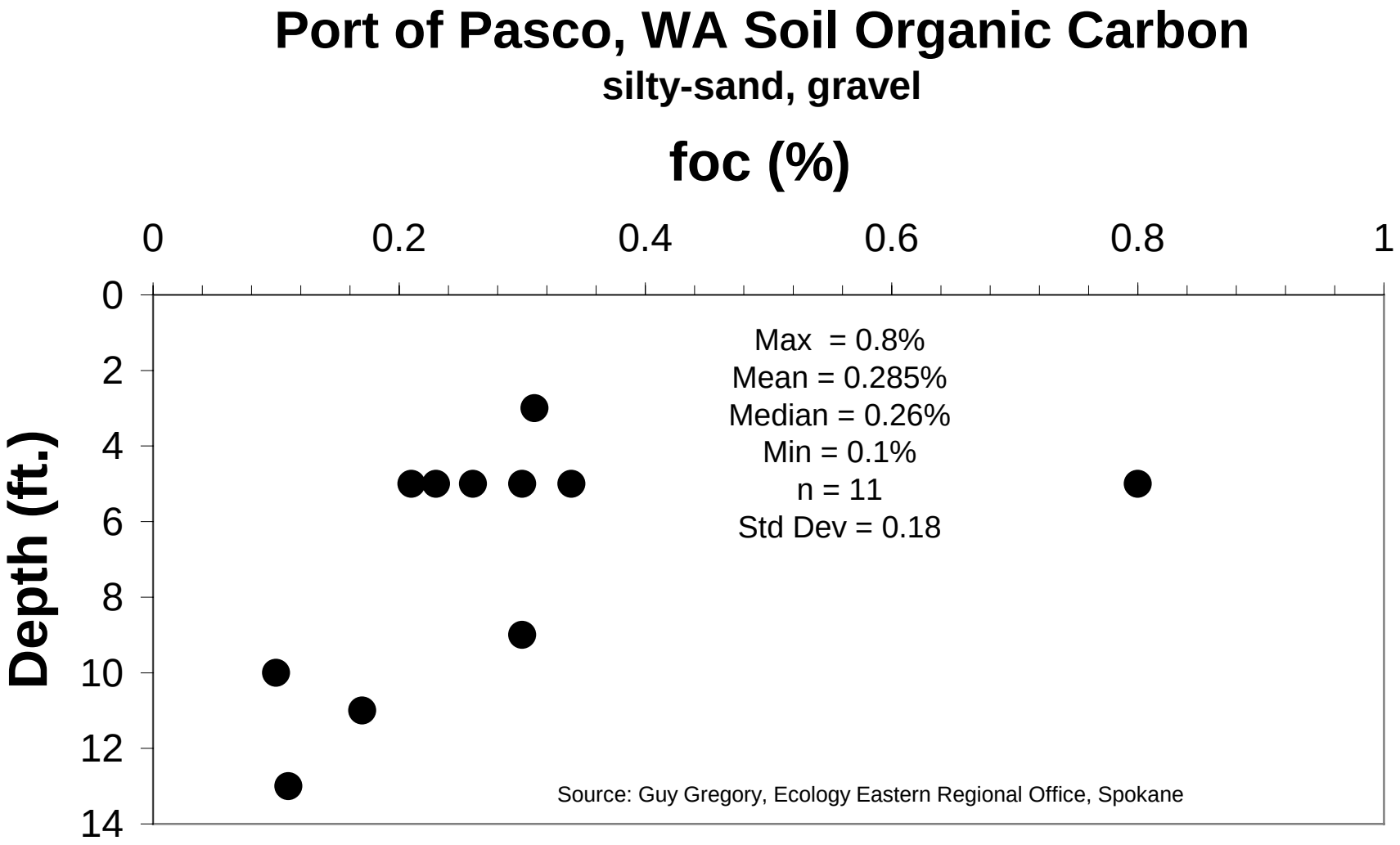


Figure 15-10: Borden Aquifer Soil Fraction of Organic Carbon.

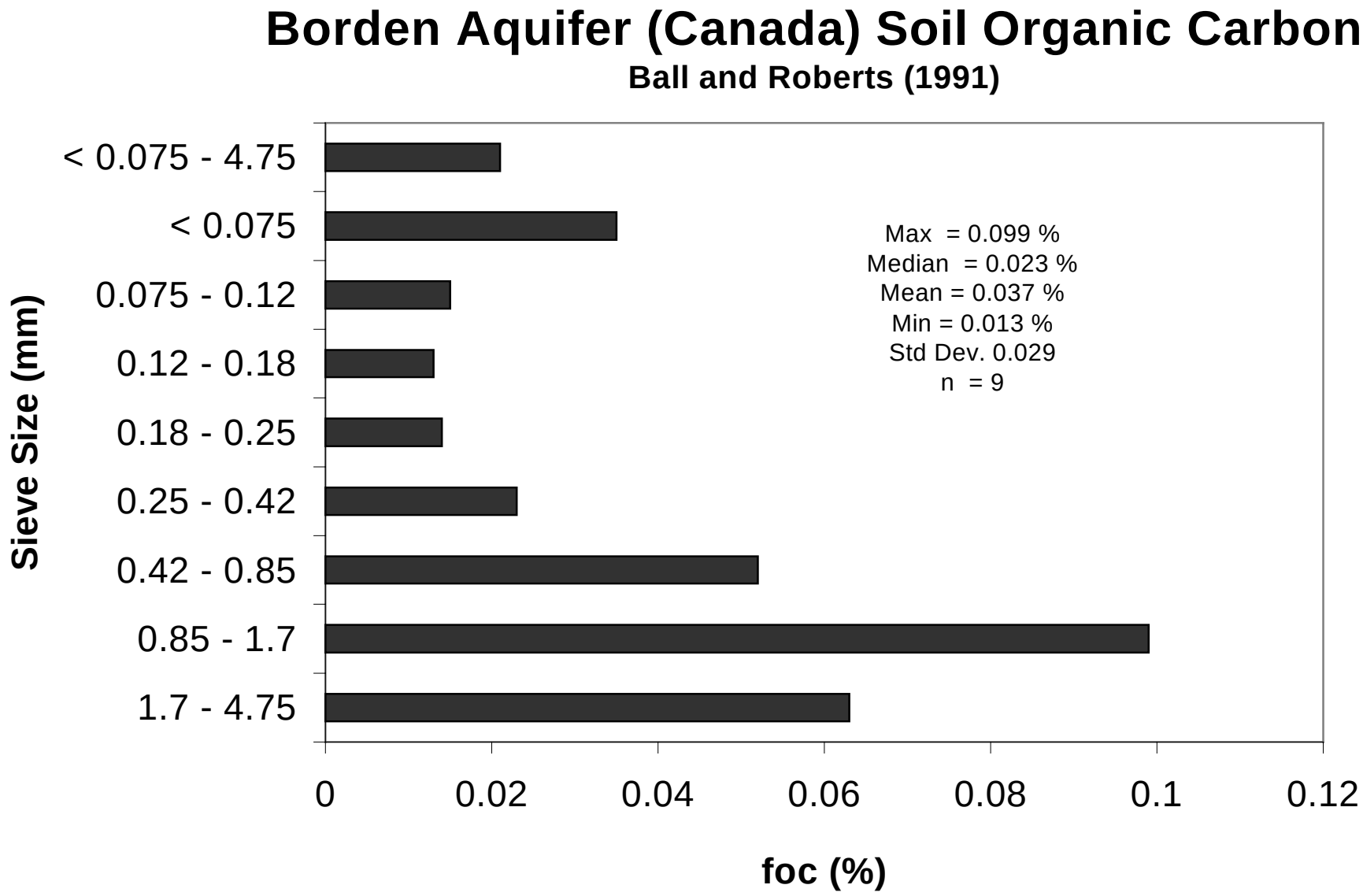


Figure 15-11: TCE Kd.

Ecology Default TCE Kd =0.158 ml/g.

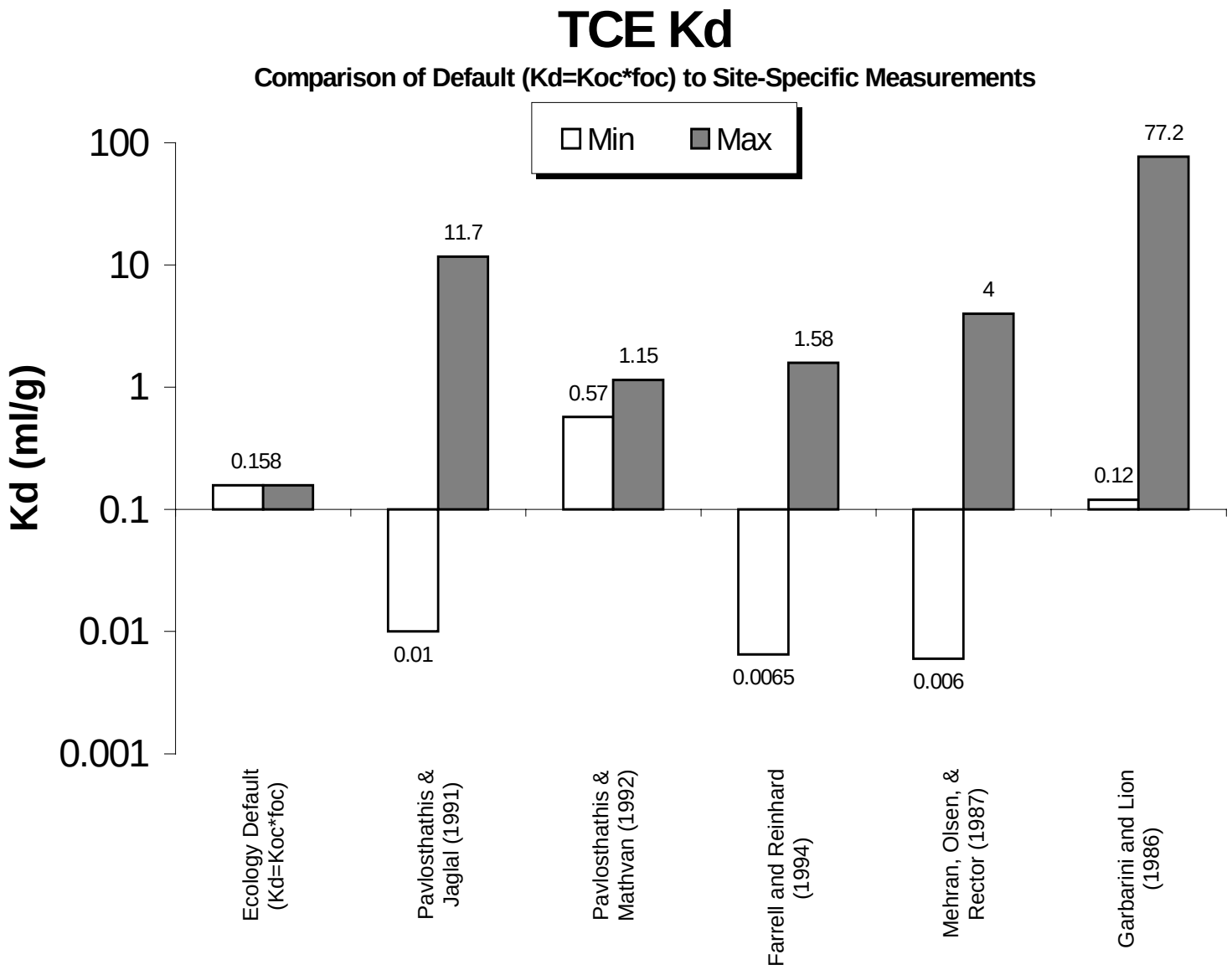
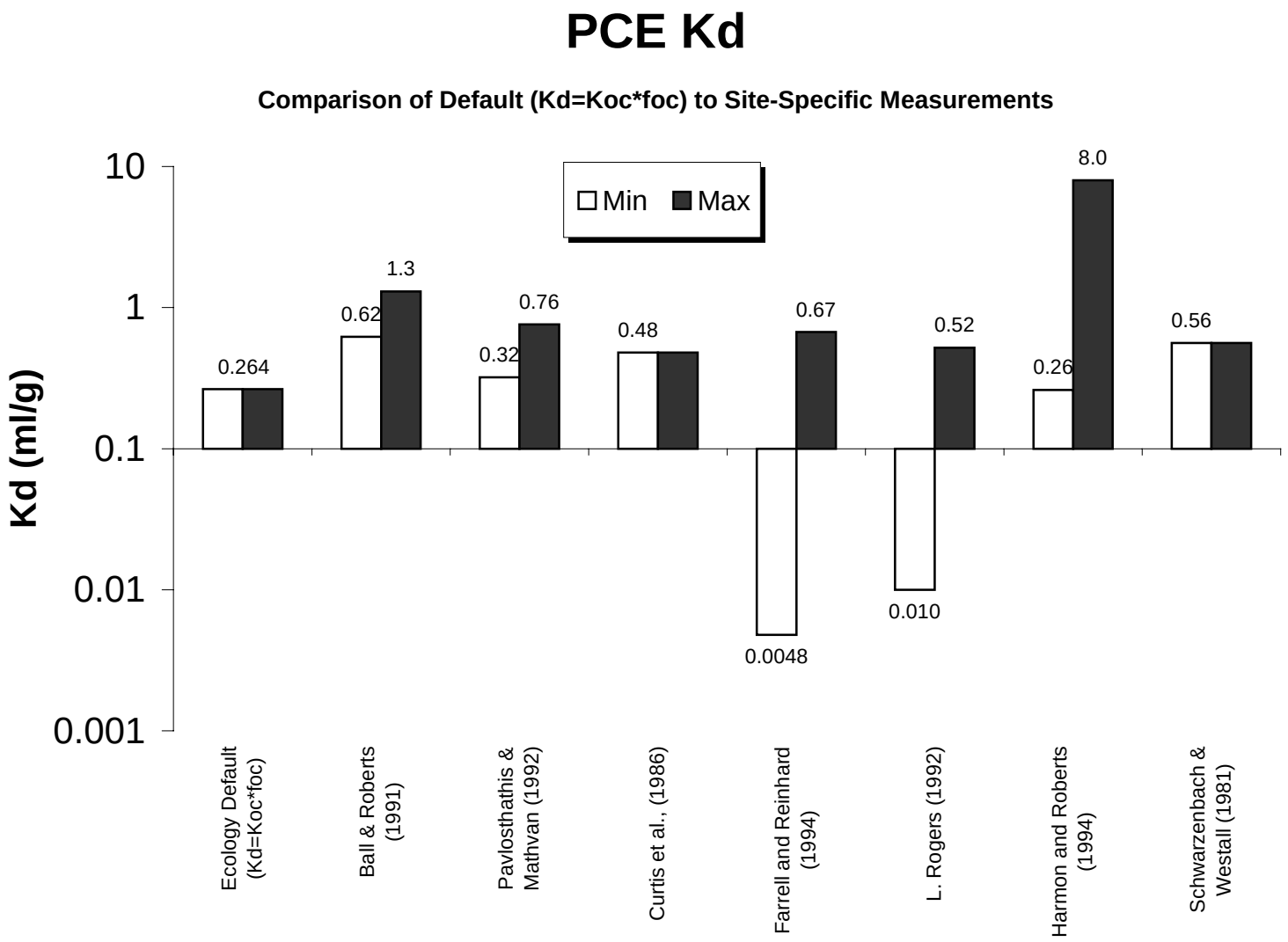


Figure 15-12: PCE Kd.



Ecology Default Kd = PCE Koc (264 ml/g) * foc (0.1%) = 0.264 ml/g

Figure 15-13: Arsenic (+3) Kd.

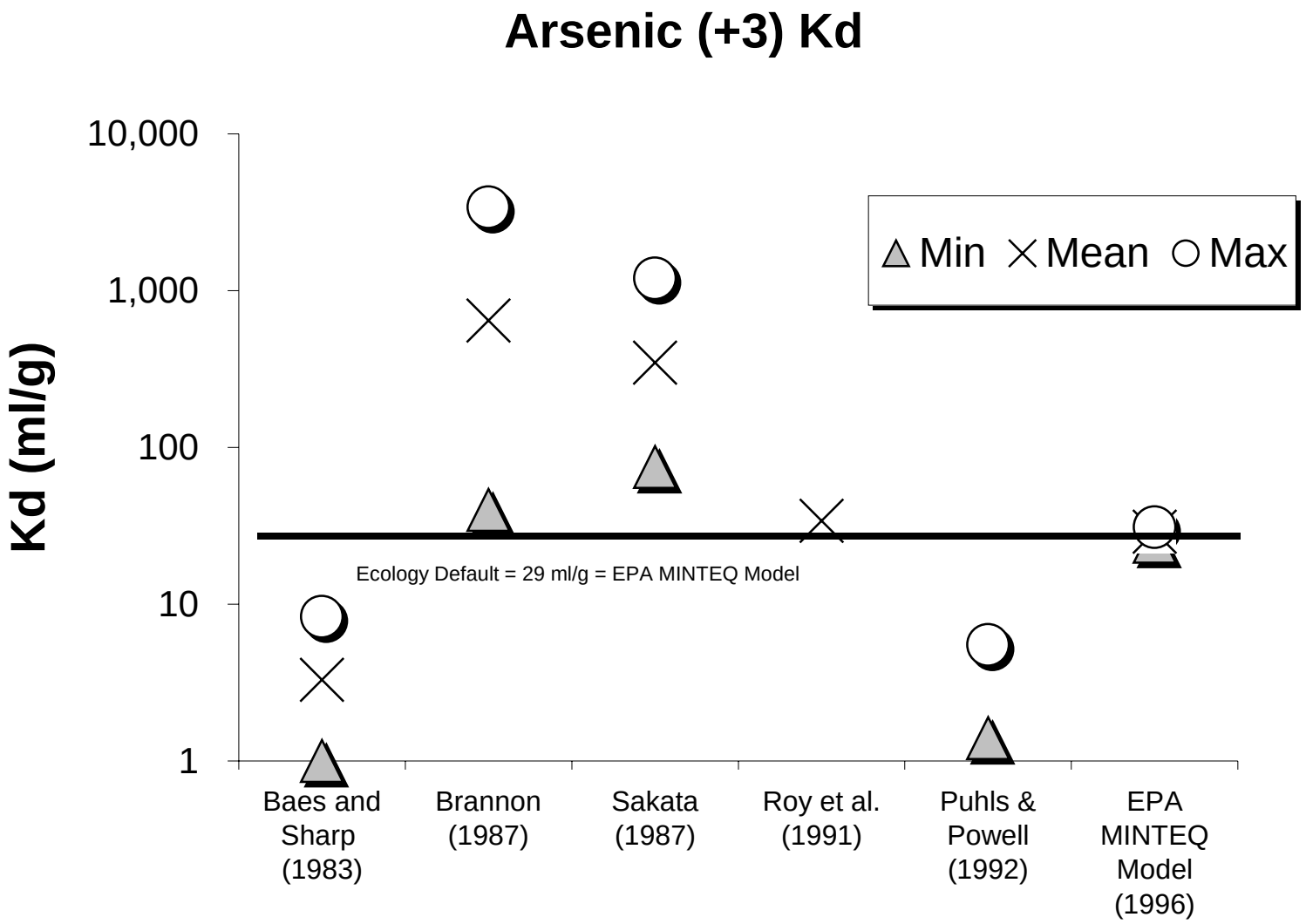


Figure 15-14: Arsenic Adsorption.

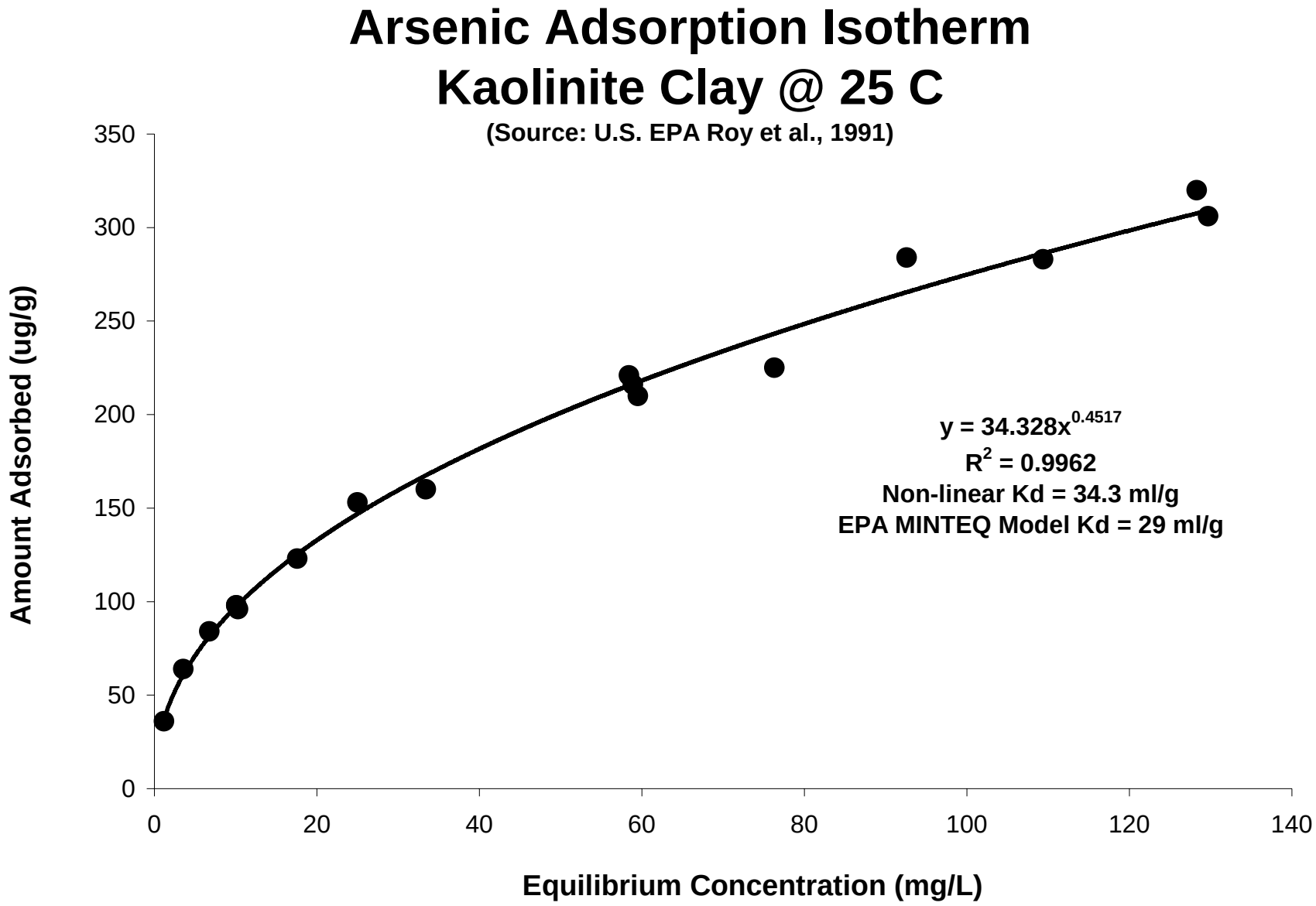


Figure 15-15: Cadmium Kd.

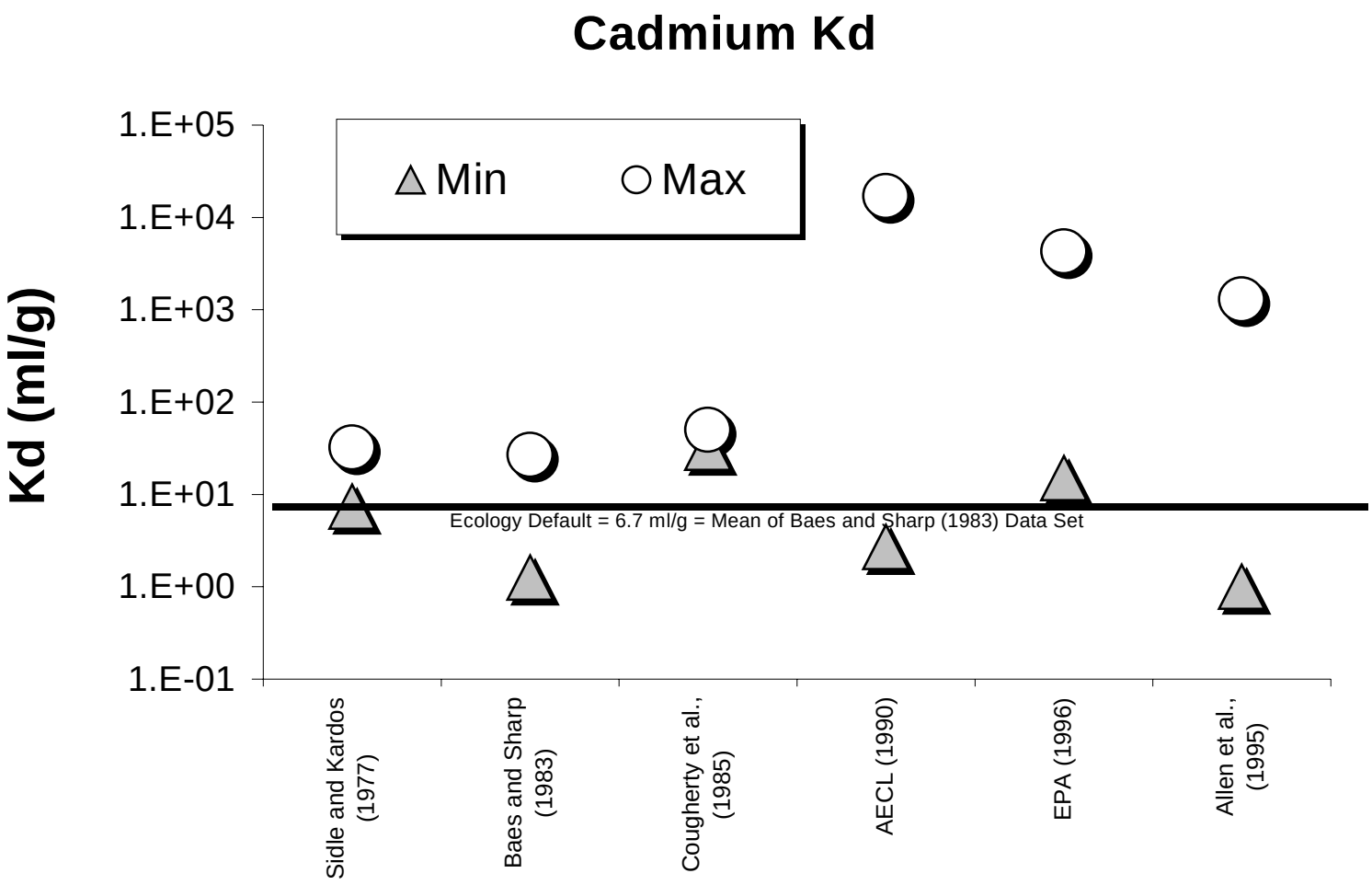


Figure 15-16: Total Chromium Kd.

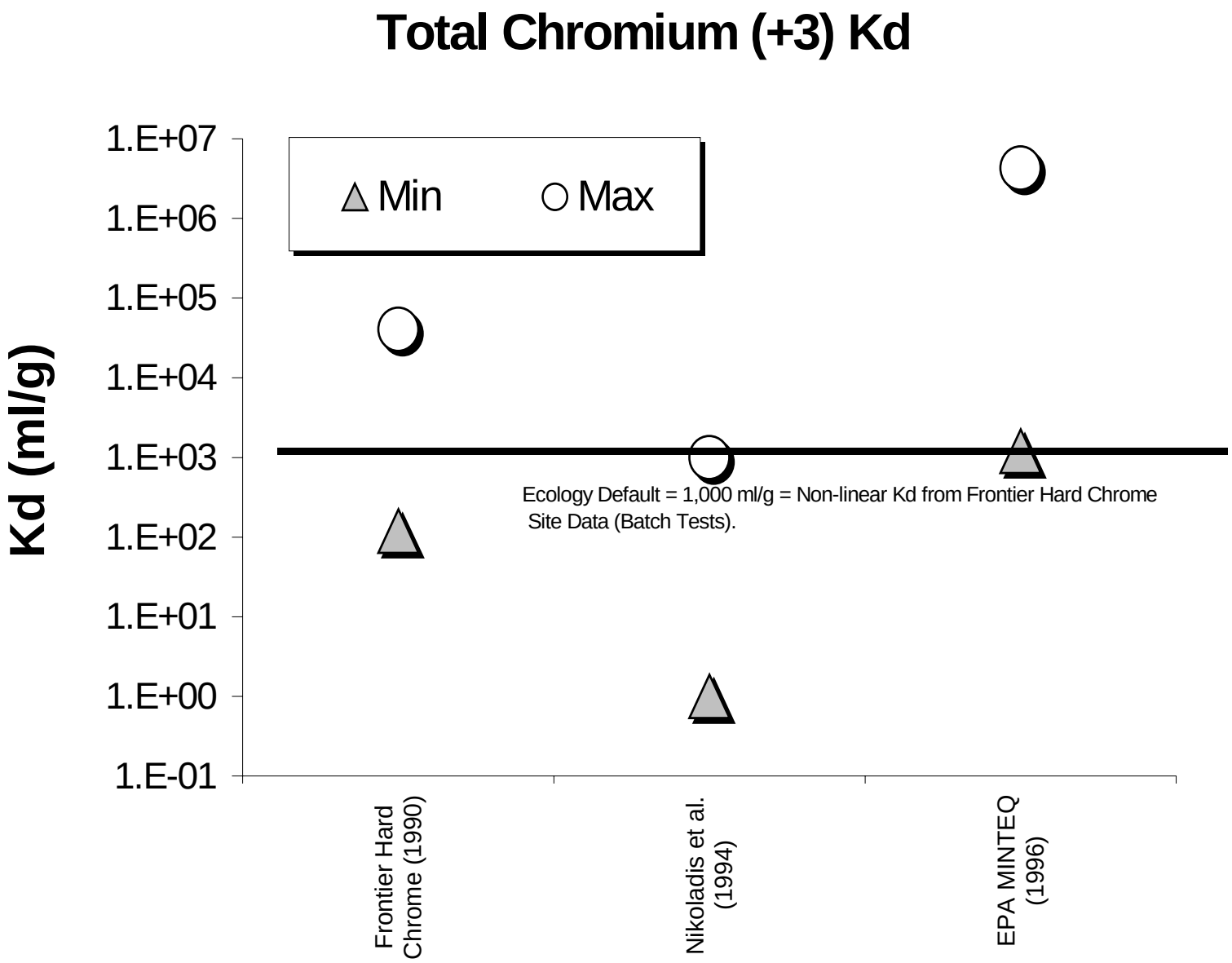


Figure 15-17: Frontier Hard Chrome.

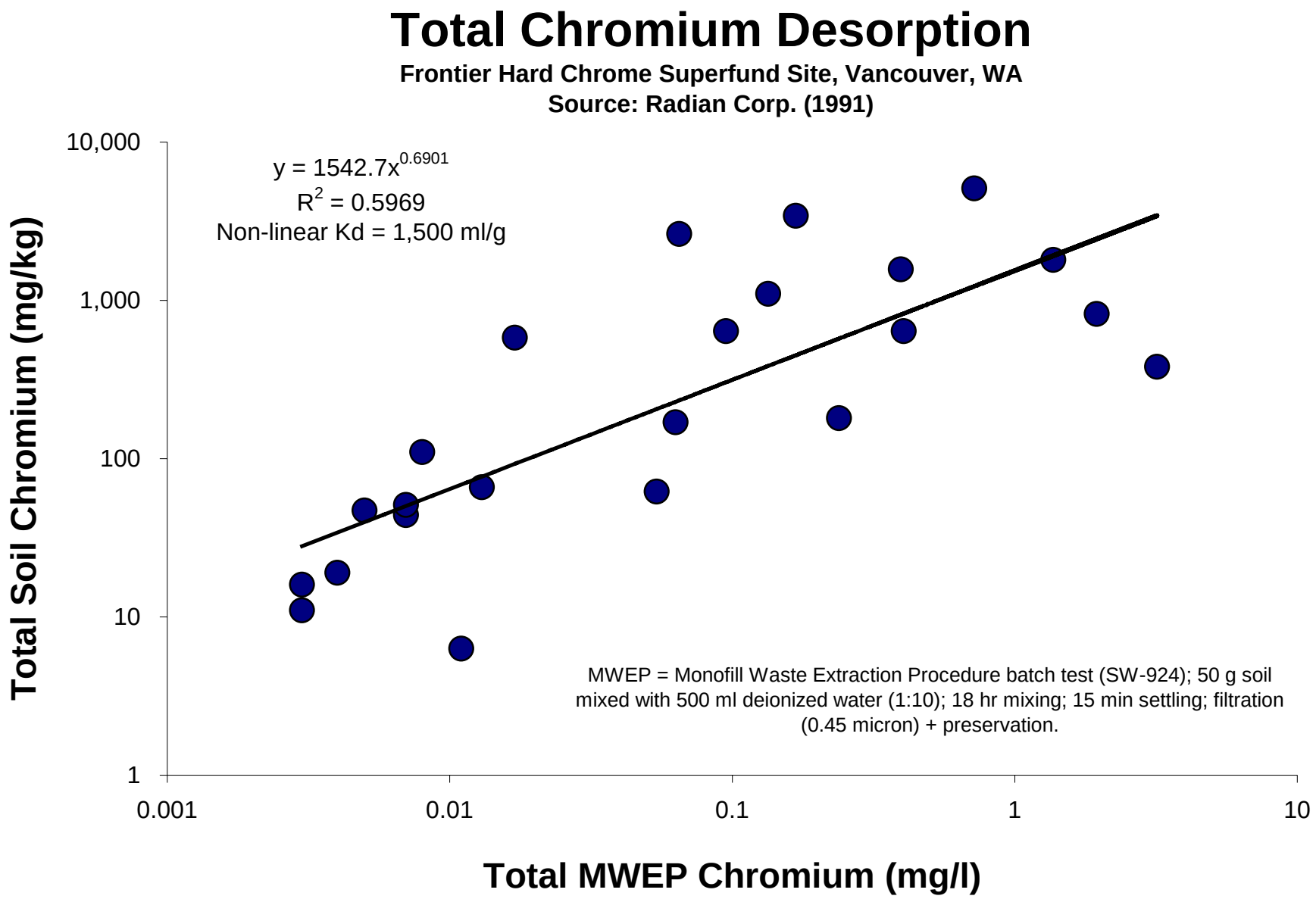


Figure 15-18: Hexavalent Chromium Kd.

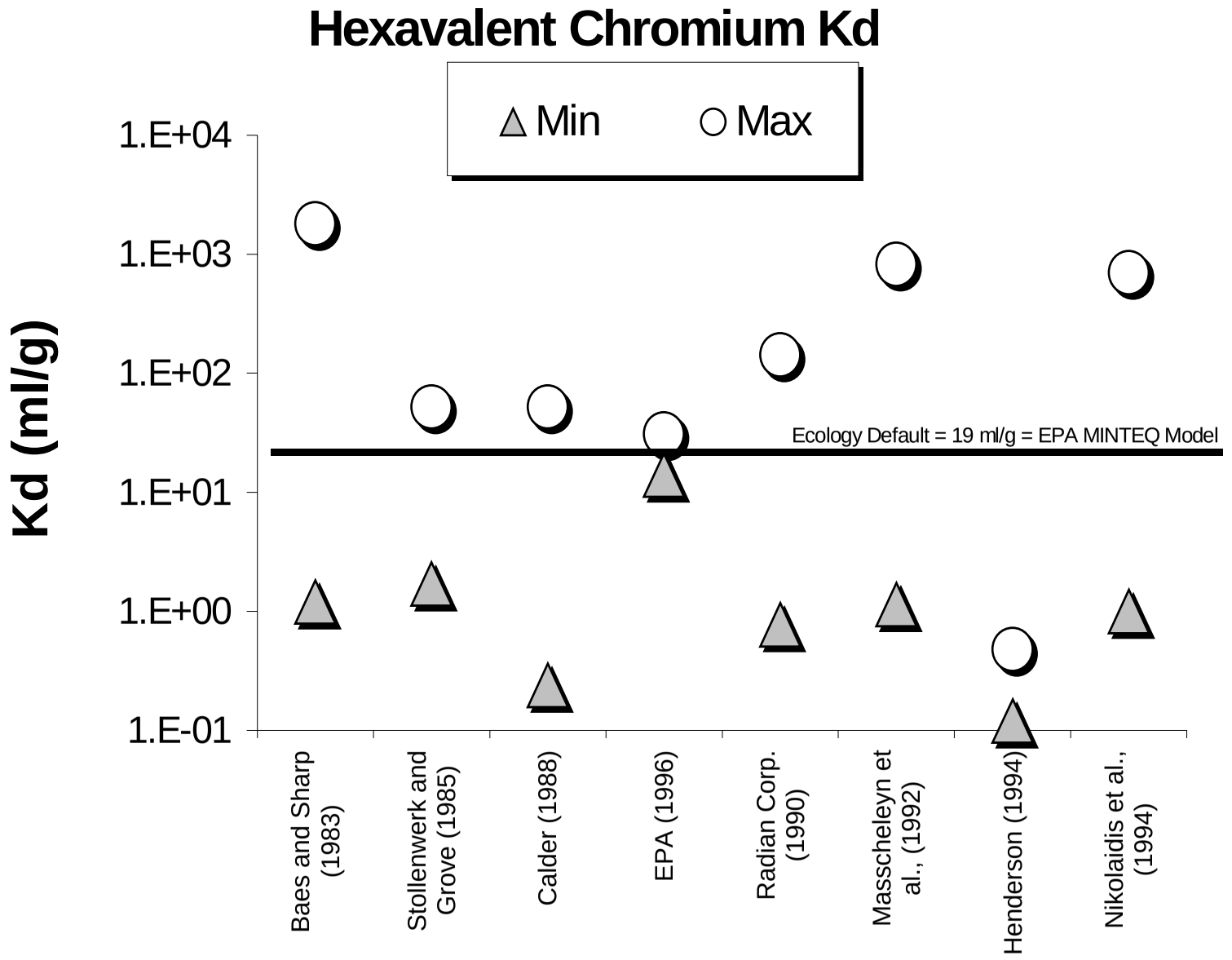


Figure 15-19: Copper Kd.

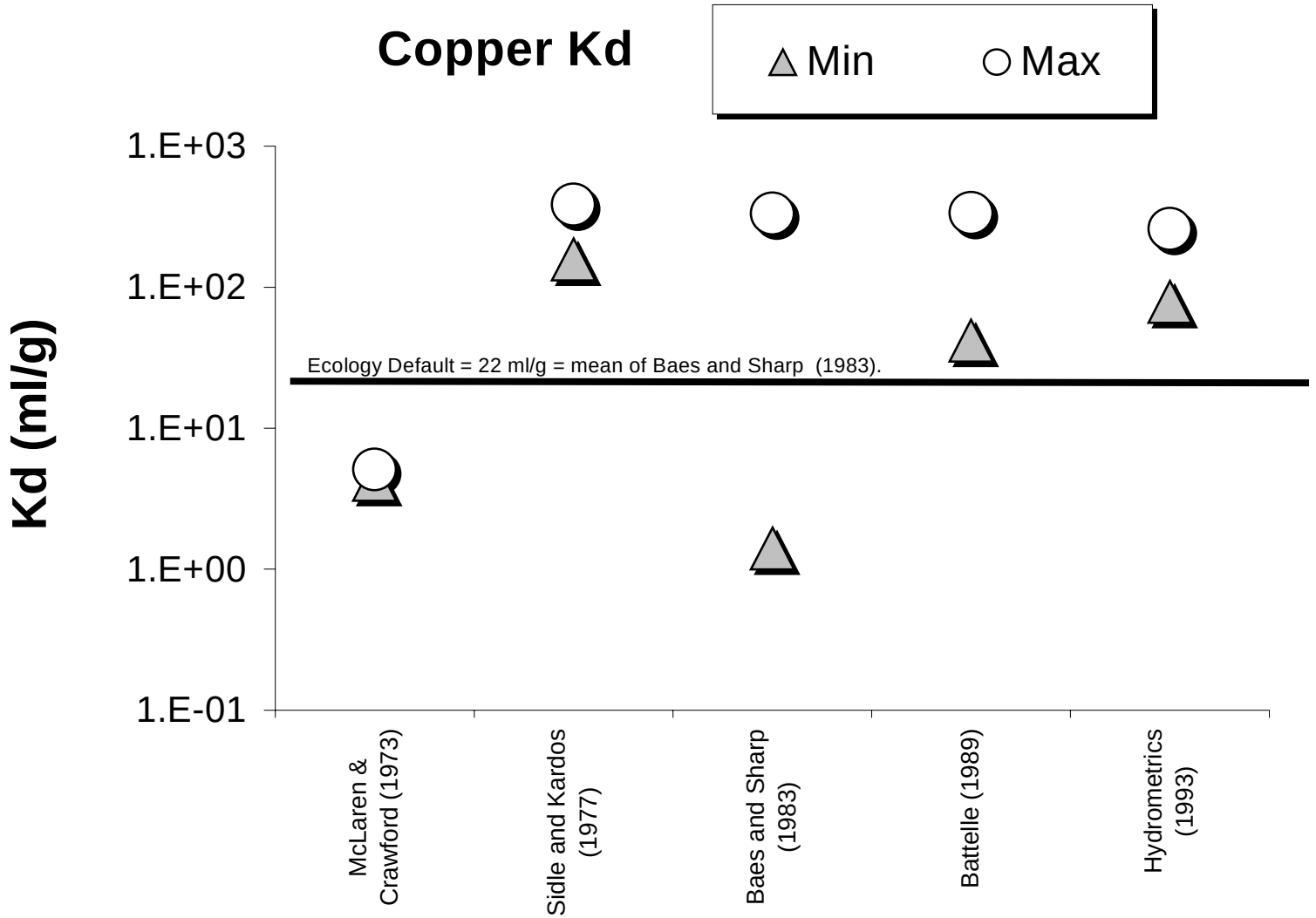


Figure 15-20: Mercury Kd.

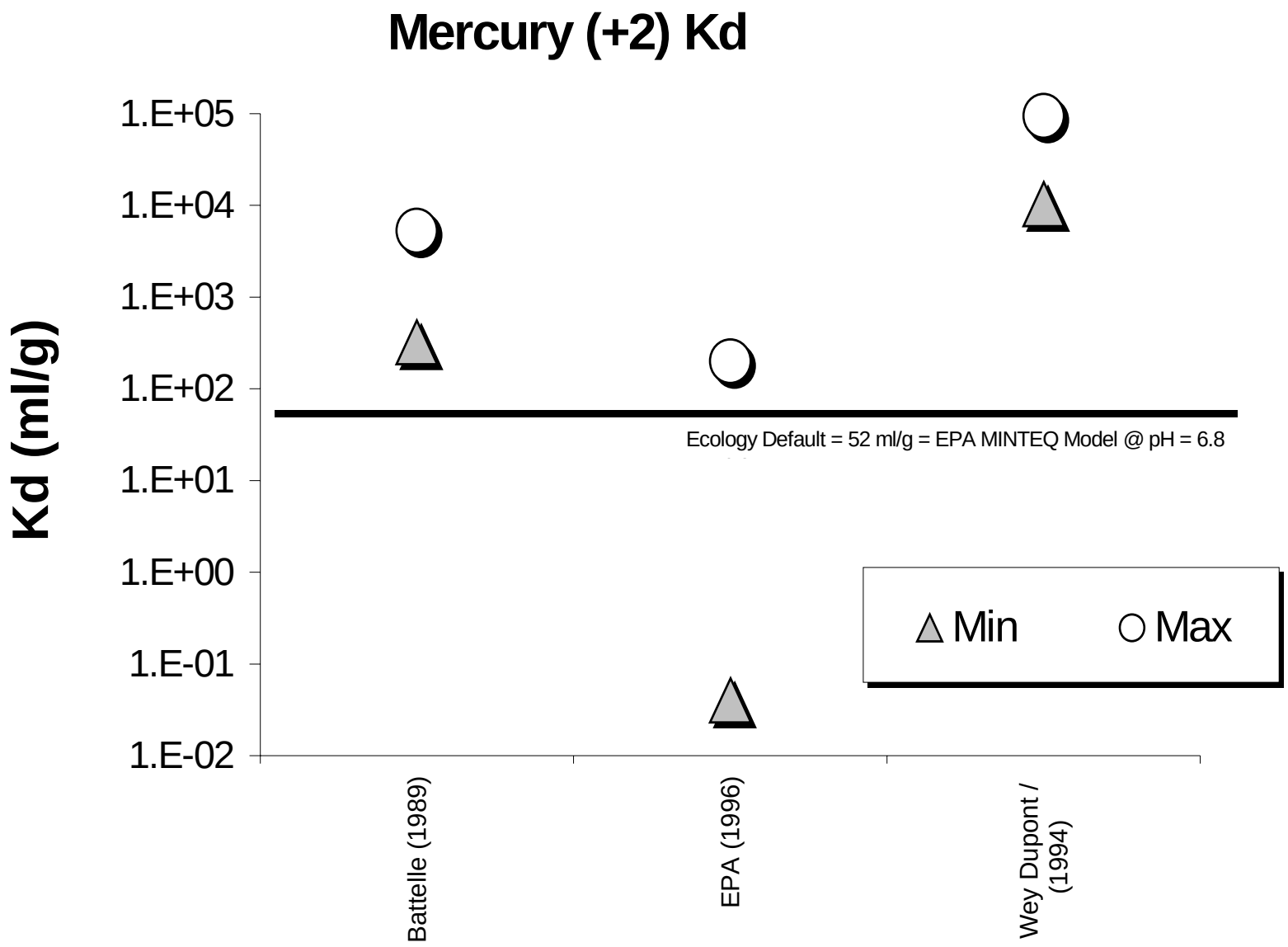
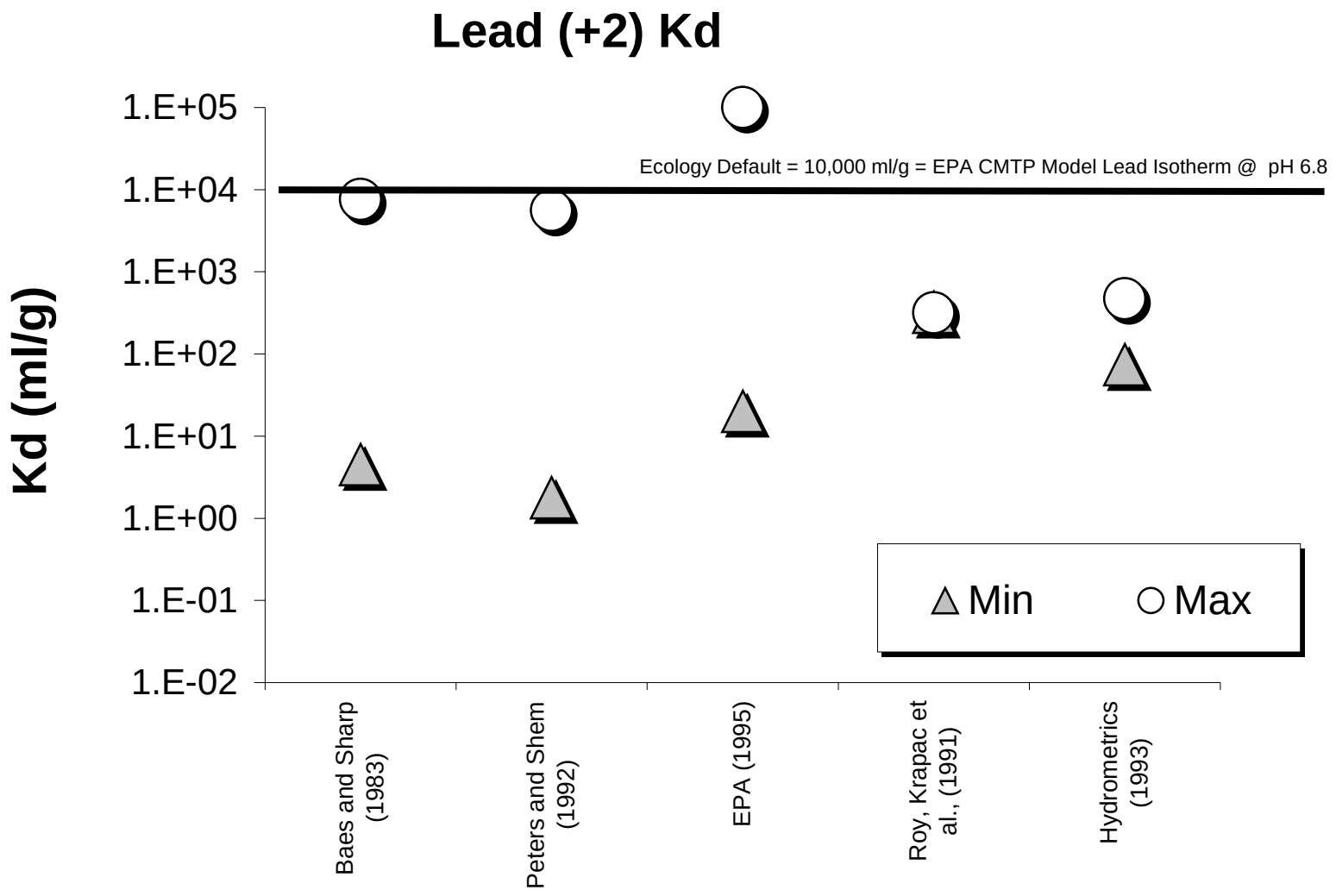


Figure 15-21: Lead Kd.



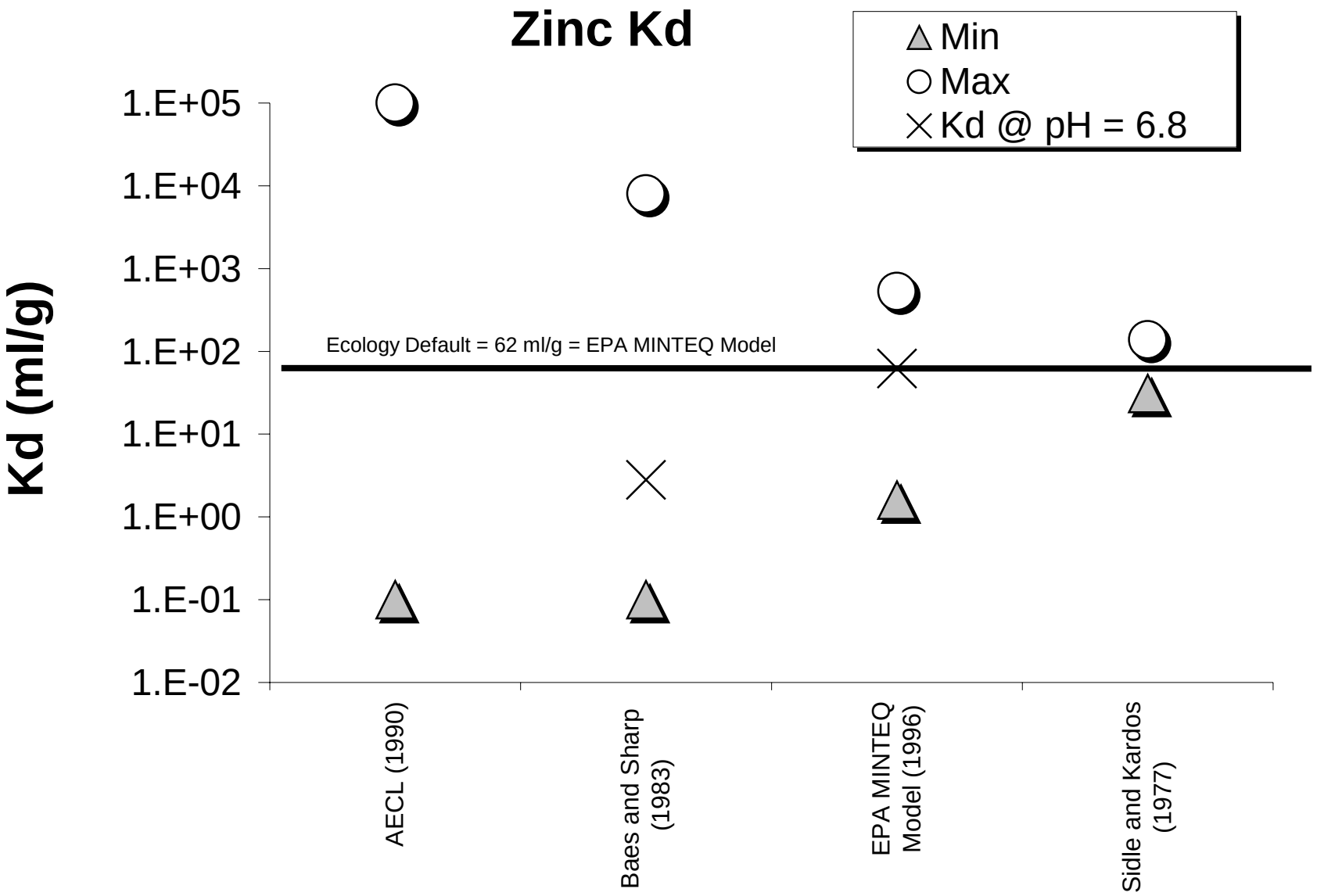


Figure 15-22: Zinc Kd.

15.12 Tables

Table 15-1: Impact of Using 100 Times Ground Water Model for Mobile Carcinogens.

<u>Impact:</u> If 100 Times G.W. is Used to Derive Soil Concentrations, it will Result in Ground Water Concentrations that Exceed Criteria (Model Underestimates Risk).

Hazardous Substance	100 X G.W. Soil Concentration	***Predicted G.W.**	G.W. Cleanup Level	Bulk Density	Soil Water Content	H_{cc}	Soil Air Content	Koc	Kd	foc	Solubility	Estimated Soil Pore Water
	(mg/kg)	**(ug/l)**	(ug/l)	(g/ml)	(ml/ml)		(ml/ml)	(ml/g)	(ml/g)	%	(mg/l)	(ug/l)
Benzene	0.5	**89**	5	1.5	0.3	0.228	0.13	62	0.06	0.1	1,780	1,775
1,2-Dichloroethane	0.5	**104**	5	1.5	0.3	0.0401	0.13	38	0.04	0.1	8,520	2,071
Tetrachloroethylene	0.5	**47**	5	1.5	0.3	0.754	0.13	265	0.27	0.1	150	0.5
Trichloroethylene	0.5	**76**	5	1.5	0.3	0.422	0.13	94	0.09	0.1	1,100	0.05
Vinyl Chloride	0.2	**32**	2	1.5	0.3	1.11	0.13	19	0.02	0.1	2,760	4

* Derived using Equation 15-1.

Equation 15-1: $$C_w = \frac{C_t * \rho_b}{UCF * DF * (K_d \rho_b + \theta_w + H_{cc} \theta_a)}$$

C_w = Predicted ground water concentration (ug/l)

UCF = Unit Conversion Factor (1,000)

DF = Dilution Factor (dimensionless, 20)

C_t = Soil concentration (ug/g; derived using 100 X ground water model)

ρ_b = Soil bulk density (1.5 g/ml)

K_d = Distribution coefficient (ml/g)

θ_w = Soil volumetric water content (0.3 ml/ml)

H_{cc} = Henry's Law constant (dimensionless)

θ_a = Soil air content (0.13 ml/ml)

Table 15-2: Impact of Using 100 Times Ground Water Model for Less Mobile Hazardous Substances.

<u>Impact:</u> If 100 Times G.W. is Used to Derive Soil Concentrations, it will Result in Ground Water Concentrations that are Less Than Criteria (Model Overestimates Risk).

Hazardous Substance	100 X G.W. Soil Concentration	***Predicted G.W.**	G.W. Cleanup Level	Bulk Density	Soil Water Content	H_{cc}	Soil Air Content	Koc	Kd	foc	Solubility	Estimated Soil Pore Water
	(ug/g)	**(ug/l)**	(ug/l)	(Kg/l)	(ml/ml)		(ml/ml)	(ml/g)	(ml/g)	%	(mg/l)	(ug/l)
Benzo(a)pyrene	0.02	0.001	0.2	1.5	0.3	4.63E-05	0.13	968,774	969	0.1	1.62E-03	0.02
Chlordane	0.2	0.194	2	1.5	0.3	1.99E-03	0.13	51,310	51.3	0.1	5.60E-02	3.9
Chromium (+3)	10	0.500	100	1.5	0.3	-	0.13	-	1,000	0.1	-	10
Lead	1.5	0.007	15	1.5	0.3	-	0.13	-	10,000	0.1	-	0.1
Mercury	0.2	0.191	2	1.5	0.3	0.467	0.13	-	52	0.1	-	3.8

* Derived using Equation 15-2.

Equation 15-2: $$C_w = \frac{C_t * \rho_b}{UCF * DF * (K_d \rho_b + \theta_w + H_{cc} \theta_a)}$$

C_w = Predicted ground water concentration (ug/l)

UCF = Unit Conversion Factor (1,000)

DF = Dilution Factor (dimensionless, 20)

C_t = Soil concentration (ug/g; derived using 100 X ground water model)

ρ_b = Soil bulk density (1.5 g/ml)

K_d = Distribution coefficient (ml/g)

θ_w = Soil volumetric water content (0.3 ml/ml)

H_{cc} = Henry's Law constant (dimensionless)

θ_a = Soil air content (0.13 ml/ml)

Table 15-3: Risk Calculations.

Hazardous Substance	*RISK @ Predicted G.W. Concentration	**Predicted G.W. Concentration	ABW	LIFE	UCF	CPF	DWIR	DUR	INH	DWF
		ug/l	kg	years	ug/mg	kg-day/mg	L/day	Years		
Benzene	5.88E-05	89	70	75	1,000	0.029	2	30	2	1
1,2-Dichloroethane	2.15E-04	104	70	75	1,000	0.091	2	30	2	1
Tetrachloroethylene	2.75E-05	47	70	75	1,000	0.051	2	30	1	1
Trichloroethylene	9.51E-06	76	70	75	1,000	0.011	2	30	1	1
Vinyl Chloride	1.38E-03	32	70	75	1,000	1.9	2	30	2	1

*Derived using Equation 15-3.
** Derived using Equation 15-1.

Equation 15-3: RISK = (PGW * CPF * DWIR * DUR * INH * DWF) / (ABW * LIFE * UCF)

PGW = Predicted ground water concentration (ug/l)
CPF = Carcinogenic potency factor (kg-day/mg)
DWIR = Drinking water ingestion rate (2 liters/day)
DUR = Duration of exposure (30 Years)
INH = Inhalation correction factor (2 for volatile hazardous substances and 1 for all other substances[unitless])
DWF = Drinking water fraction (1.0).
ABW = Average body weight during period of exposure (16 kg)
LIFE = Lifetime (75 years)
UCF = Unit conversion factor (1,000 ug/mg)

Table 15-4: SAB Fate / Transport Subcommittee Meeting Summary.

Meeting	Date	Location	Issues Discussed
1	27-Mar-96	Tacoma	Organics and metals Kd.
2	01-May-96	Tacoma	Ecology TPH leach test study.
3	12-Jun-96	Ecology Bldg.	Planning / steering.
4	24-Jul-96	Ecology Bldg.	Composition of the fate / transport subcommittee.
5	30-Aug-96	Ecology Bldg.	Planning / steering.
6	26-Sep-96	Sea Tac Airport	Conceptual site model, screening levels, TPH leach study results.
7	24-Oct-96	Sea Tac Airport	Conceptual site model assumptions.
8	14-Nov-96	Sea Tac Airport	3-phase partitioning model input parameters.
9	05-Dec-96	Sea Tac Airport	Ecology Interim-TPH Policy.
10	22-Jan-97	Sea Tac Airport	Dilution factor input parameters, equilibrium linear partitioning assumptions.
11	05-Mar-97	Sea Tac Airport	Metals Kd.
12	26-Mar-97	Sea Tac Airport	Conceptual model assumptions.
13	02-May-97	Sea Tac Airport	Metals Kd, leach tests.
14	16-Jul-97	Sea Tac Airport	Total organic carbon, metals Kd, leach tests.
15	19-Aug-97	Sea Tac Airport	Total organic carbon, metals Kd, leach tests & dilution factor.
16	22-Sep-97	Sea Tac Airport	Total organic carbon, metals Kd, leach tests, computer models & biodegradation.
17	23-Oct-97	Sea Tac Airport	TPH fate / transport, residual saturation, leach tests, metals Kd.
18	03-Dec-97	Sea Tac Airport	Metals Kd, total organic carbon.
19	03-Feb-98	Sea Tac Airport	Draft MTCA rule, 3-phase partitioning model input parameters.
20	05-Mar-98	Sea Tac Airport	Draft MTCA rule, petroleum fate / transport, leach tests.
21	29-Jan-99	EPA Region X	Method A soil TPH cleanup levels.
22	28-May-99	EPA Region X	Method A soil TPH cleanup levels.
23	06-Jul-99	EPA Region X	Method A soil benzene cleanup level.
24	20-Dec-99	EPA Region X	MTCA rule.

Table 15-5: Arsenic (+3) Kd.

Study	Site(s)	Sorbent(s)	Kd Range (L/kg)	Mean Kd	As Species	Summary
Baes and Sharp (1983)	United States	Agricultural soil, clay	1.0 – 8.3 1.9 - 18	3.3 6.7	+3 +5	Investigated 222 soils; mean pH = 6.7.
Brannon (1987)	10 sites across U.S.	Sediments	40 - 3,409 26 - 2,679	645 392	+3 +5	Unamended sediments. Batch test: 4:1 liquids to solids ratio, mechanical shaking for 1 month (aerobic).
EPA (1996)	N/A		25 – 31	N/A	+3	MINTEQ model used to derive Kd values; Kd based upon pH 4.9-8.
Hydrometrics (1993)	Asarco Smelter, WA	Slag fill Soil Ground water	396 – 415 50 - 76 66	N/A	N/A	Based on Sequential Extraction and SW 924 leach tests.
Puhls & Powell (1992)	Globe, AZ	Unconsolidated alluvium	1.4 – 5.5	N/A	+3	Kd values apply to arsenate (+3) only. Batch test: 24 hrs, 5:1 liquids to solids ratio, pH 4-8. Non-linear Freundlich isotherm used to interpret data (1/n = 0.73). Kd values from column test (1.4) comparable to batch test.
Roy, Krapac et al., (1991)	Pike County, Illinois	Kaolinite clay	34	N/A	N/A	Batch adsorption (solution concentrations of 4.89 - 160.3 mg/l used). Test: 10:1 liquids to solids ratio; 254 hours @ 25° C. Soil pH = 8.1.
Sakata (1987)	15 sites Japan	Subsurface soil (sieved to < 0.4 mm)	75 - 1,200	348	+3	Study found that Kd value of As(+3) relates well to dithionite-extractable Fe content of soil.

N/A = information not available or not applicable.

- Baes, CF (III), and R.D. Sharp, (1983). A proposal for estimation of soil leaching and leaching constants for use in assessment models. J. Environ. Qual. 12(1): 17-28.
- Brannon, J.M., Patrick, W.H. (1987). Fixation, Transformation, and Mobilization of Arsenic in Sediments. Environ. Sci. Technol., Vol. 21, No. 5, 450-459.
- EPA Soil Screening Guidance: Technical Background Document (pp. 150-160). EPA/540/R-95/128 (May, 1996).
- Hydrometrics, Inc. Asarco, Tacoma Plant Remedial Investigation, August, 1993.
- Puls, R.W. and Powell, R.M. (1992). Transport of Inorganic Colloids through Natural Aquifer Material: Implications for Contaminant Transport. Env. Sci. Tech. Vol. 26. No. 3, 614-621.
- Roy et al. (1991). Batch-Type Procedures For Estimating Soil Adsorption of Chemicals. U.S. EPA Technical Resource Document, EPA 530/SW-87/006-F
- Sakata, M. (1987). Relationship between Adsorption of Arsenic (III) and Boron by Soil Properties. Env. Sci. Tech. 21, No.11, 1126-1130.

Table 15-6: Cadmium Kd.

Study	Sorbent	pH	Kd Range (L/kg)	Summary
AECL (1990)	sand, silty, clay, and organic material		2.7 - 17,000	AECL = Atomic Energy of Canada, Limited. Data on Kd obtained from available literature.
Allen et al., (1995)	Delaware River sediment	3 – 9	1 - 1,300	Study found that Kd values increased with increasing column flow velocity. Study authors concluded that column leach data is often misinterpreted. Cd Kd very sensitive to pH changes.
Baes and Sharp (1983)	Agricultural soil, clay	6.7	1.26 - 26.8	15 samples
Battelle (1989)	Clay, Al & Fe oxyhydroxides	5 – 9	14.9 – 567	Kd reported as a function of pH (5 - 9) and sorbent content. Data based on available literature.
Cougherty et al., (1985)	N/A		32 – 50	Kd = best estimates and ranges for a limited number of samples.
EPA (1996)	silt loam	4.8 – 8.0	15 - 4,300	Kd range from MINTEQ model.
Sidle and Kardos (1977)	Forest soil, PA	7.2	7.4 - 32.4	Organic-rich soil and cation exchange capacity (CEC) found to be a factor in adsorption.

- AECL (Atomic Energy of Canada Limited), (1990). A Critical Compilation and Review of Default Soil Solid/Liquid Partition Coefficients, Kd, for Use in Environmental Assessments, by D.H. Thibault, M.I. Sheppard, and P.A. Smith, Whiteshell Nuclear Research Establishment, Pinawa, Manitoba.
- Allen, H.E., Yu-Tung, C. Sanders, P.F. et al. (1995). Soil Partition Coefficients for Cd by Column Desorption and Comparison to Batch Adsorption Measurements. Env. Sci. Technol., Vol. 29, No. 8. 1887-1891.
- Baes, CF (III), and R.D. Sharp, (1983). A proposal for estimation of soil leaching and leaching constants for use in assessment models. J. Environ. Qual. 12(1): 17-28.
- Battelle Memorial Institute (1989). Chemical Data Bases of the Multimedia Environmental Pollutant Assessment System (MEPAS): Version 1. PNL Laboratory, operated by Battelle Memorial Institute.
- Cougherty, P.J., Jackson, D., and Thorne, M.C. (1985). Radionuclide Distribution and Transporting Terrestrial and Aquatic Ecosystems: A Compendium of Data. A.A. Balkem, Netherlands, Vol. 6.
- EPA Soil Screening Guidance: Technical Background Document (pp. 150-160). EPA/540/R-95/128 (May, 1996).
- Sidle, R.C., and Kardos, L.T. (1977). Adsorption of Copper, Zinc, and Cadmium by a Forest Soil. J. Environ. Qual., Vol. 6, No. 3, 313-317.

Table 15-7: Total Chromium Kd.

Study	Sorbent	pH	Kd Range (L/kg)	Summary
EPA MINTEQ Model	-	-	1,200 – 4,300,000	
Frontier Hard Chrome (1991)	Clay + Fill Soils	-	119 – 40,462	Most (80-90%) of the chromium present in both the soil and ground water is in the +3 state. MWEP and TCLP batch tests used to measure total chromium Kd.
Nikoladis et al. (1994)	Aquifer sediments – National Chromium Inc. Superfund site, CT.	-	1 – 1,000	Kd derived by measuring total chromium in both soil and ground water.

- EPA Soil Screening Guidance: Technical Background Document (pp. 150-160). EPA/540/R-95/128 (May, 1996).
- Frontier Hard Chrome (1991) Ecology Frontier Hard Chrome site files.
- Nikolaidis, N.P., Robbins, G.A. et al. (1994). Vertical Distribution and Partitioning of Chromium in a Glaciofluvial Aquifer. Ground Water Monitoring Review. V. 14, 150-159

Table 15-8: Hexavalent Chromium Kd.

Study	Site(s)	Sorbent(s)	Kd Range (L/kg)	Summary
Baes and Sharp (1983)	United States	Agricultural soil, clay	1.2 - 1,800	Investigated 222 soils; mean pH = 6.7. Mean Cr (+6) Kd = 37 L/kg.
Calder (1988)	N/A	Natural soils, clay, and aquifer materials	0.24 - 52	Author of this study reports that adsorption of Cr (+6) by various sorbents is low to moderate under near-neutral pH ranges commonly encountered in ground water.
EPA (1996)	-	-	14 - 31	EPA MINTEQ model predicted values.
Henderson (1994)	Odessa, TX	Sediment, Trinity Sand aquifer	0.12 - 0.48	ASTM D 3987-85 used for batch tests; 2:1 liquids to solids ratio, 24 hours.
Masscheleyn et al., (1992)	Wetland soils (67% clay)	Avoyelles Parrish, LA	1.14 - 822	Cr (+6) Kd increased with decreasing redox potential Max Kd = 822 @ -200 mV and pH 7.3).
Nikolaidis et al., (1994)	National Chromium site, Putnam, CT	Glaciofluvial (kame terrace)	1 - 700	Kd values derived by dividing soil and ground water Cr (+6) concentrations.
Radian Corp. (1990)	Frontier Hard Chrome Superfund site, Vancouver, WA	fill material, clayey-silt	0.77 - 143	Cr (+6) Kd = soil/solution (clay and fill soils).
Stollenwerk and Grove (1985)	Telluride, CO	Alluvial aquifer	2.3 - 2.4 (column) 1.7 - 52 (batch test)	Column leach test used derive Kd values (pH = 6.8). First 10 pore volumes removed 50% of the Cr (+6), next 50 pore removed 34% of the Cr (+6).

- Baes, CF (III), and R.D. Sharp, (1983). A proposal for estimation of soil leaching and leaching constants for use in assessment models. J. Environ. Qual. 12(1): 17-28.
- Calder, L.M. (1988). Chromium contamination in ground water. In: Chromium in the Natural and Human Environments. J.O. Nridgu and E.Bieboer, eds. Wiley-Interscience, NY.
- EPA Soil Screening Guidance: Technical Background Document (pp. 150-160). EPA/540/R-95/128 (May, 1996).
- Henderson, Thomas (1994). Geochemical Reduction of Hexavalent Chromium in the In the Trinity Sand Aquifer. Ground Water, Vol. 32, No. 3. (May-June), 477-486.
- Masscheleyn, pH, Pardue, J.H., Delanue, R.D., and Patrick, W.H. (1992). Chromium Redox Chemistry in a Lower Mississippi Valley Bottomland Hardwood Wetland. Environ. Sci. Technol., Vol. 26, No. 6, 1217-1226.
- Nikolaidis, N.P., Robbins, G.A. et al. (1994). Vertical Distribution and Partitioning of Chromium in a Glaciofluvial Aquifer. Ground Water Monitoring Review. V. 14, 150-159.
- Radian Corp. (1991). Evaluation of Soil Remedial Levels for Frontier Hard Chrome, Vancouver, Washington. Draft Technical Memorandum, October, 1990.
- Stollenwerk, K.G., and Grove, D.B., (1985). Adsorption and Desorption of Hexavalent Chromium in an Alluvial aquifer near Telluride, Colorado. J. Environ. Qual. V. 14, 150-155.

Table 15-9: Copper Kd.

Study	Sorbent	pH	Kd Range (L/kg)	Summary
Baes and Sharp (1983)	Agricultural soil	6.7	1.4 – 333	Investigated 222 soils, 55 samples.
Battelle (1989)		5 - 9	41.9 – 336	Kd reported as a function of pH (5 - 9) and sorbent content. Data based on available literature.
Hydrometrics (1993)	soil, slag, granular fill		79 – 259	Kd range = 79 - 610 for soil and ground water samples (11). Range of Kd's for slag/fill = 79 - 259 (9 samples).
McLaren & Crawford (1973)	Soil	5.5	4.3 - 5.1 [25]	Langmuir isotherm often used to describe Cu adsorption. Tested 23 soil samples with organic matter content range of 0.4 - 26.2%.
Sidle and Kardos (1977)	Forest soil, PA	7.2	158.1 – 386.4	Cu adsorption fit the Freundlich isotherm better than the Langmuir isotherm. Higher Kd (386.4) may be due to organic-rich (10.6 %) topsoil and high cation exchange capacity (18.4 meq/100 g, 0 - 7.5 cm depth). Cu was also adsorbed almost instantaneously from batch solutions.

- Battelle Memorial Institute (1989). Chemical Data Bases of the Multimedia Environmental Pollutant Assessment System (MEPAS): Version 1. PNL Laboratory, operated by Battelle Memorial Institute.
- Baes, CF (III), and R.D. Sharp, (1983). A proposal for estimation of soil leaching and leaching constants for use in assessment models. J. Environ. Qual. 12(1): 17-28.
- McLaren, R.G. and Crawford, D.V. (1973). Studies on Soil Copper. II. The Specific Adsorption of Copper by Soils, J. Soil Sci. Vol. 24, 443-452.
- Sidle, R.C., and Kardos, L.T. (1977). Adsorption of Copper, Zinc, and Cadmium by a Forest Soil. J. Environ. Qual., Vol. 6, No. 3, 313-317.
- Hydrometrics, Inc. Asarco, Tacoma Plant Remedial Investigation, August, 1993.

[25] Langmuir constant, log M^{-1}.

Table 15-10: Mercury Kd.

Study	Site(s)	Sorbent(s)	Kd Range (L/kg)	Summary
Battelle (1989)	-	-	322 – 5,280	
EPA (1996)	-	-	0.04 - 200	EPA MINTEQ model predicted values.
Wey / Dupont (1994)	-	Glaciofluvial soil	10,000 – 100,000	Column leach tests used on mercury contaminated soils.

- Battelle Memorial Institute (1989). Chemical Data Bases of the Multimedia Environmental Pollutant Assessment System (MEPAS): Version 1. PNL Laboratory, operated by Battelle Memorial Institute.
- EPA Soil Screening Guidance: Technical Background Document (pp. 150-160). EPA/540/R-95/128 (May, 1996).
- Weyerhaeuser / Dupont site investigation (1994). Ecology site files (work performed by Hart Crowser).

Table 15-11: Lead Kd.

Study	Site	Sorbent	Kd Range (L/kg)	Comments
Baes and Sharp (1983)	United States	Agricultural soil	4.5 - 7,640	Kd range based upon 125 measurements.
EPA (1995)	-	-	4.9 – 8.0	MINTEQA2 model used to generate a Kd isotherm for lead @ pH 6.8. The range of values was 20 - 100,000.
Hydrometrics (1993)	Asarco, Tacoma	soil slag/fill	74 – 91 315 – 471	No correlation between soil and g.w. lead data.
Peters and Shem (1992)	Cecil, GA	two soils, silty clay and loamy sand	1.78 - 5,570	Median Kd = 5 L/kg (two soils). Pb adsorption was much higher onto soil with high silty clay content. Linear Freundlich isotherm was adequate in describing partitioning. Chelating agent EDTA used in batch tests.
Roy, Krapac et al., (1991)	Pike County, IL	Cecil clay loam	323 – 317	Kd = linear and non-linear Freundlich. 20:1 liquids to solids ratio, pH 4.5, 25°C.

- Baes, CF (III), and R.D. Sharp, (1983). A proposal for estimation of soil leaching and leaching constants for use in assessment models. J. Environ. Qual. 12(1): 17-28.
- EPA CMTP Background Document for Metals (1995). Volume 1: Methodology. (EPACMTP = EPA's Composite Model for Leachate Migration with Transformation Products). EPA Office of Solid Waste.
- Hydrometrics, Inc. Asarco, Tacoma Plant Remedial Investigation, August, 1993.
- Peters, R.W. and Shem, L. (1992). Adsorption/Desorption Characteristics of Lead on Various Types of Soil. Env. Progress, Vol. 11, No. 3, August, 234-240.
- Roy et al. (1991). Batch-Type Procedures For Estimating Soil Adsorption of Chemicals. U.S. EPA Technical Resource Document, EPA 530/SW-87/006-F

Table 15-12: Zinc Kd.

Study	Site	Sorbent	Kd Range (L/kg)	Summary
AECL (1990)		sand, silty, clay, and organic material	0.1 – 100,000	AECL = Atomic Energy of Canada, Limited. Data on Kd obtained from available literature.
Baes and Sharp (1983)	United States	Agricultural soil	0.1 – 8,000	
EPA MINTEQ Model			1.6 – 530	
Sidle and Kardos (1977)		Forest Soil	31 - 138	

- AECL (Atomic Energy of Canada Limited), (1990). A Critical Compilation and Review of Default Soil Solid/Liquid Partition Coefficients, Kd, for Use in Environmental Assessments, by D.H. Thibault, M.I. Sheppard, and P.A. Smith, Whiteshell Nuclear Research Establishment, Pinawa, Manitoba.

- Baes, CF (III), and R.D. Sharp, (1983). A proposal for estimation of soil leaching and leaching constants for use in assessment models. J. Environ. Qual. 12(1): 17-28.

- EPA Soil Screening Guidance: Technical Background Document (pp. 150-160). EPA/540/R-95/128 (May, 1996).

- Sidle, R.C., and Kardos, L.T. (1977). Adsorption of Copper, Zinc, and Cadmium by a Forest Soil. J. Environ. Qual., Vol. 6, No. 3, 313-317.

Table 15-13: Estimates of Soil Volumetric Water Content at Field Capacity and Wilting Point.

* Adapted from Baes and Sharp (1983).

Soil	Field Capacity	Wilting Point	No. Observed
Silt Loams	0.243 to 0.454	0.060 to 0.297	76
Clays and clay loams	0.255 to 0.448	0.145 to 0.325	33
Sandy Loams	0.124 to 0.329	0.029 to 0.158	24
Loams	0.226 to 0.394	0.082 to 0.167	11
All soils	0.124 to 0.454	0.124 to 0.454	154

- Field capacity = 0.3 bar tension, wilting point = 15 bar tension (1.01 bar = 1 atm = 14.7 1b/in^2).
- Baes, CF (III), and R.D. Sharp, (1983). A proposal for estimation of soil leaching and leaching constants for use in assessment models. J. Environ. Qual. 12(1): 17-28.

Table 15-14: Residual Saturation Values.

Adapted from Mercer and Cohen (1990)

Residual Fluid	Medium	*Residual Saturation (R) (l/m3)	Porosity N (cm3/cm3)	Medium Density (g/cm3)	Fluid Density (g/cm3)	**Equivalent Soil Concentration (mg/kg)
Gasoline	**Coarse gravel**	**2.5**	**0.325**	**1.75**	**0.675**	**964 (used as default value for gasoline)**
Gasoline	Coarse sand and gravel	4	0.35	1.65	0.675	1,636
Gasoline	Medium to coarse sand	7.5	0.375	1.55	0.675	3,266
Gasoline	fine to medium sand	12.5	0.375	1.5	0.675	5,625
Gasoline	silt to fine sand	20	0.4	1.4	0.675	9,643
Middle distillates	**Coarse gravel**	**5**	**0.325**	**1.75**	**0.8**	**2,286 (used as default value for diesel fuel)**
Middle distillates	Coarse sand and gravel	8	0.35	1.65	0.8	3,879
Middle distillates	Medium to coarse sand	15	0.375	1.55	0.8	7,742
Middle distillates	fine to medium sand	25	0.375	1.5	0.8	13,333
Middle distillates	silt to fine sand	40	0.4	1.4	0.8	22,857
Fuel oils	Coarse gravel	10	0.325	1.75	0.9	5,143
Fuel oils	Coarse sand and gravel	16	0.35	1.65	0.9	8,727
Fuel oils	Medium to coarse sand	30	0.375	1.55	0.9	17,419
Fuel oils	fine to medium sand	50	0.375	1.5	0.9	30,000
Fuel oils	silt to fine sand	80	0.4	1.4	0.9	51,429

*Residual Saturation (R) = liters of residual NAPL per cubic meter of medium x porosity x 1,000

** Equivalent Soil Concentration = Residual saturation x fluid density ÷ medium density.

- Mercer, J.W. and Cohen, R.M. (1990) A Review of Immiscible Fluids in the Subsurface: Properties, Models, Characterization and Remediation. J. of Contaminant Hydrol. 6 (1990) 107-163. Ecology's default residual saturation values were obtained from Table 3 (p. 120) of this study.

- Middle distillate = Diesel No. 2 Fuel Oil

Table 15-15: Predicted Ground Water Concentration for Residual Saturation Gasoline Concentration.

Equivalent Carbon Fraction	* Gasoline Composition	Predicted Ground Water Concentration @ Gasoline Soil Concentration = 1,000 mg/kg (Ecology Default Residual Saturation Level)	Hazard Index of Predicted Ground Water
	%	(ug/L)	%
Aliphatics			
EC >5-6	2.640%	64	0.02%
EC >6-8	14.131%	48	0.02%
EC >8-10	9.935%	2	0.13%
EC >10-12	13.808%	0	0.01%
Aromatics			
Benzene	0.127%	103	64.64%
Toluene	2.003%	596	5.63%
Ethylbenzene	1.135%	110	2.07%
Xylenes	6.427%	638	0.60%
EC >8-10	10.248%	326	12.30%
EC >10-12	20.242%	242	9.12%
EC >12-16	16.106%	40	0.76%
Naphthalene	3.198%	50	4.69%
	Total	2,218	100%

Derived using the 4-phase partitioning model.

Chapter 16 Air Cleanup Standards

Several amendments to WAC 173-340-745 were made for clarification purposes and to reflect changes made to other chapters, including updating several cross-references. Substantive and other changes, listed by subsection, include the following:

Subsection (1) – General considerations
(a) Added language that expands applicability of Section to indoor air, in addition to the current outdoor air. This change is mirrored throughout the Section.
(a) Added an explanation of the kinds of sites where air cleanup standards need to be established. Includes a statement that doesn't apply to concentrations in the air originating from an industrial or commercial process or operation or to substances originating from an off-site source.
(b) Edited to direct the user to the appropriate subsections for establishing air cleanup levels. This replaces deleted language in (1)(b).
(c) Deleted language about treatment, removal and containment and replaced with trigger that cleanup action being required where cleanup levels are exceeded.
(d) Added a statement that each medium must be evaluated separately to determine if it qualifies for a Method C cleanup level.
(e) Moved language from later in Section to here discussing when more stringent cleanup levels can be required by the dept. Also, reference to Sections 702 & 708 added.

Subsection (2) – Method A air cleanup levels.
Deleted all language for establishing Method A air cleanup levels and direct user to Methods B or C.

Subsection (3) – Method B air cleanup levels.
(a) Amended language to provide for "standard" and "modified" Method B air cleanup levels.
(b) Several editing changes to equations. Includes the addition of averaging time and exposure duration and default value of 6 years for both to equation 750-1. Added exposure frequency and default value of 1 to both equations.
(b) Existing (b) deleted and moved to (1).
(b) Added provision describing how air cleanup levels for petroleum mixtures are to be established.
(b)(iii) Added provision stating air cleanup levels cannot exceed 10% of the lower explosive limit.
(c) Provided detailed list of changes to equation default values that can be made under modified Method B to derive site-specific cleanup levels.
(d) Added statement that other adjustments to the reasonable maximum exposure scenario and default assumptions can be made when using a quantitative site-specific risk assessment to demonstrate the protectiveness of a remedy and provide cross-references to appropriate provisions.

Subsection (4) – Method C air cleanup levels.
(a) Changed to reference WAC 173-340-706 for eligibility criteria.

(b) Amended language to provide for "standard" and "modified" Method B air cleanup levels.
(b) Deleted (e) and moved to (1)
(b)(ii) Added provision describing how air cleanup levels for petroleum mixtures are to be established.
(b)(ii) Added provision stating air cleanup levels cannot exceed 10% of the lower explosive limit.
(c) Provided description of what changes can be made to equation default values under modified Method C
(d) Added statement that other adjustments to the reasonable maximum exposure scenario and default assumptions can be made when using a quantitative site-specific risk assessment to demonstrate the protectiveness of a remedy and provide cross-references to appropriate provisions.

Subsection (5) – Adjustments to air cleanup levels.
(a) Added statement about when an adjustment for total site risk needs to be made.
(b) Reworded statement on when cleanup levels found under applicable laws must be adjusted.
(c) Added statement on how PQLs and natural background get factored into cleanup levels.

Subsection (6) – Points of compliance.
Deleted provision providing for conditional point of compliance at industrial sites. (This provision has been restored in final rule.)

Subsection (7) – Compliance monitoring.
Added statement that monitoring may be required to demonstrate compliance with air cleanup levels.

GQ 16.1.1
Why has WAC 173-340-750 been expanded to include standards for indoor air?

(356, 666, 1379)

Response:
WAC 173-340-750 now explicitly notes the applicability of this section to include indoor air. It now provides procedures for establishing air standards for inside buildings and other structures. This was necessary to implement the PAC recommendations to allow the use of site-specific risk assessment under MTCA. Final PAC Report, p. 24. Such an assessment for soil or ground water may include the need to assess vapor exposure, and air standards for both indoor and outdoor air would be needed to complete the assessment.

GQ 16.1.2
What sites must establish air cleanup levels?

(900, 986, 550, 551, 1095, 1140, 2064, 2106, 2107)

Several commentors expressed concern that the amended rule will require all sites to address air exposures, complicating cleanup. Some expressed concern that sites could be forced into cleanup because site air contaminants were due to urban background concentrations or industrial processes, not because of vapors migrating from the soil or ground water.

Response:
It is not Ecology's intent to require every site to address air contamination. The applicability of WAC 173-340-750 is described in subsection (1), which provides that air cleanup standards shall be established at the following sites:

> **(i)** Where a nonpotable ground water cleanup level is being established for volatile organic compounds using a site-specific risk assessment under WAC 173-340-720(6).
> **(ii)** Where a soil cleanup level that addresses vapors or dust is being established under WAC 173-340-740 or 173-340-745.
> **(iii)** Where it is necessary to establish air emission limits for a remedial action.
> **(iv)** At other sites as determined by the department.

WAC 173-340-750(1). To address the concerns that ambient air quality or industrial processes could unintentionally trigger a cleanup, a specific exemption has been provided in subsection (1) as follows:

> This section does not apply to concentrations of hazardous substances in the air originating from an industrial or commercial process or operation or to hazardous substances in the air originating from an off-site source. This section does apply to concentrations of hazardous substances in the air originating from other contaminated media or a remedial action at the site.

GQ 16.1.3
Why have the Method A air cleanup levels been eliminated?

(125, 771, 772, 2286, 2412, 2443)

In comments on earlier rule drafts, several commentors expressed concern that the subsection describing the establishment of Method A air cleanup levels was confusing because there is no table of values in the MTCA rule and there are very few ambient air standards for toxic substances. The way Method A was worded could have resulted in sites having to use natural background or a PQL for air cleanup levels.

Response:
In response to the above concern, Ecology concurs that the earlier language was confusing for the very reasons cited by the commentors. Thus, to avoid this confusion, Method A was eliminated as an option for setting air cleanup levels. This means that air cleanup levels can only be established using Methods B or C. For substances that have an applicable air standard, these standards can be used under Methods B and C anyway. Also, since the types of situations where

air cleanup levels are likely to be established are when a site-specific risk assessment is being used at a site, it makes sense to use Methods B or C to establish air cleanup levels also.

GQ 16.1.4
What is the applicability of the OSHA/WISHA standards to cleanups?

(357, 666, 821, 900, 1170, 1345, 1379, 2063, 2106)

Several commentors had questions about the relationship between the air cleanup levels under MTCA and the worker exposure limits established by OSHA and WISHA. Some suggested that these worker exposure limits should be allowed to be used as air cleanup levels under MTCA. For example, Graves stated the following:

> Under this section, indoor air quality cleanup levels for contaminated soils at industrial sites should be based upon OSHA/WISHA standards and not on risk assessment exposure models provided the chemical is used in the industrial process and appropriate worker right-to-know actions are implemented.

And K. Johnson:

> The extension of the air cleanup standards to encompass indoor air, in addition to ambient air, is duplicative of WSHA and OSHA regulations and is an unnecessary expansion of MTCA. In instances where there are workers, indoor air concentrations should be below federal and state occupational exposure standards.

Others recommended that these worker exposure limits not be used under MTCA. For example, Valeriano stated the following:

> Earlier drafts of this section circulated by the department indicated that OSHA and WISHA worker standards were not an appropriate method A or B ARAR. That language has been removed from this draft with no explanation. Those standards were never intended to be used in residential settings or even non-industrial commercial buildings and the rule should be revised to state that.

And the MTCA Science Advisory Board:

> We are pleased to see that Ecology followed the Board's advice to exclude the use of OSHA and WSHA standards to set cleanup levels.

Response:
Ecology does not believe the OSHA/WISHA worker exposure limits are appropriate standards to use to set air cleanup levels under MTCA. The applicability of the OSHA/WISHA worker exposure limits was a topic of considerable discussion by the MTCA Science Advisory Board. The Board concurred with Ecology that it was not appropriate to use these exposure limits to set air cleanup levels under MTCA because those exposure limits were developed primarily to regulate working environments, for example, where chemicals are used as part of a manufacturing process where it may not be practical to control emissions. Also, because these exposure limits typically use a higher level of risk than allowed under MTCA, they are not suitable for establishing standards under MTCA.

This is not to mean that the OSHA/WISHA worker exposure limits cannot be used to monitor worker conditions at an industrial process or during site cleanup. However, these exposure limits cannot be used to set cleanup levels and to avoid addressing a vapor hazard emanating from contaminated soil or ground water.

GQ 16.1.5
Are ASIL's an applicable state and federal law in setting cleanup levels under MTCA?

(548)

Response:
Acceptable Source Impact Levels (ASILs) are concentrations that must be met at the property boundary for new sources regulated under the Federal Clean Air Act. If the remedial action creates a new source that would be regulated under that act (such as an on-site incinerator), the ASILs would be an applicable standard that would have to be met. For other situations, ASILs can be used as a relevant and appropriate standard, if they meet the criteria for use as such under WAC 173-340-710.

GQ 16.1.6
Why have provisions been included addressing petroleum mixture air cleanup standards?

(126, 773, 1283, 2287, 2288)

Two commentors expressed concern about the inclusion of provisions for petroleum mixture air cleanup levels in WAC 173-340-750, indicating that these provisions should be deleted unless reliable sampling and analysis methods exist for measuring petroleum mixture concentrations in air.

Response:
Ecology has included provisions addressing petroleum mixture air cleanup levels under Methods B and C because we believe this is necessary to implement the PAC recommendations to allow the use of site-specific risk assessment under MTCA. A site-specific risk assessment for soil or ground water may include the need to assess vapor exposure, and air cleanup levels would be needed to complete the assessment.

Methods currently exist for sampling and analyzing air for the individual toxic substances within petroleum mixtures such as benzene (EPA, 1988). For total petroleum hydrocarbon fractions, analytical methods are in the final stages of development by the Massachusetts Department of Environmental Protection. Ecology expects to have these methods adopted for use under MTCA before the rule becomes effective.

GQ 16.1.7
What types of facilities can use Method C air cleanup levels?

(807)

In earlier drafts of the proposed amendments, Ecology proposed elimination of Method C air cleanup levels for other than industrial settings because it added complexity to the rule and had never been used. Several comments were received on these earlier drafts objecting to this deletion. In the August, 2000 draft, Method C was retained as an acceptable method for establishing air cleanup levels provided the conditions in WAC 173-340-706(1) are met. One commentor objected to this addition. Specifically, the MTCA Science Advisory Board had the following comment:

> We agree that it makes sense to retain the risk range and risk equations now in Method C for industrial land uses for setting soil cleanup levels and for worker exposure to air contaminants in manholes and utility vaults. However, we do not see sufficient reason for retaining Method C for ground water, surface water and generic Method C air cleanup levels. The general conditions that trigger the ability to use Method C in these other media--high area background concentrations, the overall risk of cleanup, and technical constraints--can all be considered during the remedy selection process. Including these criteria as part of the cleanup level decision process and the remedy selection process is confusing.

Response:
In light of the above comment, Ecology again evaluated whether Method C air cleanup levels should be included in the final rule. Based on that evaluation, we concur with the MTCA Science Advisory Board that it is unlikely that a site will qualify for use of the Method C air cleanup levels unless it is an industrial property or cleanup levels are being set for a manhole or utility vault. However, since so many earlier commentors objected so strongly to its removal, we have opted to retain the current allowance for use in other situations. We intend to keep track of its use and may revisit this issue in a future rule-making, if warranted.

GQ 16.1.8
When is it appropriate to designate a conditional point of compliance for air cleanup levels?

(2109, 2375)

As noted above, in the summary of changes to WAC 173-340-750, the 2000 proposal proposed to eliminate the option of using a conditional point of compliance at the property boundary for industrial sites. Two comments were received on this provision. For example, McCain stated the following:

> In proposed WAC 173-340-750(6) regarding points of compliance, the stricken language at the end of the subsection should be retained. The proposed rules delete the previously available conditional POC for industrial sites. Therefore, air cleanup levels would need to be met throughout the site. This is a problemmatic result. There may be situations in which, for instance, soil contamination is contained (e.g., sheetpile around DNAPL) and related emissions to the air do not meet ambient air standards in the immediate area but do meet those standards elsewhere on the property. Without conditional POC, the proposal may leave no practicable cleanup alternative. [What is the reason for proposing to delete language allowing the department to approve a conditional POC at the property boundary for air at industrial sites under WAC 173-340-750? Obviously, access can be controlled at many industrial sites, and worker exposures are highly regulated. There does not appear to be any justification.]

In addition to agreeing with the above comment on restoring this provision for industrial properties, the Port of Seattle suggested expanding it to include all properties.

Response:
In light of the above comments, Ecology has again evaluated the appropriateness for including a conditional point of compliance for industrial properties. Ecology proposed to eliminate this as an option because it appeared that it would result in on-site worker exposure to a higher level of risk than allowed under MTCA and could result in off-site concentrations in excess of Method B cleanup levels for nonindustrial properties.

However, there appear to be at least two situations where the use of a conditional point of compliance may be protective. The first is the scenario suggested by McCain, where worker access could be controlled to the area of active remediation. A second would be at a site using a remediation method with air emissions from a stack that are dispersed well above ground level. Although both situations could also be addressed through a remediation level analysis since they are likely to be temporary situations, Ecology has concluded that retaining the option of using a conditional point of compliance for these situations should still be protective and thus will restore this provision in the final rule.

As for the suggestion to expand the allowance for the use of a conditional point of compliance to all cleanups, such a change is beyond the scope of this rule-making and would be inappropriate to make at this stage in the rule-making process without further public review. Ecology also believes that, if necessary, the expressed concerns can be addressed by the use of remediation levels.

GQ 16.1.9
How can compliance with air cleanup standards be demonstrated?

(1402, 1434, 2108)

One commentor expressed concern that it will be difficult to demonstrate compliance with air cleanup levels at a site because of the low concentrations that will need to be measured and because of interference from ambient background and industrial process contributions. Another suggested that sampling of the soil or ground water in lieu of air sampling should be sufficient for demonstrating compliance at a site.

Response:
Ecology disagrees with the assertion that it is not possible to measure air concentrations at the air cleanup levels. Several sites have already done this under the existing rule using standard air monitoring methods. As for interference from ambient background or industrial processes, we acknowledge this may be a problem at some sites. That is why an exemption has been included for air concentrations due to these sources under WAC 173-340-750(1). As for using soil or ground water monitoring, rather than air monitoring, to demonstrate compliance, Ecology believes some air monitoring will be required at all sites that establish air cleanup levels. If it is possible to demonstrate a correlation between soil and ground water concentrations and air

concentrations, it may be possible to use this to reduce the amount of air monitoring needed but will probably not totally eliminate monitoring requirements.

GQ 16.1.10
Other comments regarding WAC 173-340-750 are addressed in the following table:

Comment ID	Comment	Response
773, Newlon 2444, Newlon 1283, POG	Delete equation 750-3 since there are no methods to analyze carbon fractions	Equation was deleted in 1999 proposal.

Chapter 17 Sediment Cleanup Standards

The only change made to WAC 173-340-760 was to add a cross-reference to the sediment management rules.

GQ 17.1.1
What is the relationship between the MTCA Cleanup Regulation and the sediment rules?

(552, 901)

In an earlier draft of the rule, Ecology had proposed some additional language that addressed the relationship between the two rules more specifically. Some commentors objected to inclusion of those provisions and as a result of those objections, those provisions were not included in the August, 2000 draft. One commentor made the following comment:

> Section 173-340-760, Sediment Cleanup Standards, is impacted because Ecology recently (12/30/99) halted revisions to the Sediment Management Standards. Those revisions were to have included establishing freshwater sediment standards which were to incorporate aquatic ecological risk factors. While the water quality standards and marine sediment standards do to some extent incorporate environmental risk factors, there are essentially no regulations which require evaluation of ecological risk associated with contaminated freshwater sediments. This is a major omission, particularly in light of the recent ESA listings.

Response:
Ecology acknowledges that, with the withdrawal of those provisions and the proposed sediment management rules there may be some overlap between the two rules and this may complicate sediment cleanup at sites where the cleanup is being conducted under MTCA. At this point, without further clarification in rule, it will be necessary for persons conducting sediment cleanups under MTCA to work closely with Ecology staff to minimize the need for duplicative studies and reports.

As for the concern with the lack of promulgated freshwater sediment standards, if there is a site needing to establish such standards, the framework for marine sediments and narrative standards in the sediment rule can be used to establish freshwater standards. Ecology plans to publish future guidance to facilitate cleanup of sites with freshwater sediment contamination until appropriate standards are established.

Chapter 18 General Provisions (Part VIII)

Several amendments were made in Part VIII of the regulation. Most of these amendments were made to improve the clarity and usability of the regulation and are not intended to change the meaning of the provisions. Substantive changes include the following:

- Updating the analytical methods specified in WAC 173-340-830(3) to comply with existing requirements and policy and to comply with Executive Order #97-02;
- The addition in WAC 173-340-830(3)(a)(vi) of analytical methods for petroleum hydrocarbons to implement PAC and POG recommendations pertaining to cleanup of petroleum contaminated sites (see Final PAC Report, pp. 28-30);
- The addition in WAC 173-340-840(3) of a reference to RCW 18.43.130 to allow military engineers to submit engineering work. This amendment was made to reflect current engineering licensing law;
- The addition in WAC 173-340-840(5) of the requirement that, unless otherwise specified by Ecology, analytical data be submitted in both printed form and an electronic form. This amendment was made to reflect existing policy; and
- The addition in WAC 173-340-850(2) of the requirement that records be retained as long as institutional controls remain in effect. Thus amendment was made to implement the PAC recommendations regarding assuring the long-term effectiveness of cleanup actions that use institutional controls (see Final PAC Report, pp. 32-35).

Several comments were received regarding the amendments to Part VIII of the regulation. These comments are addressed below.

GQ 18.1.1
Why is table 830-1 included describing the required testing for petroleum releases when this has not been done for other hazardous substances?

(304, 2194)

Response:
There are several reasons why the testing requirements for petroleum mixtures have been included the rule:

Unlike other hazardous substances, petroleum contamination is a complex mixture of hazardous substances and to properly characterize it requires testing for several substances. What to test for is not always apparent. This table is intended to ensure proper characterization of these sites.

This table replaces similar testing requirements previously specified in WAC 173-340-450, which have been deleted by this rule amendment.

To receive certification from EPA for Ecology's underground storage tank program, Ecology must adopt rules that EPA agrees will provide for proper characterization and cleanup of leaking underground storage tanks. EPA staff have been involved in the development of this table by participation through the POG.

These testing requirements were recommended to be included by the POG.

GQ 18.1.2
Comments regarding Part VIII of the regulation are addressed in the following table:

Comment ID	Section	Comment	Response
553, Allen	800	Should the owner be held harmless if the department's employees, agents, or contractors injure themselves while on site? Does not suggest addressing issue in rule.	Ecology agrees it is not necessary to address this issue in the rule. To our knowledge, no Ecology employee has pursued a claim for an injury incurred while performing their duties under MTCA on private property. Whether an owner is liable or not for an injury to an Ecology employee will depend on the circumstances leading to the injury.
1268, Gillett	820(2)	Suggested editorial change.	Comment addressed in 2000 proposal.
1242, Gillett	830(2)(e)	Suggested editorial change.	Comment addressed in 2000 proposal.
554, Allen	840(5)	Provide guidelines on the specific format for electronic data deliverables required by the department.	Comment noted. Ecology will specify the expected data for format for electronic submissions.
Table 830-1			
138, POG 2299 POG 777, Newlon 2414, Newlon 2447, Newlon	The POG concurs with the current version of Table 830-1, with the following exceptions:		
	1. Disagrees with the inclusion of PCBs with mineral oil.		Comment addressed in adopted rule.
	2. Footnote (8) should be added to the cells for Naphthalenes/Gasoline Range Organics, Naphthalenes/Diesel Range Organics and Naphthalenes/Heavy Oils.		Comment addressed in 2000 proposal.
	3. In footnote (12)(b), change "when the inhalation exposure pathway may be required" to "when the inhalation exposure pathway is evaluated" for clarification purposes.		Comment addressed in 2000 proposal.
	4. In footnote (12)(c), delete the first sentence if footnote (8) is added to the Naphthalenes/Diesel Range Organics cell, as recommended in item 3), above.		Comment addressed in 2000 proposal.
	5. Include naphthalenes with "Volatile Petroleum Components" instead of with "Semivolatile Petroleum Components," because they are defined as volatiles for the purposes of evaluating petroleum in MTCA sections 740,		The "semi-volatile" category was removed and naphthalenes moved to "other petroleum components" since they will not be routinely tested with the other volatile petroleum components.

	745 and 750.	
	6. Footnote (8) should be deleted from the cell for PCBs/Heavy Oils and substituted with a new footnote which requires PCB testing only of heavy oils known to have been historically manufactured using PCBs or historically used in processes/activities known to include PCBs. Examples include transformers, railroad transformers, mining motors, hydraulic systems, heat transfer systems, electromagnets, compressors, capacitors, switches, and miscellaneous electrical devices.	Comment addressed in adopted rule.
	7. Change the title of the row that currently reads "TPH Analytical Methods for Use with Method A cleanup Levels" to "TPH Analytical Methods for Total TPH." Change the title of the row that currently reads "TPH Analytical Methods for Use with Methods B or C (TPH "fractions") to "TPH Analytical Methods for Use with TPH Fractions."These recommended changes are to increase the clarity of the analytical applicabilities.	Comment addressed in 2000 proposal.
	8. Delete footnote (10) from the cell representing GRO and Volatile Fuel Additives and Blending Compounds, and add an "X" to the cell. Ecology's own research has demonstrated that these hazardous substances are found in this state, and geographic location of a release is not sufficient for prediction purposes. Therefore, these should be standard analytes when gasoline has been released. (If analyses over time show there is little or no reason for concern, this requirement could be amended/deleted.)	Comment addressed in 2000 proposal.
	9. Amend footnote (10) language to make clear that it applies to DRO releases only.	Comment addressed in 2000 proposal.
	10. Add the following language to the note "Use of Table 830-1" immediately under the table: "An 'X' signifies that the analytical requirement applies to both ground water and soil samples, when those are media of concern at a site."	Comment addressed in 2000 proposal and further modified for clarity in the adopted rule.
992, Graves 2070, Graves	It would be helpful to reference specific analytical methods for various fuel additives.	Ecology will address in guidance.
992, Graves 2070, Graves	The proposed scheme would require testing for several fuel additives and we question the value of this. The regulation should provide flexibility based on historical information available on each site.	Comment addressed in adopted rule.
2600, Riley 2601, Riley 2603, Hooton	Should be able to test for MTBE using Method 8015/8020 as it is three times cheaper than 8260.	Method 8260 is not required. However, be aware that Method 8015/ 8020 may result in a "false positive."

2603, Hooton	Testing for hexane, EDB and EDC is not necessary given considerable extra cost as it forces switching analytical methods.	Testing for n-hexane can be included with the VPH and BTEX analyses for no extra cost. EDB and EDC can be added for little or no additional cost. The latter are not required to be analyzed except in TPH contaminated ground water and if found, then in the soil. See Table 830-1, footnote #10.

Chapter 19 Method A Tables (WAC 173-340-900)

19.1 Table 720-1: Method A Ground Water Cleanup Levels

GQ 19.1.1
If a drinking water standard, reference dose or cancer potency factor for a chemical changes in the future, is Ecology committed to updating the Method A values as this new information becomes available?

(2317)

One commentor noted that EPA's reference dose for benzene is likely to go down in the near future. They inquired as to whether Ecology is committed to changing the Method A value for benzene or other substances as new RfD's are released.

Response:
WAC 173-340-702(11) requires Ecology to review, and if appropriate, update the cleanup standards at least once every five years. At a minimum the Method A values would be reviewed and updated as necessary to reflect new drinking water standards and new toxicological information. In addition, chapter 70.105D RCW requires that cleanups be protective of human health and the environment and that cleanup standards be at least as stringent as applicable state and federal laws. In the interim, if Ecology becomes aware of new drinking water standards or updated toxicological information requiring a standard more stringent than the Method A values, we will provide guidance to the regulated community advising them of the change and can require more stringent standards on a case by case basis.

GQ 19.1.2
What level of risk was used as the basis for the Method A ground water cleanup levels?

(810)

One commentor expressed concern with the inconsistent level of risk represented by the Method A ground water cleanup levels.

Response:
The Method A ground water cleanup levels were developed using the procedures under Method B for protection of drinking water beneficial uses and, except for the total TPH values, without consideration of additive effects due to exposure to multiple hazardous substances. This process is the same as that used to establish the Method A values in 1991. More detail about these calculations is provided in Appendix D of the CES. In general, the following process was used to develop the Method A ground water cleanup levels:

1. If there was an available drinking water standard (maximum contaminant level of MCL) or advisory level that was based on a cancer risk of 1×10^{-5} or less or a hazard quotient of 1 or less, that value was used. An example of this is benzene.
2. If the drinking water standard exceeded a cancer risk of 1×10^{-5} or less or a hazard quotient of 1, the standard was adjusted downward to a value that met this level of risk. An example of this is vinyl chloride.
3. If there was no available drinking water standard, a value was calculated using the MTCA Method B equations. If both a reference dose and cancer potency factor was available for a substance, a concentration was calculated using both equations 720-1 and 720-2 and the more stringent value was selected as the cleanup level. An example of this is DDT.
4. The calculated value was compared to natural background concentration and the practical quantitation limit (PQL). If the calculated value was below either of these concentrations, the higher of the natural background or PQL was selected as the Method A cleanup level. An example of this is arsenic.

Ecology acknowledges that this decision-making process results in Method A ground water cleanup levels that have different levels of risk. However, the values are consistent with what would be allowed under Method B and thus we believe are appropriate to use as Method A values. The following provides a more detailed description of how these values were determined.

GQ 19.1.3
What is the basis for the Method A ground water cleanup level for **arsenic**?

Response:
The Method A ground water cleanup level for arsenic was reviewed under this rule-making action, but has not been changed. The basis for this cleanup level was discussed in the 1991 Responsiveness Summary. Note that it was based on ground water natural background, since the federal maximum contaminant level existing at that time exceeded the acceptable level of risk under MTCA.

GQ 19.1.4
What is the basis for the Method A ground water cleanup level for **benzene**?

The Method A ground water cleanup level for benzene was reviewed under this rule-making action, but has not been changed. The basis for this cleanup level was discussed in the 1991 Responsiveness Summary. It is based on the state and federal maximum contaminant level for drinking water supplies (WAC 246-290-310 and 40 C.F.R. 141.61).

GQ 19.1.5
What is the basis for the Method A ground water cleanup level for **benzo(a)pyrene**?

Response:
The Method A ground water cleanup level for benzo(a)pyrene is based on the state and federal maximum contaminant level for drinking water supplies (WAC 246-290-310 and 40 C.F.R.

141.61), adjusted to the MTCA maximum acceptable level of cancer risk of 1 x 10^{-5} using equation 720-2 and the cancer potency factor for benzo(a)pyrene (7.3 kg-day/mg) from IRIS. This cleanup level can be also be used as the total concentration for all carcinogenic polycyclic aromatic hydrocarbons (cPAHs) by converting the other cPAHs to an equivalent concentration of benzo(a)pyrene using the procedures in WAC 173-340-708(8)(d). **See cPAHs, below.**

GQ 19.1.6
What is the basis for the Method A ground water cleanup level for **cadmium**?

Response:
The Method A ground water cleanup level for cadmium was reviewed under this rule-making action, but has not been changed. The basis for this cleanup level was discussed in the 1991 Responsiveness Summary. It is based on the state and federal maximum contaminant level for drinking water supplies (WAC 246-290-310 and 40 C.F.R. 141.62)

GQ 19.1.7
What is the basis for the Method A ground water cleanup level for total **chromium**?

Response:
The Method A ground water cleanup level for total chromium was reviewed under this rule-making action, but has not been changed. The basis for this cleanup level was discussed in the 1991 Responsiveness Summary. It was based on the method B equation (now equation 720-1) and the reference dose in IRIS for hexavalent chromium (0.003 mg/kg-day).

GQ 19.1.8
What cleanup level can be used when there is a mixture of chromium (III) and chromium (VI) at a site?

(2661)

Response:
If just hexavalent chromium (Cr+6) is present at the site, the 50 ug/l must be used as the Method A cleanup level. As discussed in the footnote to this value, if just trivalent chromium (Cr+3) is present at a site, the state and federal maximum contaminant level for drinking water supplies of 100 ug/l can be used (WAC 246-290-310 and 40 C.F.R. 141.62). There is no provision for a sample with a combination of Cr+3 and Cr+6 because additive risk is not provided for in the Method A table. If both are present at a site, the total chromium cleanup level of 50 ug/l must be used or the standard will need to be established using Method B, taking into account the additive risk of both types of chromium. Note that if Method B is used, the total chromium cleanup level cannot exceed the drinking water maximum contaminant level of 100 ug/l.

GQ 19.1.9
What is the basis for the Method A ground water cleanup level for **DDT**?

Response:

The Method A ground water cleanup level for DDT is based on equation 720-2 and calculated using the cancer potency factor for DDT in IRIS (0.34 kg-day/mg).

GQ 19.1.10
What is the basis for the Method A ground water cleanup level for **1,2 dichloroethane**?

Response:
The Method A ground water cleanup level for 1,2 dichloroethane is not proposed to be changed by this rule-making action. The basis for this cleanup level was discussed in the 1991 Responsiveness Summary. It is based on the state and federal maximum contaminant level for drinking water supplies (WAC 246-290-310 and 40 C.F.R. 141.61).

GQ 19.1.11
What is the basis for the Method A ground water cleanup level for **ethyl benzene**?

(995, 997)

The Method A ground water cleanup level for ethyl benzene is proposed to increase from the current value of 30 ug/l to 700 ug/l. One commentor expressed concern with this increase.

Response:
The Method A ground water cleanup level for ethyl benzene is based on the state and federal maximum contaminant level for drinking water supplies (WAC 246-290-310 and 40 C.F.R. 141.61). Using equation 720-1, and the reference dose from IRIS (0.1 mg/kg-day), drinking water at this concentration has a hazard quotient of less than 1, and thus meets the standard for protectiveness under MTCA.

This cleanup level is based on the assumption that ethyl benzene occurs alone, not in combination with other substances. If other substances are present in the water, this concentration may not be protective. Also, the taste and odor thresholds for ethyl benzene, based on limited data, appear to be somewhat lower than the drinking water standard (Kmet, 1999). If taste and odor concerns are an issue at a site, a more stringent cleanup level may be necessary.

GQ 19.1.12
What is the basis for the Method A ground water cleanup level for **gross alpha particle activity**?

Response:
The Method A ground water cleanup level for gross alpha particle activity was reviewed under this rule-making action, but has not been changed. The basis for this cleanup level was discussed in the 1991 Responsiveness Summary. It is based on the state and federal maximum contaminant level for drinking water supplies (WAC 246-290-310 and 40 C.F.R. 141.15) and excludes uranium.

GQ 19.1.13
What is the basis for the Method A ground water cleanup level for **gross beta particle activity**?

Response:
The Method A ground water cleanup level for gross beta particle activity was reviewed under this rule-making action, but has not been changed. The basis for this cleanup level was discussed in the 1991 Responsiveness Summary. It is based on the state and federal maximum contaminant level for drinking water supplies (WAC 246-290-310 and 40 C.F.R. 141.15). It includes both gross beta and gamma activity.

GQ 19.1.14
What is the basis for the Method A ground water cleanup level for **lead**?

(412, 995, 997)

In an earlier draft of the rule, Ecology had proposed to base the Method A ground water cleanup level for lead on the maximum contaminant level goal (MCLG) of zero in 40 C.F.R. 141. One commentor objected to that concentration, indicating that goal is based on cancer effects and that this was inconsistent with Method B, where only MCLGs based on noncancer effects must be considered when establishing a cleanup level. In response to this comment, the August, 2000 draft proposed to base the cleanup level for lead on the federal target concentration of 15 ug/l. One commentor objected to the increase from the current Method A concentration of 5 ug/l, citing concerns with lead toxicity.

Response:
Ecology has examined the original federal register published in the federal register on June 7, 1991 (56 FRN 26467-26468), discussing EPA's basis for the MCLG for lead of zero. That discussion indicates that the lead MCLG was based on a variety of health effects, including carcinogenic effects. Thus Ecology agrees with the commentor that this cleanup level should be based on EPA's target concentration of 15 ug/l in 40 C.F.R. 141.80.

GQ 19.1.15
What is the basis for the Method A ground water cleanup level for **lindane**?

Response:
The Method A ground water cleanup level for lindane is based on equation 720-2 and calculated using the cancer potency factor for lindane in IRIS (1.3 kg-day/mg).

GQ 19.1.16
What is the basis for the Method A ground water cleanup level for **methylene chloride**?

Response:
The Method A ground water cleanup level for methylene chloride was reviewed under this rule-making action, but has not been changed. The basis for this cleanup level was discussed in the

1991 Responsiveness Summary. It is based on the state and federal maximum contaminant level for drinking water supplies (WAC 246-290-310 and 40 C.F.R. 141.61).

GQ 19.1.17
What is the basis for the Method A ground water cleanup level for **mercury**?

Response:
The Method A ground water cleanup level for mercury was reviewed under this rule-making action, but has not been changed. The basis for this cleanup level was discussed in the 1991 responsiveness summary. It is based on the state and federal maximum contaminant level for drinking water supplies (WAC 246-290-310 and 40 C.F.R. 141.62).

GQ 19.1.18
What is the basis for the Method A ground water cleanup level for **MTBE**?

(265, 2175, 2602)

Three comments were received regarding the proposed Method A ground water cleanup level for MTBE. Two commentors expressed concern that the proposed MTBE value was based on aesthetic considerations, and, as such, claimed that Ecology has no authority to use that value. The other commentor questioned what analytical method Ecology will require for measuring MTBE in ground water.

Response:
The proposed Method A ground water cleanup level for MTBE is 20 ug/l. This is based on EPA's health advisory (EPA, 1997f) that recommended a concentration range of 20-40 ug/l for drinking water supplies. EPA, in the documentation discussing that recommendation, notes that the recommendation is based not only on aesthetic considerations, but also because this value provides a "large margin of safety from toxic effects" – similar to how other drinking water standards have been established. In addition to the EPA health advisory, the University of California, on behalf of the State of California, conducted an extensive review of the literature for health effects of MTBE (Univ. of California, 1998). That study concluded that there was substantial evidence that MTBE causes cancer in mice and rats--animals typically used to test chemicals for evidence of human carcinogencity. That study recommended a drinking standard even lower than EPA's Health Advisory to achieve a 1×10^{-6} cancer risk. While Ecology acknowledges that this cleanup level will also minimize the adverse aesthetic impacts of MTBE, based on the above information, it is clear that the 20 ug/l cleanup level addresses more than aesthetic impacts.

GQ 19.1.19
Why have cleanup levels for **MTBE** been included in the Method A Tables?

Response:
The reason why MTBE has been included in the testing requirements for gasoline releases and in the Method A tables is because of the recent discovery of the occurrence of MTBE in ground

water affected by gasoline releases at numerous gas stations throughout Washington State and the risk that MTBE poses to human health.

MTBE (methyl tertiary-butyl ether) is a fuel blending oxygenate used to raise the octane rating of gasoline and/or to reduce hydrocarbon emissions. The POG has identified MTBE as an "indicator chemical" for TPH. MTBE is a troublesome chemical that has been widely used in gasoline in the United States and has contaminated ground water in numerous places. Because MTBE is very water soluble and stable, gasoline mixtures containing MTBE that are released into the soil can easily contaminate ground water with MTBE. Since gasoline sold in Washington State was not known to include MTBE as an oxygenate (unlike many other states), it was assumed that the State of Washington had little reason to worry about this compound. However, Ecology has recently completed testing of ground water at sites throughout the state contaminated with gasoline and discovered MTBE (Ecology, 2000a). The reasons for this are unclear. However, the presence of MTBE in gasoline sold in Washington State might have resulted from its use as an octane booster or from cross-contamination with gasoline from other states.

Whatever, the reason for its presence, because of the prevalence of its occurrence, its mobility in the environment, and its characteristic of rendering ground water unusable at very low concentrations, Ecology believes it is appropriate to require testing for this chemical and to establish Method A cleanup levels to facilitate cleanup of gasoline contaminated sites.

GQ 19.1.20
What is the basis for the Method A ground water cleanup level for **naphthalene**?

Response:
The Method A ground water cleanup level for naphthalene is based on equation 720-1 and using the reference dose in IRIS (0.02 mg/kg-day).

Note that recently, the National Institute of Environmental Health Services has announced that naphthalene causes cancer in animals. If EPA proceeds with development of a cancer potency factor for naphthalene, this could result in a much lower ground water cleanup level for naphthalene.

GQ 19.1.21
Why does the **naphthalene** cleanup level include 1-methyl and 2-methyl naphthalene?

(1145)

The footnote to the naphthalene ground water cleanup level states that this is a total value for naphthalene, 1-methyl and 2-methyl naphthalene. One commentor stated that there is no toxicological basis for assuming these three compounds are equivalent to naphthalene and they should not be grouped together.

Response:

The reason these three compounds were included in the rule is because this was the approach recommended by the POG. Upon receipt of this comment, Ecology asked for confirmation from EPA's Region 10 that treating these substances equally was appropriate, and this was confirmed (EPA, 2000). The EPA recommended that the two "substituted naphthalenes" (1-methyl naphthalene and 2-methyl napththalene) be considered equal in toxicity to naphthalene, rather than grouping these compounds with the aromatic EC 10-12 fraction.

GQ 19.1.22
What is the basis for the Method A ground water cleanup level for **total carcinogenic polycyclic aromatic hydrocarbons (total cPAHs)**?

(135, 136, 1286, 2296, 2297)

Response:
There is no separate Method A ground water cleanup level for total cPAHs. The user is referred to the ground water cleanup level for benzo(a)pyrene, which, as noted above, is based on the federal drinking water standard, adjusted to a 1×10^{-5} cancer risk. The person using Method A to determine if a sample exceeds the Method A cleanup level for cPAHs must first convert the cPAHs to an equivalent concentration of benzo(a)pyrene. That can be done either assuming all of the cPAHs are equally toxic to benzo(a)pyrene or using the CalEPA toxicity equivalency factors. That concentration is then compared to the Method A cleanup level for benzo(a)pyrene to determine if the sample is above or below the Method A cleanup level. The weighting factors used in these calculations are illustrated in Table 19-1.

Table 19-1: Weighting Factors for Conversion of a cPAH mixture to an equivalent concentration of benzo(a)pyrene.

Compound	Weighting factors for conversion of cPAH mixtures to an equivalent concentration of benzo(a)pyrene, assuming all cPAHs are equivalent in toxicity to benzo(a)pyrene	CalEPA weighting factors for conversion of cPAH mixtures to an equivalent concentration of benzo(a)pyrene*
Benzo(a)pyrene	1.0	1.0
Benzo(a)anthracene	1.0	0.1
Benzo(b)fluoranthene	1.0	0.1
Benzo(k)fluoranthene	1.0	0.1
Chrysene	1.0	0.01
Dibenz(a,h)anthracene	1.0	0.4
Ideno(1,2,3-cd)pyrene	1.0	0.1

* CalEPA, 1994

Note that in the November, 1999 draft of the rule amendments, Ecology had proposed a Method A ground water cleanup level for cPAHs of 0.1 ug/l. This value was based on assuming seven cPAHs were present in the ground water, all in equal concentration and of equal toxicity to benzo(a)pyrene. The POG indicated they believed this calculation was incorrect. Ecology agreed, deleting the cPAH cleanup level and instead proposed the above approach in the August, 2000 proposed rule.

GQ 19.1.23
If **cPAHs** are suspected of being present at a site, does just benzo(a)pyrene have to be tested for or does testing have to be done for all cPAHs?

(2314)

Response:
While not explicitly stated in the August, 2000 draft rule, the intent was that all cPAHs must be tested for and equated to an equivalent concentration of benzo(a)pyrene. The POG noted that this intent was not clear and suggested changing the table and footnote to reflect this intent.

Ecology agrees with the POG comment. The intent of changing from a total cPAH value to a benzo(a)pyrene cleanup level was not to imply that other cPAHs (if suspected of being present at a site) did not need to be tested for and meet a Method A cleanup level. Accordingly, as suggested by the POG, in the final rule, cPAH is added back into the table, with a cross reference to B(a)P. In addition, the footnote to benzo(a)pyrene has been changed as follows:

> Benzo(a)pyrene. Cleanup level based on applicable state and federal law (WAC 246-290-310 and 40 C.R.R 141.61), adjusted to a 1 x 10-5 risk. <u>If other carcinogenic PAHs are suspected of being present as the site, test for them and use this value</u> as the total concentration that all carcinogenic PAHs must meet using the toxicity equivalency methodlogy in WAC 173-340-708(8).

And a parallel change made in tables 740-1 and 745-1.

GQ 19.1.24
What is the basis for the Method A ground water cleanup level for **polychlorinated biphenols (PCBs)**?

Response:
The Method A ground water cleanup level for PCBs is based on equation 720-2, using the cancer potency factor in IRIS (2.0 mg/kg-day for high risk and persistent) and adjusted to the PQL of 0.1 ug/l (this is the PQL for EPA method SW 8082).

GQ 19.1.25
What is the basis for the Method A ground water cleanup level for **radium 226 and 228**?

Response:

The Method A ground water cleanup level for radium 226 and 228 was reviewed under this rule-making action, but has not been changed. The basis for this cleanup level was discussed in the 1991 Responsiveness Summary. It is based on the state and federal maximum contaminant level for drinking water supplies (WAC 246-290-310 and 40 C.F.R. 141.15).

GQ 19.1.26
What is the basis for the Method A ground water cleanup level for **radium 226**?

Response:
The Method A ground water cleanup level for radium 226 was reviewed under this rule-making action, but has not been changed. The basis for this cleanup level was discussed in the 1991 Responsiveness Summary. It is based on the state maximum contaminant level for drinking water supplies (WAC 246-290-310).

GQ 19.1.27
What is the basis for the Method A ground water cleanup level for **tetrachloroethylene**?

Response:
The Method A ground water cleanup level for tetrachloroethylene was reviewed under this rule-making action, but has not been changed. The basis for this cleanup level was discussed in the 1991 Responsiveness Summary. It is based on the state and federal maximum contaminant level for drinking water supplies (WAC 246-290-310 and 40 C.F.R. 141.61).

GQ 19.1.28
What is the basis for the Method A ground water cleanup level for **toluene**?

(995, 997)

The Method A ground water standard for toluene is proposed to increase from the current value of 40 ug/l to 1,000 ug/l. One commentor expressed concern with this increase.

Response:
The Method A ground water cleanup level for toluene is based on the state and federal maximum contaminant level for drinking water supplies (WAC 246-290-310 and 40 C.F.R. 141.61). Using equation 720-1, and the reference dose from IRIS (0.2 mg/kg-day), drinking water at this concentration has a hazard quotient of less than 1, and thus meets the standard for protectiveness under MTCA. Also, based on limited data, this concentration appears to be at or below the taste and odor threshold for toluene (Kmet, 1999).

This cleanup level is based on the assumption that toluene occurs alone, not in combination with other substances. If other substances are present in the water, this concentration may not be protective.

GQ 19.1.29
Why is Ecology changing the Method A ground water cleanup level for **total petroleum hydrocarbons**?

(129, 2018, 2290, 2487, 2488, 2580, 2575, 2576)

Response:
The following describes the basis for the TPH related changes to the Method A ground water cleanup levels. Several commentors generically objected to any lowering of the Method A cleanup levels at petroleum contaminated sites. They also indicated that Ecology needs to demonstrate that the more stringent standards are necessary to protect human health and the environment before changing the cleanup levels.

An earlier version of the rule stated that the TPH cleanup levels were based on "average" product composition and that compositions deviating significantly from this assumed composition could not use the Method A cleanup levels. The POG requested that the product compositions the TPH cleanup levels were based on be described in the rule so a person could tell if their product composition was significantly different.

First, in response to the POG comment, the footnote referring to product compositions was removed from the rule because Ecology recognized this would limit the usefulness of the Method A TPH values. The actual product compositions that these values were based on can be found in the rule-making file.

Second, in response to concerns about the lowering of several Method A petroleum-related cleanup levels, the 1991 Method A ground water TPH cleanup level of 1,000 ug/l was based primarily on analytical limitations. This is because at the time that value was set there was very little information available for estimating human health risk of different petroleum mixtures. Using work done by the National Criteria Working Group (which included broad participation from the petroleum industry), Ecology worked with the POG and MTCA Science Advisory Board to develop techniques for estimating the human health risk of petroleum mixtures. Based on this work, Ecology concluded that the current Method A TPH ground water cleanup level of 1000 ug/l is not protective for most petroleum mixtures. Ecology then used these techniques to derive new total TPH ground water cleanup levels that more accurately take into account the human health risk of various petroleum mixtures.

GQ 19.1.30
What is the basis for the Method A ground water cleanup level for **diesel range organics**?

(78, 127, 130, 133, 147, 745, 774, 775, 776, 2288, 2291, 2294, 2318, 2404, 2445)

Response:
The Method A ground water cleanup level for diesel range organics was determined using the following procedure. Additional details on these calculations can be found in the January 28, 1999 (revised February 26, 1999) memo by Steve Robb to the Science Advisory Board.

First, a typical product composition was assumed. The composition used assumed the diesel range organics are present in the form of diesel fuel with no detectable benzene. Ecology believes this is representative of the type of product likely to be seen at retail pumps and home heating oil tanks.

Second, the composition of this product dissolved in the ground water was estimated using laboratory partitioning test data and two models (Rault's law and Ecology's 4-phase model).
Third, the POG-recommended reference doses were used, along with equation 720-3 to calculate a ground water cleanup level.

The above procedure resulted in a cleanup level of 500 ug/l. The MTCA Science Advisory Board reviewed this procedure and concurred with Ecology's proposed cleanup level. However, the POG disagreed with this level, suggesting that a different product composition be used, assuming the diesel fuel is not completely dissolved in the ground water.

The approach taken by Ecology to estimate dissolved product composition is based on a widely accepted principle, called Raoult's Law, that the various fractions of the petroleum product will partition or dissolve into water depending on their relative solubility. The POG product composition was based on an assumption that the diesel fuel would be present in the ground water in the same composition as the original product. As a result of the POG comment, Ecology asked a POG representative to present their method for estimating product composition in the ground water to the MTCA Science Advisory Board. That presentation was made and after that presentation, the Board concluded that the POG approach was not scientifically supportable. Based on that review, Ecology did not accept the POG approach.

Since these initial calculations, Ecology has continued to gather information on diesel product compositions and calculate ground water cleanup levels. Those calculations, available in the rule record file, confirm the proposed cleanup level of 500 ug/l will be protective for a variety of diesel product compositions.

GQ 19.1.31
Can the Method A ground water cleanup level for diesel range organics be used for **jet fuel**?

(1069, 1435)

Response:
Ecology did not include a Method A ground water cleanup level for jet fuel because equivalent carbon fraction data was not available for jet fuels. Based on limited data, jet fuels and marine diesel fuels may contain more benzene and light aromatics than that assumed for the diesel range organics (DRO) calculation. Thus, the DRO cleanup level may be used at a site contaminated with these products only if it is confirmed that the product present has a similar composition to that used to derive the Method A value.

GQ 19.1.32
What is the basis for the Method A ground water cleanup level for **gasoline range organics**?

(1087, 1194, 2484)

Response:
The development of the Method A ground water cleanup level for gasoline range organics (GRO) went through many iterations. Ecology considered establishing only one ground water cleanup level for GRO, assuming benzene was always present. However, this would disregard the possibility that, under some circumstances, GRO contaminated ground water may not contain benzene. Hence, Ecology decided that a Method A ground water cleanup level for gasoline range organics should be provided for ground water with and without the presence of benzene. Using various models, Ecology noted that the resulting cleanup levels were very sensitive to the presence of benzene. As a result, Ecology decided to calculate the ground water cleanup level assuming the benzene concentration was at the Method A concentration of 5 ug/l. Using this premise, the Method A ground water cleanup level for gasoline range organics was determined using the following procedure:

- First, a typical product composition was assumed. The composition selected was representative of gasoline products without oxgenates added.
- Second, this product was assumed to completely dissolve in the ground water. For gasoline, this was thought to be a reasonable assumption because gasoline is quite soluble in water.
- Third, an adjustment was made to the dissolved product compositions: one assuming benzene was present at the MCL of 5 ug/l; a second assuming no (zero) benzene was present.
- Third, the POG recommended reference doses were used, along with equation 720-3 to calculate a ground water cleanup level for the adjusted dissolved product compositions. Two cleanup levels were determined, one for gasoline without benzene and one for gasoline with benzene present at the MCL.

There were three comments on this approach. One commentor expressed concern that these cleanup levels were too high and not protective. Two commentors asked for clarification on the detection limit to be used to conclude benzene is not present in the ground water. They recommended a detection limit of 5 ug/l be used.

The cleanup level for gasoline without benzene assumes that no (zero) benzene is present in the ground water and is not contributing any risk to the gasoline mixture. This means that to use this value, no benzene can be detected in the ground water, using a detection limit of 1 ug/l or less.

Ecology believes these cleanup levels will be protective, provided the assumed ground water composition is representative of site conditions. It should be noted that in making the various adjustments to the product composition to conduct this calculation, the resulting ground water composition is enriched in toluene. If that is not the case, this value may not be protective. It should also be noted that both the 800 ug/l and 1000 ug/l concentrations, based on limited information, are above taste and odor thresholds for gasoline in water reported in the literature (Kmet, 1999). Thus, if this is an issue at a site, a more stringent cleanup level may be necessary.

GQ 19.1.33
What is the basis for the Method A ground water cleanup level for **heavy oils**?

(1146, 2318)

Response:
The Method A ground water cleanup level for heavy oils was determined assuming the heavy oil composition was the same as that used for the diesel range organics. One commentor, Kenefick, questioned this value, suggesting that heavy oil was closer in composition to mineral oil than diesel fuel. In addition, he indicated that a cleanup level of 500 ug/l is not an achievable practical quantitation limit due to interference. The POG suggested that the same approach they recommended for diesel fuel be used to develop a cleanup level for heavy oil.

Heavy oils include products such as lubricating oils, hydraulic oils and bunker fuels. In developing this cleanup level, Ecology did not have access to heavy oil compositions broken down by equivalent carbon fractions, but we did have information on the general composition of these various heavy oils. This information was compared to information on petroleum products with fraction information, primarily mineral oil and diesel fuels. Mineral oil is a much more refined product and did not appear to be similar enough in composition to most heavy oils to be a good model to use for heavy oil. Diesel fuels contain more light aromatic components than most heavy oils but also do not contain the carcinogenic PAHs that are likely to be present in heavy oils. On balance, Ecology determined that diesel fuel would be a reasonable conservative model for heavy oils and the cleanup level for diesel range organics, described above, was used as the heavy oil cleanup level.

Ecology acknowledges that there is a wide range of heavy oil products on the market. If a more specific value is desired for the particular petroleum product present at a site, a site-specific cleanup level can be developed using Method B, or if applicable, Method C.

As for not being able to achieve a practical quantitation limit (PQL) for heavy oil of 500 ug/l, Ecology's Manchester laboratory indicates this is an achievable PQL. As for the POG suggestion for using a different method to calculate a cleanup level, this method was not accepted by Ecology for the same reasons discussed above for diesel fuel.

GQ 19.1.34
What is the basis for the Method A ground water cleanup level for **mineral oil**?

(130, 775, 776, 809, 2288, 2291, 2413, 2446, 2457)

Response:
The Method A ground water cleanup level for mineral oil in the August, 2000 draft rule of 1,000 ug/l was determined using a dissolved product composition provided by Puget Sound Energy from two laboratory experiments--a water/oil partitioning study and a column leaching experiment. Equation 720-3 was then used to calculate a ground water cleanup level.

The MTCA Science Advisory Board indicated they could not support this cleanup level, indicating other mineral oil information suggested a lower cleanup level was more appropriate. They cited two principle concerns: (1) The PSE mineral oil composition appeared to be significantly different from the POG recommended mineral oil composition; and, (2) The laboratory experiments appeared flawed in that pure product, had been inadvertently mixed with the water, providing an inaccurate estimate of the dissolved product composition.

The POG and Newlon also disagreed with this cleanup level, but instead recommended a higher concentration based on the same approach described above for diesel range organics. The POG and Newlon also stated they disagreed with a footnote in the November, 1999 rule draft stating that ground water affected by a mineral oil release needed to be tested for PCBs only if the mineral oil released contained more than 50 PPM of PCBs.

As a result of the SAB's comment, Ecology sought and obtained additional mineral oil composition data from the Electric Power Research Institute (EPRI), which had completed an extensive nation-wide study of mineral oil composition.

Similar to the process used for diesel fuel, these product compositions were used in two models (Raoult's Law and 4-Phase Model) to estimate dissolved phase ground water compositions. These compositions and equation 720-3 were then used to calculate a ground water cleanup level. The result of that work, was that Ecology concluded the SAB's concerns with the Puget Sound Energy data were valid and that the mineral oil ground water cleanup level should be revised to 500 ug/l (Kmet, 2000). The SAB was asked to review these calculations and concurred with the result. This is the value adopted in the final rule.

The POG's recommended approach for calculating a mineral oil cleanup level was not accepted for the same reasons discussed above under diesel fuel. With regard to the POG's and Newlon's concern with the PCB language in the footnote, that language was removed in the August, 2000 draft rule. In response to a similar comment on Table 830-1, a parallel change has been made to the mineral oil footnote in Table 830-1.

GQ 19.1.35
What is the basis for the Method A ground water cleanup level for **1,1,1 trichloroethane**?

Response:
The Method A ground water cleanup level for 1,1,1 trichloroethane was reviewed under this rule-making action, but has not been changed. The basis for this cleanup level was discussed in the 1991 Responsiveness Summary. It is based on the state and federal maximum contaminant level for drinking water supplies (WAC 246-290-310 and 40 C.F.R. 141.61).

GQ 19.1.36
What is the basis for the Method A ground water cleanup level for **trichloroethylene**?

Response:

The Method A ground water cleanup level for trichloroethylene was reviewed under this rule-making action, but has not been changed. The basis for this cleanup level was discussed in the 1991 Responsiveness Summary. It is based on the state and federal maximum contaminant level for drinking water supplies (WAC 246-290-310 and 40 C.F.R. 141.61).

GQ 19.1.37
What is the basis for the Method A ground water cleanup level for **vinyl chloride**?

(1355)

Response:
The Method A ground water cleanup level for vinyl chloride is not proposed to be changed by this rule making action. The basis for this cleanup level was discussed in the 1991 responsiveness summary. It is based on the state and federal maximum contaminant level for drinking water supplies (WAC 246-290-310 and 40 C.F.R. 141.61), adjusted to the MTCA maximum acceptable level of cancer risk of 1X10-5 using equation 720-2 and the cancer potency factor for vinyl chloride from IRIS (1.9 kg-day/mg).

GQ 19.1.38
What is the basis for the Method A ground water cleanup level for **xylene**?

(266, 745, 995, 997, 1147, 1284, 2176, 2404, 2316)

The Method A ground water standard for xylene is proposed to increase from the current value of 20 ug/l to 1,000 ug/l. Two commentors expressed concern with this increase, one requesting a lower concentration, the other requesting an even higher concentration. Two commentors requested clarification regarding whether xylene had to be measured when using the Method A TPH cleanup levels. Finally, the POG requested a clarification in the footnote on what TPH value was being referred to.

Response:
The Method A cleanup level for xylene has been increased because toxicological information published since the 1991 cleanup standards were established indicates a higher cleanup level can be protective of human health. Using equation 720-1, the proposed cleanup level results in drinking water at this concentration having a hazard quotient of less than 1, and thus meets the standard for protectiveness under MTCA. One of the considerations in establishing this value, which is less than the MCL of 10,000 ug/l, was the relationship of this value to the total TPH cleanup level for gasoline. If the MCL was adopted, the xylene standard would be in excess of the total amount of TPH allowed in ground water for gasoline contaminated ground water of 1,000 ug/l. Since, to date, xylene has only been a contaminant of concern at gasoline contaminated sites, this would result in an inconsistency between these two standards in this table. In addition, based on limited information (Kmet, 1999), a cleanup level for xylene of 1,000 ug/l should be at or below the taste and odor threshold for this chemical, whereas the MCL would be nearly an order of magnitude above these thresholds.

With respect to the POG comment, Ecology has made the suggested wording change to the footnote in the final rule, which will read as follows:

> Cleanup level based on xylene not exceeding the maximum allowed cleanup level in this table for total petroleum hydrocarbons and on prevention of adverse aestheic characteristics. This is a total value for all xylenes.

In response to the request for clarification on whether xylene needs to be measured at petroleum contaminated sites, Ecology believes this is appropriate because this chemical is a major constituent of gasoline. While it is possible that the total TPH value, if met, will meet the xylene cleanup level, as noted above, the gasoline cleanup levels are based on an assumed composition that may not be applicable to all sites. Measuring xylene, along with the other major gasoline ingredients will provide information to help determine if use of the total TPH cleanup level for gasoline is appropriate at a particular site.

GQ 19.1.39
Other comments regarding Table 720-1 are addressed in the following table.

Comment ID	Comment	Response
774, Newlon 2445 Newlon	Notes earlier comments addressed.	Comment noted.
809, Landau	Board concurs with all proposed changes except mineral oil.	Comment noted.
1239, Gillett	Wrong cross-reference used for DOH rules. Should be 246-290-310, not 296-290-310	Comment addressed in 2000 proposal.
1240, Gillett	Wrong cross-reference used for federal register. Should be 40 CFR 141.62 not 141.61.	Comment addressed in 2000 proposal.
1241, Gillett	Wrong cross reference for footnote l. Should be 40 CFR 141.80 not 141.51.	Comment addressed in 2000 proposal.
2330, Heaton	PHSKC supports changes to ground water cleanup standards.	Comment noted.

19.2 Method A Soil Cleanup Levels – General

The following generalized questions and responses apply to both Tables 740-1 and 745-1.

GQ 19.2.1
Was information from other studies (e.g. LLNL, Texas, Report to Gov. Locke) used in setting these standards?

(12, 13, 67, 797, 798, 837, 838, 841, 843, 915, 915, 941, 1197, 1198, 1232, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2544)

Commentors cited reports on petroleum contamination prepared by the Lawrence Livermore National Laboratory (LLNL), the Texas Bureau of Economic Geology, and an April, 1999 report

to Governor Locke on well contamination in WA State as justification for not needing more stringent Method A petroleum cleanup standards.

Response:
Ecology has reviewed the Lawrence Livermore Study (LLNL study) and the Texas Bureau of Economic Geology study cited by the commentors. Contrary to some perceptions, the purpose of the LLNL study was not to find out how many LUFT (the California acronym for "leaking underground fuel tanks") cases had contaminated the ground water and thus to say that the chances of ground water contamination from LUFTs are insignificant. The purpose of the LLNL study was to show through modeling the extent of benzene contamination and how much reduction in the benzene concentration can occur over time without active remediation.

The background for Ecology's conclusions about these two studies is discussed below:

Lawrence Livermore selected for study 271 sites from a database of about 29,000 cases. (Additional details on the selection criteria and the selection process is included GQ 1.1.2 of the Cost Benefit Analysis.)

LLNL found that about one-half of the plumes in those 271 sites were stable or expanding in length. The other half were "exhausted" (defined as having an insignificant trend and an average plume concentration of < 10 micrograms per liter) or shrinking in length. Additionally, the benzene concentrations in 76% of the plumes were "exhausted" or "shrinking." The rest (24%) were either stable or expanding. The Texas Bureau of Economic Geology study found somewhat higher percentages with stable or expanding plume lengths and benzene concentrations within the plumes.

Using a plume delineation limit of 10 ppb benzene, LLNL determined that the median plume length was 101 feet, the 90^{th} percentile plume length was 255 feet, and the maximum was 1,713 feet.

As a result of the LLNL study the California Environmental Protection Agency (CAL/EPA) made a policy decision about how many of the tank sites in the state would not require ground water cleanup. This was based on (1) estimated plume lengths, (2) how much degradation of benzene should occur, and (3) the likelihood of a receptor well. This decision was an administrative policy decision made by CAL/EPA, not a technical or scientific judgment made by the Lawrence Livermore National Laboratory.

Ecology has concerns about using these studies as the basis for concluding gasoline contaminated sites in Washington State have minimal impacts on ground water or justifying higher soil cleanup levels, as suggested by several commentors, for several reasons:

(1) The extent of ground water contamination in the LLNL study shows many of these plumes extended onto other properties;
(2) The analysis in both studies was limited to benzene and did not take into account more mobile additives like MTBE; and,

(3) While both studies confirmed benzene and other gasoline components degrade over time, these degradation processes adversely impact the usability of the ground water.
(4) The assumption in these studies that ground water in the vicinity of petroleum contaminated sites will not be used, contrary to State water quality laws and the MTCA cleanup regulation.
(5) These studies focused on ground water impacts of petroleum contaminated sites, not soil cleanup levels.

Consequently, Ecology cannot conclude from the LLNL or Texas studies that an insignificant number or percentage of ground water wells may be affected by a petroleum release or that ground water impacts from petroleum contaminated sites are minimal.

With regard to the report to Governor Locke (Ecology, 1999b), several commentors indicated that this report indicated 3.2% of the contaminated sites were due to gasoline contamination.

Actually, five of the thirty-eight specific sites reported on, or 13%, attributed the contamination to petroleum releases. That report was not intended to be a comprehensive look at all sites with ground water contamination in Washington State.

In the draft EIS on these rule amendments, Ecology reported an estimated 60% of all sites have contaminated ground water with 12% of sites having contaminated public or private wells. The EIS did not specifically focus on petroleum contamination. However, in a more recent report on MTBE contamination in WA State (Ecology, 2000a), Ecology took a more comprehensive look at ground water contamination at petroleum contaminated sites. That report indicated 1,900 of 6,000 or 32% of regulated underground storage tank sites in WA State have reported ground water contamination.

While these analyses have looked at the question of ground water contamination from different approaches, Ecology believes all of these statistics indicate ground water contamination in general, and ground water contamination by petroleum releases in particular, remains a major area of concern in WA State. Since contaminated soils can be a major contributor to ground water contamination, it is logical that the current Method A soil cleanup levels be subject to review and appropriate adjustments. In addition, none of these studies provide information from which can be concluded that the current Method A soil cleanup levels are protective of ground water, as asserted by several commentors.

GQ 19.2.2
Why was the particular model selected? Were other models tested? Why hasn't natural attenuation been incorporated into the model used? Why isn't 100 X ground water being used?

(38, 66, 355, 677, 718, 719, 825, 826, 835, 836, 844, 845, 846, 847, 849, 922, 1063, 1075, 1122, 1189, 1204, 1413, 2017, 2319, 2495, 2500, 2501, 2509, 2510, 2511, 2512, 2513, 2518)

Numerous commentors expressed concern with basing the Method A soil cleanup levels on the selected models, rather than the current 100 X ground water cleanup level approach in MTCA. Most of these comments were focused on the petroleum-related soil cleanup levels, with some

expressing concern that the models selected did not adequately incorporate natural attenuation. Others indicated that basing the Method A soil cleanup levels on other than 100 X ground water was not consistent with the PAC recommendations. Two commentors requested an independent review of the selected models. Still others expressed support for the approach taken.

Response:
Ecology disagrees that the Method A soil cleanup levels should be based on the old methodology of evaluating the soil-to-ground water exposure pathway by multiplying the ground water cleanup level by 100. The methodology proposed by Ecology more accurately quantifies the risk posed to ground water by hazardous substances within the soil and hence more accurately ensures the protection of human health. This amendment attempts to combine the goals advanced by the MTCA Policy Advisory Committee of creating a rule that achieves a level of simplicity combined with a level of human health and environmental protection consistent with advances in scientific information.

The proposal to replace the old "100 X ground water" model with the more accurate chemical and site-specific fate and transport models is based on an extensive review of new scientific and technical information. Although the 100 X ground water model was based on the best scientific and technical information available at the time, the old model does not adequately account for site or chemical-specific factors that control the movement of hazardous substances from soil into water. The movement of hazardous substances from soil into water is primarily controlled by two factors: the soil properties and the hazardous substance water solubility.

For example, some hazardous substances like benzene are relatively soluble in water. When gasoline is released to the soil, benzene will immediately start to partition from the gasoline into water that is held within the soil pores. The 100 X ground water model does not adequately account for this mobility. All hazardous substances are treated the same, even if some are more mobile than others. Consequently, for hazardous substances that are highly mobile (e.g., benzene, gasoline and chlorinated organics), the 100 X model will predict a soil concentration that is too high and consequently not sufficiently protective of human health. Conversely, for hazardous substances that are less mobile (e.g., PCBs, metals and heavier petroleum products), the 100 X model will predict a soil concentration that is too low.

The selection of the 3-phase model was based on a review of the scientific and technical information developed since the adoption of the 100 X ground water methodology in 1991. That review found that while there were numerous models available, many of the models were not suitable as a regulatory tool for a variety of reasons. For example, many of the models were proprietary and would not be available to consultants and PLPs without purchasing them—some for a considerable amount of money. Other models were written in specialized computer code or were difficult to use. Still others were developed for other purposes and were not suitable for the use Ecology intended. Thus, Ecology selected the model that has come to be known as the "3-phase" model. This model was selected because it did not have the above limitations and for several other reasons:

- It is based on scientific principles that are widely accepted by the academic community and industry.
- It is scientifically defensible.
- It is easy to use
- It is similar to the models used in the ASTM Risk-Based Correction Action standard and the U.S. Environmental Protection Agency's Soil Screening Guidance.

The 3-phase model accounts for partitioning of hazardous substances between the water, air and solid phases of a soil. One of the simplifying assumptions that went into the 3-phase model is that non-aqueous phase liquids or "NAPL" are not present at the site. Ecology recognized this could be a significant issue because a large percentage of the petroleum sites have NAPL present in both the soil and ground water, constituting a "fourth phase" in the soil. To address this issue, Ecology began a review of the scientific literature on how petroleum components partition from oil into water. What Ecology found is that when pure oil (i.e. gasoline or diesel fuel) was mixed with water, dissolved-phase concentrations could be accurately predicted using Raoult's law. Using this and other information, Ecology developed its "Interim TPH Policy" describing the use of Raoult's Law to predict ground water impacts at petroleum contaminated sites (Ecology, 1997a).

After publication of the Interim-TPH policy, Ecology contracted with Dr. Richelle Allen-King of Washington State University to do a sensitivity analysis on Ecology's Raoult's law model. Dr. Allen-King's work found that Ecology's Raoult's law model would over-predict, and in some cases under-predict, ground water concentrations at lower (100 - 1,000 mg/kg) soil concentrations (Roberts and Allen-King, 199?). As a result of this work, Ecology decided to replace the Interim-TPH (Raoult's law) model with the 4-phase partitioning model.

With regard to natural attenuation, Ecology acknowledges that the selected models do not directly include natural attenuation in either the soil or ground water. This policy choice was made for several reasons:

- The rate that natural attenuation that occurs is highly chemical and site-specific. It is not possible to develop generic assumptions that will be protective of ground water at all sites.
- While natural attenuation can help reduce contaminant impacts, in doing so, it causes a reducing condition in the ground water, resulting in other contaminant concentrations increasing in the ground water. These other contaminants can render the water unusable. Thus, Ecology believes it is inappropriate to base soil cleanup levels on an assumption that the ground water won't be used when these values are intended to represent concentrations that can be left in the soil without having to place restrictions on the property after cleanup.
- At many sites the contamination extends from near the ground surface to the ground water and thus there is no "clean" treatment zone in the soil.
- The 20 times ground water dilution factor used in both models is higher than the amount of ground water dilution that is likely to be found at many sites and thus does, to some degree, already factor in natural attenuation processes.

While the standard models provided in the rule do not directly take into account natural attenuation, the rule does provide for site-specific measurement of biodegradation rates and use of alternative models that do incorporate this and other attenuation mechanisms.

With regard to the request by some commentors for an independent review of these models, Ecology believes such a further review is unnecessary. As noted above, both of these models were subject to rigorous review by the MTCA Science Advisory Board or it's Fate and Transport Subcommittee, which included members from the private consulting community, the University of Washington, Washington State University and, in the case of the subcommittee, a scientist from the petroleum industry. As such, Ecology believes there was an independent review conducted of the proposed approach.

Finally, with regard to concerns raised on the consistency of the use of these models with the PAC recommendations, the Board noted in a August, 21, 1998 letter to the department that they viewed their work as consistent with "…the PAC's goal of promoting risk-based and site-specific cleanup levels." Furthermore, the Board noted the following in this same letter:

> Meeting of the subcommittee and the main SAB were held every few months. These meetings were open to the public and were frequently attended by attendees of the PAC meetings. The PAC was briefed on the activities of the SAB by Ecology staff, Dr. Julie Wilson, the SAB representative to the PAC, and the SAB chair, Dr. Hank Landau. During the more than two years of interaction with the PAC, the SAB understood that elimination of the 100 times multiplier was one of the PAC's goals and the substitution of the equilibrium partitioning approach was an acceptable approach.

For these reasons, Ecology stands by these models as appropriate for developing the Method A soil cleanup levels and for use in developing site-specific Method B and C soil cleanup levels that are protective of ground water.

GQ 19.2.3
Why are the Method A soil cleanup levels based on protecting ground water for drinking water use?

(1063, 1413)

As noted below, the derivation of the Method A soil cleanup levels included consideration of the soil leaching and impacting ground water. To conduct these calculations it was necessary to establish what use the ground water was to be protected for or a target ground water concentration. For the Method A soil cleanup levels this target ground water concentration was based on a drinking water beneficial use. One commentor questioned this assumption.

Response:
As explained in WAC 173-340-720(1), ground water cleanup levels must be based on estimates of the highest beneficial use and the reasonable maximum exposure expected to occur under both current and potential future site use conditions. The current Method A soil cleanup levels are based on protection of ground water for a drinking water beneficial use. Ecology is not

proposing to change this and used the same approach for developing the Method A cleanup levels in the proposed amendments. See chapter 10 for additional discussion of Ecology's reasons for the presumption of drinking water beneficial use.

GQ 19.2.4
Why haven't Method A cleanup levels been provided for more substances?

(79, 890)

Two commentors requested Ecology add cleanup levels for more substances to the Method A tables.

Response:
In an earlier draft of the proposed rule amendments Ecology did propose adding cleanup levels for additional substances to the Method A tables. However, several commentors objected to this, expressing concerns that such changes were beyond the scope of the PAC recommendations. In addition, Ecology is concerned with expanding this list because Method A doesn't not take into account additive risk. For these reasons, there has been limited expansion of Method A, primarily to address petroleum constituents. Ecology plans to update our "CLARC" database, which provides Method B and C cleanup levels for many more substances and for a variety of exposure pathways and media and can be used as a resource for developing cleanup levels for many other contaminants.

GQ 19.2.5
Can the Method A standards be used to designate what is "clean fill"?

(1085)

One commentor expressed concern that the Method A soil cleanup levels are being used inappropriately to determine what is "clean fill". They requested a statement be placed in the MTCA rule prohibiting this.

Response:
Ecology agrees that the purpose of Method A is to establish concentrations for the cleaning up of contaminated sites, not for allowing contamination to occur up to these concentrations. While additional statements to this effect could be added to the MTCA rule, we believe this is adequately addressed by the purpose of the rule as stated in WAC 173-340-100.

GQ 19.2.6
How were the Method A soil cleanup levels derived?

(129, 495, 496, 2290)

Response:

The Method A soil cleanup levels were developed using the procedures under Method B for unrestricted land uses without consideration of additive effects due to exposure to multiple hazardous substances. This process was the same as that used to establish the Method A values in 1991. The attached tables in Appendix D of the CES describe these calculations. In general, the following process was used to develop the Method A soil cleanup levels:

1. If there was an available soil standard that was based on a cancer risk of $1X10^{-5}$ or less or a hazard quotient of 1 or less, that value was used. An example of this is PCBs.
2. If there was no available soil standard, the direct contact and leaching to ground water pathways were evaluated as follows:
   (a) A direct contact soil concentration was calculated using the standard Method B equations. If both a reference dose and cancer potency factor was available for a substance, a concentration was calculated using both equations 740-1 and 740-2.
   (b) A soil concentration protective of ground water was calculated using procedures in WAC 173-340-747(4) (the 3-phase model) or WAC 173-340-747(6) (the 4-phase model). For each substance the Method A ground water cleanup level in table 720-1 was used as the target ground water concentration.
   (c) The lowest value from these calculations was selected as the cleanup level.
   (d) The calculated value was compared to natural background and the practical quantitation limit (PQL). If the value was below either of these concentrations, the higher of the natural background or PQL was selected as the Method A cleanup level.

The following provides a more detailed description of how these values were determined.

19.3 Table 740-1: Method A Soil Cleanup Levels for Unrestricted Land Uses

The following generalized questions and responses apply to Table 740-1.

GQ 19.3.1
What is the basis for the Method A soil cleanup level for **arsenic**?

Response:
The Method A soil cleanup level for arsenic was reviewed under this rule-making action, but has not been changed. The basis for this cleanup level was discussed in the 1991 Responsiveness Summary, which indicates it was based on soil natural background.

GQ 19.3.2
What is the basis for the Method A soil cleanup level for **benzene**? What evidence is there that the existing benzene soil cleanup level is not protective? Was data from existing cleanup sites reviewed?

(2, 3, 5, 6, 8, 9, 11, 15, 17, 20, 21, 22, 29, 33, 34, 35, 37, 62, 63, 65, 131, 678, 719, 775, 791, 792, 795, 796, 797, 802, 805, 813, 825, 826, 837, 839, 840, 848, 1087, 1189, 1195, 1196, 1199,

1201, 1203, 1209, 1210, 1211, 1212, 1230, 1233, 1290, 2018, 2027, 2122, 2292, 2412, 2415, 2446, 2488, 2501, 2508, 2513, 2515, 2516, 2517, 2518, 2575, 2576, 2580, 2487, 2665)

Response:
The Method A soil cleanup level for benzene is based on protection of ground water for a drinking water beneficial use, using equation 747-1 with a target ground water concentration of 5 ug/l from table 720-1. A Henry's constant of 0.228 cc/cc from table 747-4 was used in the calculation. The partitioning coefficient used in the calculation was derived using equation 747-2 and a soil organic carbon-water partitioning coefficient of 61.7 ml/g from table 747-4.

Numerous comments were received on the proposed benzene and gasoline soil cleanup levels, with most commentors suggesting that these proposed cleanup levels were not justified and expressing concerns about the increased cost of cleanups resulting from the more stringent soil cleanup levels.

No site data was provided by any of the commentors demonstrating that a higher soil cleanup level for benzene would be protective of ground water. However, based on the comments received, Ecology conducted a further extensive review of available site data and the models used to derive soil cleanup levels for benzene and gasoline. With regard to benzene, that review resulted in Ecology concluding that the current benzene soil cleanup level of 0.5 mg/kg is not protective of ground water and should be lowered to 0.03 mg/kg. See below for a further discussion of the gasoline soil cleanup level.

This review consisted of checking the 3-phase model and assumptions. In addition, Ecology also ran the 4-phase model using a variety of gasoline compositions to determine if a higher concentration of benzene could be left in the soil for gasoline mixtures. Those model runs confirmed that a benzene soil concentration of 0.03 mg/kg was necessary to insure the benzene ground water cleanup level of 5 ug/l was achieved.

In addition to the modeling work, Ecology conducted a review of the site files of over 100 gasoline-contaminated sites to find sites with benzene measurements in both ground water and soil. We also requested this data from the Pollution Liability Insurance Agency (PLIA) and several major petroleum companies. The petroleum companies and PLIA provided useable data for only a few sites. For the limited number of sites with data, a correlation was made between reported benzene soil and ground water concentrations. This information was presented to the MTCA Science Advisory Board as part of a proposal to justify a higher soil cleanup level. The Board aptly noted that the data actually showed that benzene soil concentrations well below the current rule Method A value of 0.5 mg/kg were resulting in benzene ground water concentrations in excess of the target ground water cleanup level of 5 ug/l. From this it was concluded that the current Method A soil cleanup level was not protective of ground water.

As a result of this work, Ecology concluded that the current Method A soil cleanup level was not protective of ground water and has proposed 0.03 mg/kg as the Method A soil cleanup level for benzene.

GQ 19.3.3
What is the basis for the Method A soil cleanup level for **benzo(a)pyrene**?

Response:
The Method A soil cleanup level for benzo(a)pyrene is based on equation 740-2 for direct contact and calculated using the cancer potency factor for benzo(a)pyrene in IRIS (7.3 kg-day/mg). This cleanup level can be also be used as the total concentration for all carcinogenic polycyclic aromatic hydrocarbons (cPAHs) by converting the other cPAHs to an equivalent concentration of benzo(a)pyrene using the procedures in WAC 173-340-708(8)(d). See cPAHs, below.

GQ 19.3.4
What is the basis for the Method A soil cleanup level for **cadmium**?

Response:
The Method A soil cleanup level for cadmium is based on protection of ground water for a drinking water beneficial use, using equation 747-1 with a target ground water concentration of 5 ug/l from table 720-1, a Henry's constant of zero, and a partitioning coefficient of 6.7 L/kg from table 747-3. This calculated concentration was below the PQL using EPA Method SW 6010A, so the cleanup level was adjusted to the PQL of 2 mg/kg. It should be noted that there are other more sensitive analytical methods but this one was selected because it is a commonly used, low-cost method of measuring soil metal concentrations.

GQ 19.3.5
What is the basis for the Method A soil cleanup level for **chromium VI**?

The Method A soil cleanup level for hexavalent chromium (chromium +6) is based on protection of ground water for a drinking water beneficial use, using equation 747-1 with a target ground water concentration of 50 ug/l (from Table 720-1), a Henry's constant of zero, and a partitioning coefficient of 19 L/kg from table 747-3.

GQ 19.3.6
What is the basis for the Method A soil cleanup level for **chromium III**?

(495, 497)

Response:
The Method A soil cleanup level for trivalent chromium (chromium +3) is based on protection of ground water for a drinking water beneficial use, using equation 747-1 with a target ground water concentration of 100 ug/l from table 720-1, a Henry's constant of zero, and a partitioning coefficient of 1000 L/kg from table 747-3. One commentor questioned the resultant cleanup level, indicating that it appeared to be excessively low. This cleanup level is primarily a function of the partitioning coefficient assumed in the calculation. Ecology believes, based on the information presented in Chapter 15, that the value selected for chromium III is a reasonable mid-range estimate for its' partitioning coefficient. If it is believed this value is inappropriate for

a site, WAC 173-340-747 allows development of a site-specific partitioning coefficient or use of a leaching test to predict ground water impacts.

GQ 19.3.7
What is the basis for the Method A soil cleanup level for **DDT**?

Response:
The Method A soil cleanup level for DDT is based on equation 740-2 for direct contact and calculated using the cancer potency factor for DDT in IRIS (0.34 kg-day/mg).

GQ 19.3.8
What is the basis for the Method A soil cleanup level for **ethyl benzene**?

(132, 775, 1287, 2293, 2413, 2446)

Response:
The Method A soil cleanup level for ethyl benzene is based on protection of ground water for a drinking water beneficial use, using equation 747-1 with a target ground water concentration of 700 ug/l from table 720-1. The Henry's Constant used in the calculation was 0.323 cc/cc from table 747-4. The partitioning coefficient used in the calculation was derived using equation 747-2 and the soil organic carbon-water partitioning coefficient of 204 L/kg from table 747-4.

The POG, in a comment on an earlier rule draft, and many others commenting in general on the petroleum-related soil cleanup levels, have expressed concern with that this approach results in the reduction of the current Method A soil cleanup level and will increase the cost of cleanup. In a later comment, the POG and Newlon acknowledged that the calculation was properly completed.

No site data was provided by any of the commentors demonstrating that a higher soil cleanup level for ethyl benzene would be protective of ground water. However, in response to these comments, Ecology again reviewed the procedures used to calculate this cleanup level. We also considered using the 4-phase model results to derive a soil cleanup level for ethyl benzene but that model would have resulted in an even lower soil cleanup level. Based on this review, and review by the MTCA Science Advisory Board, we believe the appropriate procedures were used to calculate this soil cleanup level. We also believe that it is both necessary and appropriate to reduce the current Method A soil cleanup level for ethyl benzene to the proposed value to assure that the soil cleanup level will be protective of human health and the environment.

GQ 19.3.9
What is the basis for the Method A soil cleanup level for **ethylene dibromide (EDB)**?

Response:
The Method A soil cleanup level for ethylene dibromide is based on protection of ground water for a drinking water beneficial use, using equation 747-1 with a target ground water concentration of 0.01 ug/l from table 720-1. A Henry's constant of 3.36×10^{-2} cc/cc was used in

the calculation (ATSDR, 1991). The partitioning coefficient used in the calculation was derived using equation 747-2 and a soil organic carbon-water partitioning coefficient of 66 L/kg from table 747-1.

GQ 19.3.10
What is the basis for the Method A soil cleanup level for **lead**?

(413, 2232, 2233, 2234, 2662)

Three commentors suggested that this value is too low and urged Ecology to propose a higher soil cleanup level based on a variety of methods that would increase this value substantially (suggested values were 353 to 5,000 mg/kg).

Response:
The Method A soil cleanup level for lead was reviewed under this rule-making action, but has not been changed. The basis for the current Method A soil cleanup level for lead can be found in the 1991 Responsiveness Summary. See Chapter 9 for additional discussion of alternative methods for soil lead cleanup levels.

GQ 19.3.11
What is the basis for the Method A soil cleanup level for **lindane**?

Response:
The Method A soil cleanup level for lindane is based on protection of ground water for a drinking water beneficial use, using equation 747-1 with a target ground water concentration of 0.2 ug/l from table 720-1. A Henry's constant of 5.74 X 10^{-4} cc/cc was used in the calculation (U.S. EPA, 1996). The partitioning coefficient used in the calculation was derived using equation 747-2 and a soil organic carbon-water partitioning coefficient of 1,352 L/kg from table 747-1.

GQ 19.3.12
What is the basis for the Method A soil cleanup level for **methylene chloride**?

Response:
The Method A soil cleanup level for methylene chloride is based on protection of ground water for a drinking water beneficial use, using equation 747-1 with a target ground water concentration of 5 ug/l from table 720-1. A Henry's constant of 8.98 X 10^{-2} cc/cc was used in the calculation (U.S. EPA, 1996). The partitioning coefficient used in the calculation was derived using equation 747-2 and a soil organic carbon-water partitioning coefficient of 10 L/kg from table 747-1.

GQ 19.3.13
What is the basis for the Method A soil cleanup level for **mercury**?

Response:

The Method A soil cleanup level for mercury is based on protection of ground water for a drinking water beneficial use, using equation 747-1 with a target ground water concentration of 2 ug/l from table 720-1. Also used in the calculation was a Henry's constant of 0.467 cc/cc (U.S. EPA, 1996), and a partitioning coefficient of 52 L/kg from table 747-3.

GQ 19.3.14
What is the basis for the Method A soil cleanup level for **MTBE**?

Response:
The Method A soil cleanup level for methyl tertiary-butyl ether (MTBE) is based on protection of ground water for a drinking water beneficial use, using equation 747-1 with a target ground water concentration of 20 ug/l from table 720-1. A Henry's constant of 1.8 X 10^{-2} cc/cc was used in the calculation (USGS, 1996). The partitioning coefficient used in the calculation was derived using equation 747-2 and a soil organic carbon-water partitioning coefficient of 11 L/kg from table 747-1.

GQ 19.3.15
What is the basis for the Method A soil cleanup level for **naphthalene**?

Response:
The Method A soil cleanup level for naphthalene is based on protection of ground water for a drinking water beneficial use, using equation 747-1 with a target ground water concentration of 160 ug/l from table 720-1. The Henry's Constant used in the calculation was 1.98 X 10^{-2} cc/cc from table 747-4. The partitioning coefficient used in the calculation was derived using equation 747-2 and the soil organic carbon-water partitioning coefficient of 1191 L/kg from table 747-4.

GQ 19.3.16
What is the basis for the Method A soil cleanup level for **carcinogenic PAHs**?

(135, 136, 137, 1063, 1285, 2296, 2297, 2298, 2314)

Response:
There is no separate Method A soil cleanup level for total cPAHs. The user is referred to the soil cleanup level for benzo(a)pyrene, which, as noted above, is based on direct contact. The person using Method A to determine if a sample exceeds the Method A cleanup level for cPAHs must first convert the cPAHs to an equivalent concentration of benzo(a)pyrene. That can be done either assuming all of the cPAHs are equally toxic to benzo(a)pyrene or using the CalEPA toxicity equivalency factors. That concentration is then compared to the Method A cleanup level for benzo(a)pyrene to determine if the sample is above or below the Method A cleanup level. The weighting factors used in these calculations can be found in **Table 19-3**.

Table 19-2: Weighting Factors for Conversion of a cPAH mixture to an equivalent concentration of benzo(a)pyrene.

Compound	Weighting factors for conversion of cPAH mixtures to an equivalent concentration of benzo(a)pyrene, assuming all cPAHs are equivalent in toxicity to benzo(a)pyrene	CalEPA weighting factors for conversion of cPAH mixtures to an equivalent concentration of benzo(a)pyrene*
Benzo(a)pyrene	1.0	1.0
Benzo(a)anthracene	1.0	0.1
Benzo(b)fluoranthene	1.0	0.1
Benzo(k)fluoranthene	1.0	0.1
Chrysene	1.0	0.01
Dibenz(a,h)anthracene	1.0	0.4
Ideno(1,2,3-cd)pyrene	1.0	0.1

* CalEPA, 1994

Note that in the November, 1999 draft of the rule amendments, Ecology had proposed a Method A soil cleanup level for total cPAHs of 1 mg/kg. This value was based on assuming seven cPAHs were present in the soil, all in equal concentration and of equal toxicity to benzo(a)pyrene. The POG indicated they believed this calculation was incorrect. In response to this comment, in the August, 2000 draft, Ecology deleted the total cPAH cleanup level and instead proposed the above approach.

In a further comment on the August, 2000 draft, the POG expressed concern that the wording of the footnote for benzo(a)pyrene implied that the other cPAHs did not need to be tested for. In response to this comment, Ecology has modified this footnote in the final rule.

GQ 19.3.17
What is the basis for the Method A soil cleanup level for **PCBs**?

(2019)

Response:
The soil cleanup level for PCBs was based on the EPA value for unrestricted land use (40 C.F.R. Part 761.61). This value was checked for protectiveness for the direct contact and leaching pathways and determined to fall within the range of values likely to be calculated under Method B. One commentor questioned the value selected, indicating that a higher value (10 mg/kg) is allowed under the EPA rule and that value should be used.

Ecology acknowledges that EPA allows up to 10 mg/kg of PCBs in residential soils. However, for residential "high contact" situations, EPA requires a land use restriction when using 10 mg/kg. Such restrictions are inconsistent with the intent of the values in Table 740-1. For this reason, Ecology selected the lower end of the EPA range at 1 mg/kg as the Method A cleanup level.

GQ 19.3.18
What is the basis for the Method A soil cleanup level for **tetrachloroethylene**?

Response:
The Method A soil cleanup level for tetrachloroethylene is based on protection of ground water for a drinking water beneficial use, using equation 747-1 with a target ground water concentration of 5 ug/l from table 720-1. A Henry's constant of 0.754 cc/cc was used in the calculation (U.S. EPA, 1996). The partitioning coefficient used in the calculation was derived using equation 747-2 and a soil organic carbon-water partitioning coefficient of 265 L/kg from table 747-1.

GQ 19.3.19
What is the basis for the Method A soil cleanup level for **toluene**?

(132, 775, 1287, 2293, 2413, 2446)

Response:
The Method A soil cleanup level for toluene is based on protection of ground water for a drinking water beneficial use, using equation 747-1 with a target ground water concentration of 1000 ug/l from table 720-1. The Henry's Constant used in the calculation was 0.272 cc/cc from table 747-4. The partitioning coefficient used in the calculation was derived using equation 747-2 and the soil organic carbon-water partitioning coefficient of 140 L/kg from table 747-4.

The POG, in a comment on an earlier rule draft, and many others commenting in general on the petroleum-related soil cleanup levels, expressed concern that this approach results in the reduction of the current Method A soil cleanup level and will increase the cost of cleanup. In a later comment, the POG and Newlon acknowledged that the calculation was properly completed.

No site data was provided by any of the commentors demonstrating that a higher soil cleanup level for toluene would be protective of ground water. However, in response to these comments, Ecology again reviewed the procedures used to calculate this cleanup level. We also considered using the 4-phase model results to derive a soil cleanup level for toluene but that model would have resulted in an even lower soil cleanup level. Based on this review, and review by the MTCA Science Advisory Board, we believe the appropriate procedures were used to calculate this soil cleanup level. We also believe that it is both necessary and appropriate to reduce the current Method A soil cleanup level for toluene to the proposed value to assure that the soil cleanup level will be protective of human health and the environment.

GQ 19.3.20
What is the basis for the Method A soil cleanup level for **TPH-Diesel Range Organics**?

(792, 803, 1222)

Response:
The Method A soil cleanup level for diesel range organics was determined using the following procedure. Additional details can be found in the rule-making file.

- First, a typical product composition was assumed. The composition used assumed the diesel range organics are present in the form of diesel fuel with no detectable benzene. Ecology believes this is representative of the type of product releases likely to be seen at retail pumps and home heating oil tanks.
- Second, equation 740-4 and the POG-recommended reference doses were used to calculate a direct contact soil concentration.
- Third, the 4-phase model and the procedures in WAC 173-340-747(6) were used to predict a ground water concentration using various soil concentrations. For all diesel fuel mixtures without benzene it was found that the predicted ground water concentration always had a hazard index less than 1.
- The implication of the 4-phase calculations was that an infinite amount of diesel fuel could be left in the soil without causing ground water impacts. Ecology then reviewed the literature for available residual saturation soil concentrations. Based on this review of the literature, a soil concentration of 2000 mg/kg was determined to be a concentration that would not result in the exceedance of residual saturation for most soil conditions. See Chapter 15 for a discussion of the basis for this residual saturation value.

The above procedure resulted in a cleanup level of 2000 mg/kg. The MTCA Science Advisory Board reviewed this procedure and concurred with Ecology's proposed cleanup level. The three comments received on this cleanup level were all supportive.

Note that the assumed composition does not contain any carcinogenic substances such as benzene, cPAHs or PCBs. If these are present at a site, cleanup levels for those substances will have to be met and it is likely the resultant total TPH cleanup level will be considerably lower than this value. In addition, note that this cleanup level is based on the assumption that the diesel range organics contaminated soil is above the ground water. If this is not the case, a much lower soil cleanup level may be necessary to protect ground water.

Note that recently, the National Institute of Environmental Health Services has announced that naphthalene, a diesel fuel component, causes cancer in animals. If EPA proceeds with development of a cancer potency factor for naphthalene, this could result in a much lower ground water cleanup level for naphthalene than is currently allowed under Method B, and consequently, a lower soil cleanup level for diesel range organics.

GQ 19.3.21
Can the Method A soil cleanup level for diesel range organics be used for **jet fuel**?

(1069, 1435)

Response:
Ecology did not include a Method A soil cleanup level for jet fuel because equivalent carbon fraction data was not available for jet fuels. Based on limited data, jet fuels and marine diesel fuels may contain more benzene and light aromatics than that assumed for the diesel range organics (DRO) calculation. Thus, the DRO cleanup level may be used at a site contaminated

with these products only if it is confirmed that the product present has a similar composition to that used to derive the Method A diesel range organics value (including no detectable benzene).

GQ 19.3.22
What is the basis for the Method A soil cleanup level for **TPH-Gasoline Range Organics**? What evidence is there that the existing gasoline soil cleanup level is not protective? Was data from existing cleanup sites reviewed?

(2, 3, 6, 8, 9, 15, 21, 22, 29, 33, 34, 37, 62, 65, 678, 719, 775, 791, 795, 796, 797, 802, 805, 825, 826, 837, 839, 840, 848, 873, 1189, 1199, 1201, 1203, 1209, 1210, 1211, 1212, 1230, 1233, 1290, 2018, 2027, 2028, 2029, 2122, 2413, 2446, 2488, 2501, 2508, 2513, 2515, 2516, 2517, 2518, 2575, 2576, 2580, 2487, 2665)

In November, 1999, Ecology proposed reducing the gasoline TPH soil cleanup level from the current rule value of 100 mg/kg to 30 mg/kg. Numerous comments were received expressing concerns about this decreased concentration, with most concerns focusing on the potential for increased cleanup costs.

Response:
No site data was provided by any of the commentors demonstrating that a higher soil cleanup level for gasoline would be protective of ground water. However, because of these concerns, Ecology reviewed this cleanup level again. This review consisted of checking the 4-phase model and assumptions. In addition, Ecology also ran the 4-phase model using a variety of gasoline compositions to determine if a higher soil gasoline soil concentration would be protective of ground water. These modeling runs confirmed that fresh gasoline could adversely impact ground water at soil concentrations of only a few mg/kg.

In addition to the modeling work, Ecology conducted a review of the site files of over 100 gasoline-contaminated sites to find sites with benzene and gasoline measurements in both ground water and soil. We also requested this data from the Pollution Liability Insurance Agency (PLIA) and several major petroleum companies. The petroleum companies and PLIA provided data on only a few sites. We found that most sites had very limited, unusable data. Using this data, we found that, before cleanup, the typical benzene soil concentration was about 0.1% of the gasoline mixture and the typical soil gasoline TPH concentration was about 100 mg/kg. It is interesting to note that these typical soil concentrations <u>before cleanup</u> were at the current Method A soil cleanup levels, a concentration many of the commentors suggested was protective of ground water, a conclusion that contradicts other evidence discussed earlier.

Only one of these gasoline-contaminated sites had analyzed for equivalent carbon fractions. Using data from this site and gasoline composition data Ecology had measured in a earlier laboratory study, we used the 4-phase model to simulate the weathering of fresh gasoline until we achieved compositions with a 0.1% benzene content. Using these somewhat "weathered" compositions to represent a typical gasoline contaminated site we then again ran the 4-phase model to determine a soil gasoline concentration that would be protective of groundwater. Those

model runs confirmed that a gasoline soil concentration in the range of 20 to 30 mg/kg would be protective of ground water, confirming Ecology's proposed soil cleanup level.

In addition to the above, Ecology decided to extend the simulated weathering program to determine if any gasoline composition would be protective of ground water at a soil concentration of 100 mg/kg. Those model runs indicated that this was achievable with a highly weathered gasoline composition with no benzene in the soil and most of the lighter aromatics weathered out. Thus, in the August, 2000 proposed rule, we proposed two soil cleanup levels for gasoline—one at 30 mg/kg for most gasoline contaminated sites and one at 100 mg/kg at sites with highly weathered gasoline in the soil. Highly weathered was defined as containing no benzene and less than 20% aromatics in the EC 8 to EC 16 fractions.

In response to continuing concerns raised about the complexity of the rule and the added cost of cleanup under the new cleanup levels, Ecology further examined the way we had defined highly weathered gasoline. As proposed, this would have required measuring of TPH fractions, an added expense. Upon further review of the model runs, we concluded it was possible to define highly weathered gasoline by its benzene, toluene, ethyl benzene and xylene composition. Since these substances are required to be measured at gasoline contaminated sites under the current rule, we believe adjusting this footnote to focus on these four chemicals will be easier and less costly to implement. Thus, in the final rule, we have replaced the requirement for 20% aromatics with the following statement:

> The higher value of 100 mg/kg can only be used if the soil is tested and found to contain no benzene and the total of ethyl benzene, toluene and xylene are less than 1% of the gasoline mixture.

Additional details of Ecology's work can be found in the rule-making file. In conclusion, Ecology believes it has made an extraordinary effort to address concerns raised by petroleum company representatives. We believe the proposed soil cleanup levels for gasoline are scientifically justifiable and technically sound.

GQ 19.3.23
What is the basis for the Method A soil cleanup level for **TPH-Heavy Oil**?

Response:
Heavy oils include products such as lubricating oils, hydraulic oils and bunker fuels. In developing this cleanup level, Ecology did not have access to heavy oil compositions broken down by equivalent carbon fractions, but we did have information on the general composition of these various heavy oils. This information was compared to information on petroleum products with fraction information, primarily mineral oil and diesel fuels. Mineral oil is a much more refined product and did not appear to be similar enough in composition to most heavy oils to be a good model to use for heavy oil. Diesel fuels contain more light aromatic components than most heavy oils but also do not contain the carcinogenic PAHs that are likely to be present in heavy oils. On balance, Ecology determined that diesel fuel would be a reasonable conservative model

for heavy oils and the cleanup level for diesel range organics, described above, was used as the heavy oil cleanup level.

Note that the assumed composition does not contain any carcinogenic substances such as benzene, cPAHs or PCBs. If these are present at a site, cleanup levels for those substances will have to be met and it is likely the resultant total TPH cleanup level will be considerably lower than this value.

GQ 19.3.24
What is the basis for the Method A soil cleanup level for **TPH-Mineral Oil**?

(133, 775, 2294, 2413, 2446)

Response:
The Method A soil cleanup level for mineral oil was determined using the following procedure. Additional details can be found in the rule-making file.

- First, a typical product composition was assumed. The composition used assumed the mineral oil contained no detectable PCBs. Ecology believes this is representative of the type of mineral oil products likely to be in use in Washington State.
- Second, equation 740-4 and the POG-recommended reference doses were used to calculate a direct contact soil concentration.
- Third, the 4-phase model and the procedures in WAC 173-340-747(6) were used to predict a ground water concentration using various soil concentrations. For all mineral oil mixtures it was found that the predicted ground water concentration always had a hazard index less than 1.
- The implication of the 4-phase calculations was that an infinite amount of mineral oil could be left in the soil without causing ground water impacts. Ecology then reviewed the literature for available residual saturation soil concentrations. Based on this review of the literature, a soil concentration of 4000 mg/kg was determined to be a concentration that would not result in the exceedance of residual saturation for most soil conditions. This concentration was based on a study done by the Electric Power Research Institute at the Bonneville Power Corporation Franklin Substation in Washington State. The soils at that site are coarse textured sands and gravels.

The above procedure resulted in a cleanup level of 4000 mg/kg. The MTCA Science Advisory Board reviewed this procedure and concurred with Ecology's proposed cleanup level.

Note that the assumed composition does not contain any carcinogenic substances such as benzene, cPAHs or PCBs. If these are present at a site, cleanup levels for those substances will have to be met and it is likely the resultant total TPH cleanup level will be considerably lower than this value. In addition, note that this cleanup level is based on the assumption that the mineral oil contaminated soil is above the ground water. If this is not the case, a much lower soil cleanup level may be necessary to protect ground water.

GQ 19.3.25
What is the basis for the Method A soil cleanup level for **1,1,1 trichloroethane**?

Response:
The Method A soil cleanup level for 1,1,1 trichloroethane is based on protection of ground water for a drinking water beneficial use, using equation 747-1 with a target ground water concentration of 200 ug/l from table 720-1. A Henry's constant of 0.705 cc/cc was used in the calculation (U.S. EPA, 1996). The partitioning coefficient used in the calculation was derived using equation 747-2 and a soil organic carbon-water partitioning coefficient of 135 L/kg from table 747-1.

GQ 19.3.26
What is the basis for the Method A soil cleanup level for **trichloroethylene**?

(1063)

Response:
The Method A soil cleanup level for trichloroethylene is based on protection of ground water for a drinking water beneficial use, using equation 747-1 with a target ground water concentration of 5 ug/l from table 720-1. A Henry's constant of 0.422 cc/cc was used in the calculation (U.S. EPA, 1996). The partitioning coefficient used in the calculation was derived using equation 747-2 and a soil organic carbon-water partitioning coefficient of 94 L/kg from table 747-1. One comment was received on this value, expressing concern that the Method A soil cleanup level for trichloroethylene should not be based on protection of ground water for drinking water use. See the response above for a discussion of why the Method A soil cleanup levels are based on protection of ground water for drinking water beneficial use.

GQ 19.3.27
What is the basis for the Method A soil cleanup level for **xylene**?

(2, 8, 132, 775, 1287, 2293, 2413, 2446)

Response:
The Method A soil cleanup level for xylene is based on protection of ground water for a drinking water beneficial use, using equation 747-1 with a target ground water concentration of 1000 ug/l from table 720-1. The Henry's Constant used in the calculation was 0.279 cc/cc from table 747-4. The partitioning coefficient used in the calculation was derived using equation 747-2 and the soil organic carbon-water partitioning coefficient of 233 L/kg from table 747-4.

The POG, in a comment on an earlier rule draft, and many others, commenting in general on the petroleum-related soil cleanup levels, have expressed concern that this approach results in the reduction of the current Method A soil cleanup level and will increase the cost of cleanup. In a later comment, the POG and Newlon acknowledged that the calculation was properly completed.

No site data was provided by any of the commentors demonstrating that a higher soil cleanup level for xylene would be protective of ground water. However, in response to these comments, Ecology again reviewed the procedures used to calculate this cleanup level. We also considered using the 4-phase model results to derive a soil cleanup level for xylene but that model would have resulted in an even lower soil cleanup level. Based on this review, and review by the MTCA Science Advisory Board, we believe the appropriate procedures were used to calculate this soil cleanup level. We also believe that it is both necessary and appropriate to reduce the current Method A soil cleanup level for xylene to the proposed value to assure that the soil cleanup level will be protective of human health and the environment.

19.4 Table 745-1: Method A Soil Cleanup Levels for Industrial Properties

The following generalized questions and responses apply to Table 745-1

GQ 19.4.1
Why are many of the industrial soil cleanup levels the same as those for unrestricted land use?

(1414)

Response:
The reason many of the industrial soil cleanup levels are the same as those for unrestricted land use is because these cleanup levels are controlled by the soil leaching pathway. This is because the soil cleanup levels are based on the assumption that the ground water is to be protected for the highest beneficial use of drinking water. This ground water use determination is independent of the surface land use. Ecology believes this is an appropriate assumption for the reasons discussed in Chapter 10. As a result, the calculations for this pathway result in the same cleanup level as for unrestricted land uses for many contaminants.

GQ 19.4.2
What is the basis for the Method A soil cleanup level for **arsenic**?

Response:
The Method A soil cleanup level for arsenic is based on the same natural background as the soil cleanup level found in table 740-1. This is because the concentration derived for the soil leaching pathway is below natural background. That concentration was derived based on protection of ground water for a drinking water beneficial use, using equation 747-1 with a target ground water concentration of 5 ug/l from table 720-1, a Henry's constant of zero, and a partitioning coefficient of 29 L/kg from table 747-3. This calculated concentration was below natural background, so the cleanup level was adjusted to the same natural background concentration that was used for table 740-1.

GQ 19.4.3
What is the basis for the Method A soil cleanup level for **benzene**? What evidence is there that the existing benzene soil cleanup level is not protective? Was data from existing cleanup sites reviewed?

(2, 3, 5, 6, 8, 9, 11, 15, 17, 20, 21, 22, 29, 33, 34, 35, 37, 62, 63, 65, 131, 678, 719, 775, 791, 792, 795, 796, 797, 802, 805, 813, 825, 826, 837, 839, 840, 848, 1087, 1189, 1195, 1196, 1199, 1201, 1203, 1209, 1210, 1211, 1212, 1230, 1233, 1290, 2018, 2027, 2122, 2292, 2412, 2415, 2446, 2488, 2501, 2508, 2513, 2515, 2516, 2517, 2518, 2575, 2576, 2580, 2487, 2665)

Response:
See the response for Table 740-1.

GQ 19.4.4
What is the basis for the Method A soil cleanup level for **benzo(a)pyrene**?

Response:
The Method A soil cleanup level for benzo(a)pyrene is based on protection of ground water for a drinking water beneficial use, using equation 747-1 with a target ground water concentration of 0.1 ug/l from table 720-1. A Henry's constant of 4.63 X 10^{-5} cc/cc was used in the calculation (U.S. EPA, 1996). The partitioning coefficient used in the calculation was derived using equation 747-2 and a soil organic carbon-water partitioning coefficient of 968,774 L/kg from table 747-1. This cleanup level can be also be used as the total concentration for all carcinogenic polycyclic aromatic hydrocarbons (cPAHs) by converting the other cPAHs to an equivalent concentration of benzo(a)pyrene using the procedures in WAC 173-340-708(8)(d) and making an adjustment for the difference in leachability of the different cPAHs relative to benzo(a)pyrene.

GQ 19.4.5
What is the basis for the Method A soil cleanup level for **cadmium**?

Response:
See the response for Table 740-1.

GQ 19.4.6
What is the basis for the Method A soil cleanup level for **chromium VI**?

Response:
See the response for Table 740-1.

GQ 19.4.7
What is the basis for the Method A soil cleanup level for **chromium III**?

495, 497

Response:

See the response for Table 740-1.

GQ 19.4.8
What is the basis for the Method A soil cleanup level for **DDT**?

Response:
The Method A soil cleanup level for DDT is based on protection of ground water for a drinking water beneficial use, using equation 747-1 with a target ground water concentration of 0.3 ug/l from table 720-1. A Henry's constant of 3.32 X 10^{-4} cc/cc was used in the calculation (U.S. EPA, 1996). The partitioning coefficient used in the calculation was derived using equation 747-2 and a soil organic carbon-water partitioning coefficient of 386,977 L/kg from table 747-1.

GQ 19.4.9
What is the basis for the Method A soil cleanup level for **ethyl benzene**?

132, 775, 1287, 2293, 2413, 2446

Response:
See the response for Table 740-1.

GQ 19.4.10
What is the basis for the Method A soil cleanup level for **ethylene dibromide (EDB)**?

Response:
See the response for Table 740-1.

GQ 19.4.11
What is the basis for the Method A soil cleanup level for **lead**?

(2235)

One commentor suggested that this value is too low and urged Ecology to change the soil cleanup level to 5,000 mg/kg.

Response:
The Method A soil cleanup level for lead was reviewed under this rule-making action, but has not been changed. The basis for the current Method A soil cleanup level for lead can be found in the 1991 Responsiveness Summary. See Chapter 9 for additional discussion of alternative methods for soil lead cleanup levels.

GQ 19.4.12
What is the basis for the Method A soil cleanup level for **lindane**?

Response:
See the response for Table 740-1.

GQ 19.4.13
What is the basis for the Method A soil cleanup level for **methylene chloride**?

Response:
See the response for Table 740-1.

GQ 19.4.14
What is the basis for the Method A soil cleanup level for **mercury**?

Response:
See the response for Table 740-1.

GQ 19.4.15
What is the basis for the Method A soil cleanup level for **MTBE**?

Response:
See the response for Table 740-1.

GQ 19.4.16
What is the basis for the Method A soil cleanup level for **naphthalene**?

Response:
See the response for Table 740-1.

GQ 19.4.17
What is the basis for the Method A soil cleanup level for **carcinogenic PAHs**?

(135, 136, 137, 1063, 1285, 2296, 2297, 2298, 2314)

Response:
There is no separate Method A soil cleanup level for total cPAHs. The user is referred to the ground water cleanup level for benzo(a)pyrene, which, as noted above, is based on the soil leaching pathway. The person using Method A, to determine if a sample exceeds the Method A cleanup level for cPAHs, must first convert the cPAHs to an equivalent concentration of benzo(a)pyrene. That can be done either assuming all of the cPAHs are equally toxic to benzo(a)pyrene or using the CalEPA toxicity equivalency factors. Furthermore, because the cleanup level for benzo(a)pyrene is based on the leaching pathway, a further adjustment must be made for the difference in leachability of the different cPAHs relative to benzo(a)pyrene.

In a comment on the August, 2000 draft, the POG expressed concern that the wording of the footnote for benzo(a)pyrene implied that the other cPAHs did not need to be tested for. In response to this comment, Ecology has modified this footnote in the final rule.

GQ 19.4.18
What is the basis for the Method A soil cleanup level for **PCBs**?

Response:
The soil cleanup level for PCBs was based on the EPA value for high occupancy areas with a cap (40 C.F.R Part 761.61).

GQ 19.4.19
What is the basis for the Method A soil cleanup level for **tetrachloroethylene**?

Response:
See the response for Table 740-1.

GQ 19.4.20
What is the basis for the Method A soil cleanup level for **toluene**?

(132, 775, 1287, 2293, 2413, 2446)

Response:
See the response for Table 740-1.

GQ 19.4.21
What is the basis for the Method A soil cleanup level for **TPH-Diesel Range Organics**?

(792, 803, 1222)

Response:
See the response for Table 740-1.

GQ 19.4.22
Can the Method A soil cleanup level for diesel range organics be used for **jet fuel**?

(1069, 1435)

Response:
See the response for Table 740-1.

GQ 19.4.23
What is the basis for the Method A soil cleanup level for TPH-Gasoline Range Organics? What evidence is there that the existing gasoline soil cleanup level is not protective? Was data from existing cleanup sites reviewed?

2, 3, 6, 8, 9, 15, 21, 22, 29, 33, 34, 37, 62, 65, 678, 719, 775, 791, 795, 796, 797, 802, 805, 825, 826, 837, 839, 840, 848, 873, 1189, 1199, 1201, 1203, 1209, 1210, 1211, 1212, 1230, 1233,

1290, 2018, 2027, 2028, 2029, 2122, 2413, 2446, 2488, 2501, 2508, 2513, 2515, 2516, 2517, 2518, 2575, 2576, 2580, 2487, 2665

Response:
See the response for Table 740-1.

GQ 19.4.24
What is the basis for the Method A soil cleanup level for **TPH-Heavy Oil**?

Response:
See the response for Table 740-1.

GQ 19.4.25
What is the basis for the Method A soil cleanup level for **TPH-Mineral Oil**?

(133, 775, 2294, 2413, 2446)

Response:
See the response for Table 740-1.

GQ 19.4.26
What is the basis for the Method A soil cleanup level for **1,1,1 trichloroethane**?

Response:
See the response for Table 740-1.

GQ 19.4.27
What is the basis for the Method A soil cleanup level for **trichloroethylene**?

(1063)

Response:
See the response for Table 740-1.

GQ 19.4.28
What is the basis for the Method A soil cleanup level for **xylene**?

(2, 8, 132, 775, 1287, 2293, 2413, 2446)

Response:
See the response for Table 740-1.

GQ 19.4.29
Other comments regarding Table 745-1 are addressed in the following table.

Comment ID	Comment	Response
134, 2295, POG; 1252, Gillett	The footnotes in table 745-1 do not match the footnotes in the table for several substances.	Comment addressed in 2000 proposal.

19.5 General

GQ 19.5.1
Why has Ecology included information beyond the Method A tables in WAC 173-340-900?

(24)

Response:
What tables should be part of the rule versus published in guidance has been an on-going discussion during this rule-making process. Even though some information in the tables will be subject to change through a future rule-making as new information becomes available, Ecology concluded that it was better to be more inclusive and include information in the rule, since some users may not realize that further guidance is available.

Chapter 20 Economic Analyses

20.1 Small Business Economic Impact Statement

GQ 20.1.1
Has Ecology complied with the requirements of the Regulatory Fairness Act (RFA), chapter 19.85 RCW? What is the impact on small businesses?

(4, 5, 6, 10, 11, 16, 18, 21, 23, 31, 32, 64, 65, 158, 162, 169, 172→179, 181, 580, 581, 826, 827, 853→859, 903→910, 916, 930, 940, 942, 1033→1040, 1094, 1180, 1181, 1200, 1202, 1205→1208, 1226, 1227, 1229, 2364, 2494, 2518→2522, 2615)

Response:
Yes. Ecology has complied with the requirements of the Regulatory Fairness Act (RFA), chapter 19.85 RCW, in conducting this rule-making action. The RFA specifically requires that an agency prepare a small business economic impact statement (SBEIS) under RCW 19.84.040 before proposing to amend regulation if the amendments "impose more than a minor costs on businesses in an industry." RCW 19.85.030. Ecology determined the amendments may "impose more than a minor costs on businesses in an industry" and consequently prepared a SBEIS under RCW 19.85.040 to determine "whether the proposed rule [amendments] will have a disproportionate impact on small businesses." The procedures for determining whether the proposed rule amendments will have a disproportionate impact on small businesses are defined in the statute. RCW 19.85.040(1). In accordance with these procedures, Ecology determined that the proposed rule amendments may have a disproportionate impact on small businesses. To reduce the potential disproportionate impact of the proposed rule amendments on small businesses, Ecology also identified several mitigation measures throughout the rule to reduce the costs imposed by the rule amendments. Each of these determinations and mitigation measures are documented in the SBEIS.

Note that Ecology first prepared a SBEIS before proposing amendments to the MTCA Cleanup Regulation in 1999. That proposal was subsequently withdrawn. Ecology subsequently submitted another proposal in August 2000 that also included a SBEIS. Both the proposed rule amendments and the SBEIS were amended to reflect comments received on the 1999 proposal. The preparation of the SBEIS for both the 1999 and 2000 proposals was conducted in tandem with the development of the proposed rule amendments. As required by the RFA (RCW 19.85.030(1)), the SBEIS was filed with the Code Reviser along with the notice required under RCW 34.05.320 (i.e., the CR 102). Of course, the SBEIS could not be finalized until the language of the proposed rule amendments was finalized.

The impact on small businesses is described in the SBEIS. Ecology also notes that there are large variations in the disproportionate cost estimates for petroleum cleanups from different commentors. Ecology disagrees with these projected cost estimates made by commentors and believes these estimates are based on erroneous calculations that unnecessarily exaggerate the

estimates. The estimates of expected cleanup costs and percentage increases in costs in the SBEIS are based on the experience and best judgment of program staff drawn from several years experience with cleanups. The SBEIS states that while the proposed rule may slightly increase the cost, an increase of more than 20% is not expected. It was recognized in the 2000 SBEIS that total cleanup costs could fall outside of the range ($10,000 to $100,000) cited in 1999. Since those initial projections, Ecology has done a more detailed cost analysis and projected much smaller increases of 2 to 11% at gasoline contaminated sites and possibly substantial savings at diesel and heavy oil contaminated sites. Of course, no cost impact will be experienced if a site has no leaks, which should be the case for newer facilities that are properly constructed and operated. The more detailed cost analyses are described in the Estimates of the Probable Costs and Benefits.

Ecology will continue to work with the business community to facilitate cost efficient cleanups that are protective of the environment and public health.

GQ 20.1.2
Has Ecology reduced the costs imposed by the rule amendments on small business to extent required by RCW 19.85.030(3)?

(159, 160, 161, 177, 180, 676, 826, 852, 860→866, 929, 938, 1181, 2518, 2523→2529)

Response:
Yes. Ecology has reduced the costs imposed by the rule amendments on small business to the extent required by RCW 19.85.030(3). One of the stated purposes of the RFA is to reduce "the disproportionate impact of state administrative rules on small businesses." RCW 19.85.011. To effectuate that purpose, the RFA requires the following:

> Based on the extent of disproportionate impact on small businesses identified in the [SBEIS], the agency shall, **where legal and feasible in meeting the stated objectives of the statutes upon which the rule is based**, reduce the costs imposed by the rule on small businesses.

RCW 19.85.030(3) (emphasis added). Note that even if the proposed rule is found to disproportionately impact small businesses, the RFA only requires the agency to develop measures to reduce the cost of the rule for small businesses "where legal and feasible in meeting the stated objectives of the statutes upon which the rule is based." Note further that the extent of disproportionate impact is also a factor.

Having determined that the proposed rule amendments may have a disproportionate impact on small businesses, Ecology proceeded to identify several mitigation measures throughout the rule to reduce the costs imposed on small businesses where legal and feasible in meeting the stated objectives of the Model Toxics Control Act (MTCA). These mitigation measures are described in the SBEIS.

One of the primary objectives of MTCA is to prevent or remedy the threats to human health and the environment posed by the irresponsible use and disposal of hazardous substances. See RCW 70.105D.010. A more detailed discussion of the goals and objectives of MTCA is found in Chapter 1 of the CES. The MTCA Cleanup Regulation sets forth the minimum requirements for cleanup actions. Each of these requirements is necessary to achieve the goals and objectives of the statute. Those minimum requirements do not, and under MTCA cannot, take into account the size of the business that is liable for cleanup costs.

For example, determining whether a cleanup action is protective of human health and the environment is primarily dependent on whether the cleanup action complies with the cleanup standards. The establishment of cleanup standards is based on exposure factors that do not – and cannot – take into account the size of the business. For example, an industrial worker for a very large company is no more or less likely to inhale contaminated soil vapors than is an industrial worker on the same site working for a small company. Similarly, irrespective of whether a small business or a large business contaminates a drinking water aquifer, the harmful effects of the water on the citizens that drink it are the same. Because differentiation in exposures between large and small businesses cannot be made, cost reduction measures which would result in less stringent cleanup levels for small businesses would not meet MTCA's objective of protection of human health and the environment.

Some of the identified measures to reduce the disproportionate economic impact of the rule amendments on small businesses were previously identified and addressed in the existing regulation. These preexisting measures also mitigate the impacts of the rule amendments. However, in recognition of the rule amendments, additional mitigation measures have also been proposed. In addition, based on comments received, further mitigation measures will be considered following adoption of the rule amendments.

Ecology is sensitive to the needs of the small business community and will continue to work with small businesses. To the extent practicable, Ecology has coordinated with representatives of small businesses in both the development and implementation of the MTCA Cleanup Regulation. The interests of small businesses were represented through active participation of members on the MTCA Policy Advisory Committee, the Duwamish Coalition's TPH Project Oversight Group, and the MTCA External Advisory Group. As guidance is developed additional mitigation measures may be recognized and, in working with small businesses, subsequently implemented. Useful technical information will also be generated as guidance and model remedies are developed. This information will be shared with the business community across the state to help facilitate cost-efficient cleanups.

GQ 20.1.3
Were the interests of small businesses addressed during the development of the proposed rule amendments? Did the orientation of the Duwamish Coalition's Brownfields / TPH Project exclude small business interests?

(178, 179, 854, 2520)

Response:
To the extent practicable, Ecology has coordinated with representatives of small businesses in both the development and implementation of the MTCA Cleanup Regulation. The interests of small businesses were represented through active participation of members on the MTCA Policy Advisory Committee, the Duwamish Coalition's TPH Project Oversight Group, and the MTCA External Advisory Group. Ecology disagrees with the commentors' contention that the orientation of the Duwamish Coalition's TPH Project has been towards large businesses and that small business interests were not considered. A detailed list of the Washington TPH stakeholders invited to participate in the scoping and stakeholder meetings are located in the rule file. Ecology believes it is noteworthy that this list includes approximately 250 different businesses, including small businesses. To provide an historical perspective, Ecology will briefly trace some of the scoping and public meetings that helped formulate the scope of work and nature of the TPH initiative.

In January of 1996 Ecology hosted two scoping meetings with the public, industry, the Duwamish Coalition, and the National TPH Criteria Working Group. From this, a "Project Oversight Group" (POG) was formed consisting of key staff from the Washington State Department of Ecology, the U.S. Environmental Protection Agency Region 10, King County, the Port of Seattle, and the Cities of Seattle and Tukwila. Other participants included technical specialists from the Department of Ecology, the Pollution Liability Insurance Agency, industry, U.S. Naval Laboratories, project consultants, and others. In mid-1996 an interagency Memorandum of Agreement governing the actions of the POG was signed.

In April 1996 four public meetings with interested groups such as environmental consultants, electric utilities, and environmentalist representatives were held to solicit input on the scope of the work being undertaken by the POG. From the input received, a "framework" was developed using the ASTM "RBCA" (Risk-Based Corrective Action") model as a guide. As required by the Memorandum of Agreement, this "framework" was consistent with the requirements of the Model Toxics Control Act and its implementing cleanup regulation. It was not the intent of the Project Oversight Group to change MTCA policy. Instead, this Project Oversight Group incorporated the technical approaches of the ASTM, the National TPH Criteria Working Group and others into a methodology for deriving TPH cleanup levels under the Model Toxics Control Act. In May 1996, a meeting of over 100 people was held to present the framework and solicit further discussion.

20.2 Estimates of the Probable Costs and Benefits

General

GQ 20.2.1
Has Ecology complied with the rule-making procedures specified in chapter 34.05 RCW (Administrative Procedure Act) in conducting this rule-making action?

(793, 799, 804, 2195, 2366, 2479, 2494, 2577, 2582)

Response:
Ecology has complied with the rule-making procedures specified in chapter 34.05 RCW (Administrative Procedure Act) in conducting this rule-making action. The Administrative Procedure Act (APA) specifically requires that an agency make several determinations before adopting significant legislative rules. RCW 34.05.328(1). These determinations have been made and are documented in the APA Memorandum. This memorandum relies on documentation in the rule-making file. As required by RCW 34.05.328(2), the rule-making file contains documentation of sufficient quantity and quality so as to persuade a reasonable person that the determinations in RCW 34.05.328(1) are justified. These documents include, but are not limited to, the Rule Authorization Document, the Estimates of the Probable Costs and Benefits, the Least Burdensome Alternative Analysis, and the Rule Implementation Plan.

The APA specifically requires that significant legislative rules be evaluated to "[d]etermine that the probable benefits of a rule are greater than its probable costs, taking into account both quantitative and qualitative benefits and costs and the specific directives of the statute being implemented." RCW 34.05.328(1)(c). This determination must be documented prior to final rule adoption and included in the rulemaking record. The report summarizing Ecology's analysis of the probable costs and probable benefits of the amendments to the MTCA Cleanup Regulation is included as part of the rulemaking record. Note that in addition to complying with the procedural requirements of the APA, Ecology also submitted a draft report for comment during the public comment period on the 2000 proposal. The following responses respond to comments received on the draft report.

Further explanation of the basis for the rule amendments, including the changes to the Method A cleanup levels, is provided throughout the CES.

GQ 20.2.2
Were the methodologies used and assumptions made by Ecology to estimate the probable costs and benefits of rule amendments reasonable?

(2195, 2196, 2366, 2479, 2582)

Response:
The methodologies used and the assumptions made by Ecology to estimate the probable costs and benefits of the rule amendment are reasonable and allowed Ecology to make the determinations required under the APA. Ecology recognizes the inherent uncertainty and variability in those methodologies and assumptions and has evaluated the sources of that uncertainty and variability. Based on that evaluation, Ecology believes that the methodologies used and assumptions made adequately address that variability and uncertainty and result in reasonably bounded estimates that reflect the potential differential in costs and benefits of the proposed rule amendments. See Chapter 8 of the final report for a general discussion of some of the more significant sources of uncertainty and variability in the analysis and how Ecology addressed them. The basis for each of the assumptions made to address those sources of uncertainty and variability is described in the relevant sections of the report.

GQ 20.2.3
How did Ecology consider the specific directives of the statute?

(2196)

Response:
The APA specifically requires that significant legislative rules be evaluated to "[d]etermine that the probable benefits of a rule are greater than its probable costs, **taking into account** both quantitative and qualitative benefits and costs and **the specific directives of the statute being implemented**." RCW 34.05.328(1)(c) (emphasis added). Ecology considered the specific directives of the statute with respect to each of the amendments. Chapter 2 of the final report reflects this consideration.

Further explanation of the basis for the rule amendments, including the changes to the Method A cleanup levels, is provided throughout the CES.

Chapter 3 – Technical Analysis – Probable Costs of the Proposed Method A Soil and Ground Water Cleanup Levels

GQ 20.2.4
Is the assumption that contamination is uniformly located across the site reasonable?

(2593)

Response:
Ecology recognizes that contamination is not uniformly distributed across the site. However, the distribution and degree of contamination at a site is subject to significant variability. To address that variability Ecology made a simplifying assumption. That assumption is based on a survey of actual sites and the best professional judgment and experience of Ecology staff.

GQ 20.2.5
Did Ecology establish appropriate baseline cleanup levels for those hazardous substances without a specified Method A cleanup level under the current rule?

(2595)

Response:
For those hazardous substances without a specified Method A cleanup level under the current rule (MTBE and naphthalene), Ecology established the baseline cleanup level using the procedures for establishing cleanup levels under Method A. Those procedures are specified in WAC 173-340-704(2). Under those procedures, Ecology established the cleanup level based on the PQL. Using the PQL results in a less stringent cleanup level than proposed under the rule amendments. The benefit associated with the less stringent cleanup levels is the avoided cleanup cost. The less stringent cleanup level does not result in additional health risk because the hazard index for these substances is less than 1.

GQ 20.2.6
Is the estimate of the unit cost of soil vapor extraction systems reasonable?

(2531)

Response:
Ecology acknowledges that there exists a wide range of cleanup costs for the various technologies reported in the literature. This is likely due to the wide range of site contaminants, the extent of contamination and other site-specific factors. The specified source was the only source of consistent cost data that was readily available. This is also why a median unit cost was used in the cost estimates. Ecology also acknowledge that many of the site costs were for contaminants other than TPH; however, it is important to note that where TPH cleanup costs were available, such as for soil vapor extraction, the costs were considerably lower than the median costs used in the analysis. Thus, our cost estimates likely represent a conservative upper-end estimate of the cost impact of the new standards on TPH contaminated sites.

GQ 20.2.7
Is the simplifying assumption of a constant unit cost for soil vapor extraction systems reasonable?

(2531, 2541)

Response:
Ecology acknowledges that unit costs for soil vapor extraction system are not constant over time. However, Ecology believes the simplifying assumption of a constant unit cost is reasonable. The simplifying assumption is based on several considerations. First, the available unit cost information was only reported in this manner. Second, the one site with data on unit cost over time indicated that unit costs did not significantly increase with time of operation. A majority of the cost of a SVE system is in the characterization of the site and in the capitol cost of system construction. The system performance data, when available, indicated these systems achieved soil cleanup levels equivalent to or below those proposed in the Method A tables.

GQ 20.2.8
Is the simplifying assumption that the unit cost of soil vapor extraction is the same for all volatile hazardous substances reasonable?

(2533)

Response:
Ecology acknowledges that the unit cost for soil vapor extraction is not the same for all volatile hazardous substances. Unit cost data was not available for all volatile contaminants. However, Ecology believes the simplifying assumption is reasonable. The assumption likely results in an overestimate of the cost of soil cleanup for contaminants, such as benzene, that are more volatile. Note further that the available cost data for diesel and jet fuel contaminated sites indicates that

the median unit cost of soil cleanup using soil vapor extraction is much lower ($1.40/kg) than the value used and thus our estimate of probable costs represent a high-end estimate of the cost impact.

GQ 20.2.9
Does the estimated cost impact of the more stringent Method A cleanup level for benzene make sense?

(2534)

Response:
Ecology acknowledges that the incremental cost of removal of benzene to the more stringent soil cleanup level is small. This is because while there is a considerable reduction in the cleanup level, the amount of additional mass needing removal is small. Contrary to the conclusion reached by the commentor, this small increase in cost makes sense since it is a reflection of the fact that the high volatility of benzene results in the need to continue to operate the soil vapor extraction system only a short additional time to achieve the more stringent soil cleanup level.

GQ 20.2.10
Is the estimated unit cost of soil excavation and off-site disposal reasonable?

(2473, 2535)

Response:
Ecology acknowledges that excavation and disposal costs are typically based on a cost per volume or weight of soil. Ecology converted these costs to a cost per kilogram simply to allow a comparison between a treatment-based cleanup and a cleanup using soil excavation and off-site disposal. Ecology further acknowledges that the actual concentration of contaminants at a site will vary considerably from site to site. The model site concentration of 1000 mg/kg used to derive the unit costs at some sites was selected based on the typical concentrations present at other sites where such data was available. For the analysis in Chapter 3 of the report, Ecology did not predict a mass distribution pattern for each chemical. However, that approach was taken in Chapter 5, with a similar conclusion reached that the benefits exceed the costs.

One commentor noted that the unit cost of excavating and disposing of soils may differ based on level of contamination. The incremental increase in cost of soil cleanup by landfilling are presented in Tables 3-5 and 3-6 of the final report. Generally, landfills charge higher rates for wastes that require special handling beyond normal operations, such as for bulky wastes, wet sludges, or hazardous materials. Ecology is unaware of any landfill that would charge more for the disposal of soil with low levels of contamination.

GQ 20.2.11
Is the methodology used to estimate the avoided cost of ground water cleanup reasonable?

(2197, 2473, 2545, 2594)

Response:
Ecology believes the methodology used to estimate the avoided cost of ground water cleanup is reasonable. The description of the methodology used and assumptions made is found in Chapter 3 of the final report.

The methodology starts with the assumption that the contamination at the model site is distributed throughout the soil profile from a source near the ground surface down to the ground water table. This is thought to be a reasonable assumption since many contaminated sites fit this profile. The scientific evidence is unequivocal that the contaminants in soil will partition or divide up into the various soil compartments (solid, liquid, air, NAPL). The portion of the contamination that dissolves into the soil water will move downward to the water table where it mixes with the ground water beneath the site. The model that Ecology uses to predict this partitioning and migration is the model recommended by the SAB and the TPH POG. This model is essentially the same model that EPA uses in its soil screening guidance (EPA, 1996) and as the model used in the "RBCA" procedure that the petroleum industry has been advocating Ecology use.

Under the methodology used by Ecology, a "safe" level of soil contamination was calculated (this is the Method A soil cleanup level). This is the soil concentration that will result in a concentration in the soil pore water that, when it mixes with the underlying ground water, will not result in an exceedance of the drinking water standard. Contaminants at concentrations in the soil above this "safe" level will dissolve into the soil water at a greater concentration and, when mixed with the ground water, result in a ground water concentration in excess of the drinking water standard.

Biodegradation within the ground water is not assumed to occur because providing for such degradation would result in the ground water being undrinkable in the treatment zone. This is contrary to the objective to achieve drinkable ground water beneath the site. Biodegradation within the soil is not assumed to occur for several reasons:

- Prior to cleanup, the soil is at a concentration that is well in excess of any cleanup standard and, as such, any nutrients and oxygen necessary to feed the biodegradation process will have likely been used up;
- Many of the Method A substances do not readily biodegrade; and
- The contamination extends throughout the entire soil profile down to the water table, so there is no clean soil treatment zone available.

Chapter 5 – Technical Analysis – Probable Cost Impact on Petroleum Contaminated Sites

Statewide Leaking Fuel Tank Study

GQ 20.2.12
Are the assumptions made for petroleum contaminated sites reasonable?

(2350)

Response:
Ecology used two different methodologies to estimate the probable costs of the rule amendments, including the proposed Method A cleanup levels, on petroleum contaminated sites. These methodologies and the associated assumptions are explained in Chapters 3 and 5 of the final report. Ecology decided to evaluate petroleum-contaminated sites independently in Chapter 5 for the following reasons:

- Petroleum contaminated sites represent the largest percentage of cleanup sites;
- Petroleum contaminated sites represent the largest percentage of cleanup sites that use Method A cleanup levels; and
- Petroleum hydrocarbons are the most commonly detected hazardous substances at all cleanup sites.

To assess that the impact of the amendments specifically on petroleum contaminated site, Ecology conducted a statewide study of leaking fuel tank sites. A description of that study and the results of that study are presented in Section 5.2 of the final report. As part of that study, Ecology randomly selected twenty nine (29) sites from the January 5, 2000, version of Ecology's Leaking Underground Storage Tank (LUST) list that have received a "No Further Action" letter from Ecology. While Ecology acknowledges that this is a limited data set, that data set was only one piece of information that was used to develop the parameters of the model site and to evaluate the impact of the rule amendments. This information was supplemented by the best professional judgment of Ecology staff based on staff experience over several years with hundreds of similar leaking underground storage tank sites.

GQ 20.2.13
Does the survey indicate that ground water is contaminated?

(2474)

Response:
As noted in Chapter 4 of the EIS, based on Ecology's database of contaminated sites, it is estimated that 60% of sites have contaminated ground water and 12% have contaminated public or private water supply wells. Ecology acknowledges that even with this staggering number of sites, many have not adequately tested the ground water either prior to or after cleanup. This is an aspect of cleanup that Ecology believes additional focus on is necessary in the future.

GQ 20.2.14
What is the significance of the fact that 49% of the 29 sites surveyed cleaned up to non-detect or to levels that are below both the current and proposed Method A cleanup levels?

(2475)

Response:

Based on the statewide leaking fuel tank study, Ecology determined that the proposed changes to the Method A cleanup levels under the proposed rule amendments would likely impact only 51% of the sites evaluated. This is based on the fact that 49% of the sites surveyed cleaned up soil to either non-detect or to levels that are below both the current and proposed Method A cleanup levels. Ecology's determination that the probable benefits exceed the probable costs does not depend on this fact. However, if previous cleanups are any indicator of future cleanups, then the changes to the Method A cleanup levels may not have any cost impact at many sites.

Chapter 5 – Site "A" – Commercial Gas Station with Contaminated Soil and No Ground Water Contamination

GQ 20.2.15
What is the basis for the assumption regarding the maximum depth of contamination?

(2598)

Response:
The assumption is based on actual site data. Based on the experience and the best professional judgment of staff, Ecology believes this data is representative of most sites.

GQ 20.2.16
Does the assumption regarding the depth to ground water conflict with default assumptions used in the four-phase equilibrium partitioning model?

(2599)

Response:
No. The four-phase equilibrium partitioning model does not assume a 20 foot depth to ground water. The factor of 20 used in the model is the dilution factor assumed when the soil pore water mixes with the ground water passing under the site.

GQ 20.2.17
Does the unit cost of soil excavation and disposal account for off-site disposal?

(2536)

Response:
Yes. The unit cost includes the cost of excavation, transportation, and disposal.

GQ 20.2.18
Is the assumption regarding the soil profile reasonable? Are the cost calculations based on the soil profile correct?

(2537)

Response:
Ecology believes the assumption regarding the soil profile is reasonable. The calculations are based a soil profile from the ground surface to a depth of twelve (12) feet. Ecology acknowledges that contamination may not exist in the top 6 feet of soil at some sites. Nonetheless, when implementing a dig and haul remedy, that soil must be removed to address contamination at depth. Based on the experience of Ecology staff with actual sites, such soil is typically removed along with the contaminated soil. Based on that assumption, the calculation of the percentage increase in soil removal and cost is correct and set forth below. Those percentage increases are as follows:

Hazardous Substance	Depth of Excavation		
	Current Rule	Proposed Rule	Incremental Difference (%)
TPHG	11.68	11.95	2%
Benzene	10.805	11.95	11%
Toluene	6.09	10.805	77%
Ethylbenzene	6.09	9.93	63%
Xylenes	10.98	11.54	5%

The percentage increase in the depths of excavation for toluene and ethylbenzene, while greater, do not control the cost of site cleanup as both would be removed during removal of the benzene and TPH-G.

Chapter 5 – Site "B" – Commercial Gas Station with Soil and Ground Water Contamination

GQ 20.2.19
Should the cost associated with using Method B under the current rule be compared with the cost associated with using Method B under the proposed rule?

(2538)

Response:
Ecology believes that the cleanup cost associated with using Method A under the current rule should be compared with the cost associated with using Method A under the proposed rule. Similarly, Ecology believes that the cleanup cost associated with using Method B under the current rule should be compared with the cost associated with using Method B under the proposed rule. Contrary to the suggestion of the commentor, Method B can be used under the current rule to establish cleanup levels at petroleum contaminated sites. The memo referred to by the commentor predates the development of the Interim TPH Policy.

GQ 20.2.20
Did Ecology overestimate the unit cost of dual-phase extraction?

(2539)

Response:

Ecology acknowledges that unit cost of dual-phase extraction is high for a typical leaking underground storage tank site and therefore probably constitutes a conservative, high-end estimate of the unit cost. Reducing the unit cost would not only reduce the total site cleanup cost, but also the differential cost of cleanup resulting from the rule amendments. Consequently, the estimated cost impact of the rule amendments on petroleum contaminated sites probably also constitutes a conservative, high-end estimate. The actual cost impact may be considerably less.

The unit cost of dual-phase extraction may be high for a typical leaking underground storage tank site because of the limited database of cost data available and because one site had exceptionally high costs, which distorted the median. If this site is ignored a median site cost for dual phase extraction is $52.59/kg and the total site cleanup cost becomes approximately $1 million. This is still considerably higher than the cost range quoted by the commentor and may be due to the difference in level of restoration achieved.

GQ 20.2.21
Can dual-phase extraction systems achieve soil and ground water cleanup levels considering their removal efficiency?

(2540)

Response:
Yes. The reports from which the cost data were obtained also provide performance data for many of the sites. This data indicates that the extraction systems were able to achieve soil and ground water concentrations comparable to the proposed Method A cleanup levels.

Chapter 4 – Probable Benefits of the Proposed Method A Soil and Ground Water Cleanup Levels

GQ 20.2.22
How was the population potentially exposed to contaminated drinking water during their lifetime considered as part of the analysis of health impacts?

(2543, 2597)

Response:
As discussed in Chapter 4 of the final report, the assumption that 3.1 million persons have the potential to be exposed to contaminated ground water during their lifetime is based on several considerations. First, 3.1 million persons already rely on ground water as their source of drinking water and a certain percentage of them are exposed to contaminated ground water. Second, exposure to contaminated ground water is expected to increase as the population of the state increases. Third, exposure to contaminated ground water is expected to increase as development density increases, resulting in more water supply wells being subjected to an increased risk of contamination. Fourth, exposure to contaminated ground water is impacted by the mobility of an increasing population over time. Given the number of contaminated sites discovered to date (over 8,000), the proximity of many of these sites to public and private wells providing drinking

water to homes and workplaces, and the number of wells that have been contaminated to date, it is not unreasonable to expect that there is a strong potential for these persons to be exposed to contaminated water during their lifetime.

As discussed in Chapter 8 of the final report, the estimate of the exposed population is subject to significant uncertainty, as well as variability over time. As a consequence of this uncertainty and variability, the exposed population estimate was not used to calculate quantitatively an estimate of the total health benefits (avoided health costs) of the more stringent cleanup levels. However, the estimate of the exposed population was used for the limited purpose of calculating the number of avoided incidences of cancer to enable the further calculation of the value of reducing risks of excess cancer mortality.

The quantitative estimates of the exposed population, along with the quantitative estimates of (1) the reduction in risk of adverse health effects; (2) the range of adverse health effects attributable to the hazardous substances of concern; (3) and the cost of even a single incidence of these adverse health effects, enabled Ecology to determine that the probable benefits of adopting the more stringent cleanup levels exceed the probable costs.

The estimated potentially exposed population of 3.1 million persons served as a foundation upon which to build the estimates of the benefits assigned to reductions in cancer mortality. (Note that the $6,000 to $200,000 values cited in the comment and the benefits discussion are per case morbidity [nonfatal illness] avoidance benefits – largely based on cost-of-illness data – and are independent of exposed population levels or risk levels. For the most part, the values shown in Table 4-23 are based on recorded data derived from actual cases of the conditions indicated.) These mortality benefits are based upon the concept of willingness to pay for reductions in cancer mortality <u>risk</u> measured on a per life basis generalized over all Washington households.

This process began with the application of cancer mortality rates obtained from the National Institute for Cancer to the changes in risk rates associated with all substances of concern and the potentially affected population . The resulting changes in potential mortality risk rates were then evaluated via a willingness to pay function derived from duVair and Loomis (full citation in notes to Table 4-24), converted to a per unit (per mortality averted) basis, and aggregated over all Washington households. Note that Chapter 4 of the final report refers to 70 years as an assumed life expectancy to discount annual streams of mortality risk reduction benefits over a 35-year period. Increasing the assumed life expectancy from 70 to 75 years negligibly increases the mortality benefit estimates and remain well within the range of expected error, uncertainty and variability.

The resulting value of $18.1 million per year cited in this comment and the October 2000 draft is, thus, a best estimate of the value of risk reduction to the population of Washington as a whole – not an averted cost. To provide prospective, this translates into less than $8.00 per year (or 70 cents per month) per household.

These results were reviewed and further analyzed subsequent to preparation and distribution of the draft report. The outcome of this process is contained in the recently completed final

evaluation of probable costs and benefits that will be included in the rulemaking file as required by RCW 34.05.328(2).

GQ 20.2.23
Has Ecology considered the Lawrence Livermore Study regarding the impact of petroleum contaminated sites on drinking water wells in California when determining the population potentially exposed to contaminated drinking water?

(2544)

Response:
Ecology considered several factors when determining the population potentially exposed to contaminated drinking water. Ecology has reviewed the Lawrence Livermore Study (LLNL study) cited by the commentor. However, the study has limited applicability in determining the population potentially exposed to contaminated drinking water in Washington State. Furthermore, the characterization of the study by the commentor is not entirely accurate. Further comment on the study and its limited applicability is provided below.

The commentor suggested that the Lawrence Livermore Study database of 30,000 cases showed only 0.7% of the total open LUST sites actually affect drinking water wells.

The figure of 0.7% refers to the 136 known LUFT (the California acronym for "leaking underground fuel tanks") cases out of the total 28,051 LUFT cases in the California LUFT database that report affected drinking water wells. The LLNL study did not conclude only 0.7% of LUFTS can affect drinking water wells.

The purpose of the LLNL study was to show through modeling the extent of benzene contamination at 271 selected LUFT sites and how much reduction in the benzene concentration can occur over time without active remediation.

The facts and the process used by LLNL to select the studied cases are as follows (in addition to the 1995 LLNL report, information used here is from the LLNL Response to USEPA Comments on the LLNL/UC LUFT Cleanup Recommendations and California Historical Case Analysis, January 1997 and the Characteristics of Dissolved Petroleum Hydrocarbon Plumes, Results From Four Studies; American Petroleum Institute; December 1998, Vers. 1.1):

- At the time of the LLNL study, there were about 29,000 known "LUFT cases." By definition, this excludes any undetected releases or releases that had not been reported. About 8,500 were closed and about 20,500 open cases.
- Of those 29,000 sites, "10,797 were identified as affecting groundwater."
- Of those 10,797 sites, 5,698 cases "were beyond preliminary site assessment" (that is, they had more than minimum information).
- LLNL then selected those in 13 counties representing 3,340 sites.
- Of those 3,340 sites, LLNL randomly selected and sought files for 1,831 sites.

- Of those 1,831 sites, 843 were "potentially available" for analysis (at least 6 monitoring wells and eight sampling events).
- Of those 843 sites, LLNL then evaluated 271 sites in detail for benzene concentrations and plume length.

LLNL then found "that 47 (17%) out of 271 plumes evaluated fit the "exhausted " criteria of having an "insignificant trend and an average plume concentration of < 10 micrograms per liter." An additional 33% were shrinking, 42% were stable, and 8% were expanding in plume length (in the Texas Bureau of Economic Geology study, these were 9% exhausted, 26% shrinking, 61% stable, and 3% expanding in plume length). In concentration within the plumes, LLNL again found 17% were exhausted, but 59% were shrinking, 16% were stable, and 8% were expanding (and for the Texas study these values are 11%, 47%, 27%, and 14% respectively).

Using a plume delineation limit of 10 ppb benzene, LLNL determined that the median plume length was 101 feet, the 90^{th} percentile plume length was 255 feet, and the maximum was 1,713 feet.

As a result of the LLNL study the California Environmental Protection Agency (CAL/EPA) made a policy decision about how many of the tank sites in the state would not require ground water cleanup. This was based on (1) estimated plume lengths, (2) how much degradation of benzene should occur, and (3) the likelihood of a receptor well. This decision was an administrative policy decision made by CAL/EPA, not a technical or scientific judgment made by the Lawrence Livermore National Laboratory.

Ecology has concerns about the reliance by CAL/EPA on (1) a threshold for benzene twice the drinking water standard; (2) an analysis limited to benzene that does not take into account additives like MTBE; (3) the process of degradation; and (4) the assumption that ground water in the vicinity of petroleum contaminated sites will not be used.

In summary, Ecology has concerns about using these studies as the basis for concluding gasoline contaminated sites in Washington State have minimal impacts on ground water. Furthermore, Ecology cannot conclude from the LLNL or Texas studies that an insignificant number or percentage of ground water wells may be affected by a petroleum release or that ground water impacts from petroleum contaminated sites are minimal.

GQ 20.2.24
Is the estimated change in cancer risk for benzene used in the analysis accurate?

(2543)

Response:
Yes. Because the Method A soil cleanup level for benzene is based on ground water protection, Ecology used drinking water exposure as the basis for the risk calculation. As for the cancer risk due to direct contact with soil contaminated with benzene, the calculation provides a low

estimate of risk because it does not take into account dermal contact and breathing of vapors volatilizing from the soil.

GQ 20.2.25
Is the source used for determining the value of a water right representative?

(2596)

Response:
Ecology acknowledges the uncertainty regarding the value of water rights (there is little information available on the value of water rights), as well as the potential variability of those values. While only one source was cited, the range of values provided by that source are based on actual purchase costs from several locations. Since that analysis was done, the Department of Ecology has paid $405,000 for 675 acre-foot (or $600 acre-foot) of surface water rights in an agricultural area near Walla Walla, WA. Even applying this lesser value to the model site, both the 10 and 20 year benefits (at $51,600 and $103,200, respectively) would exceed the cost of additional ground water cleanup.

GQ 20.2.26
Are the sources used for determining municipal water rates accurate and representative?

(2596)

Response:
Ecology acknowledges the uncertainty and potential variability of the cost of water provided by municipal utilities. Ecology is uncertain whether the water rates include maintenance, operational, financial, and depreciation costs. However, one could also view these costs as the cost of replacing private and small system public water wells impacted by contamination with a public water supply built to today's standards.

20.3 General

GQ 20.3.1
Consideration of the potential impact of the rule amendments on the cleanup and analytical costs for a site contaminated with gasoline.

(304, 2194, 2546)

Response:
One commentor characterized the potential impact of the rule amendments on the cleanup and analytical costs for a site contaminated with gasoline. Ecology has reviewed the analysis presented by the commentor and respectfully disagrees with his characterization of the potential impact. As discussed previously, Ecology believes that the cost associated with using Method A under the current rule should be compared with the cost associated with using Method A under

the proposed rule. Similarly, Ecology believes that the cost associated with using Method B under the current rule should be compared with the cost associated with using Method B under the proposed rule.

Based on the analysis conducted by Ecology, nearly half of the petroleum contaminated sites examined already achieve cleanup levels that are more stringent than those proposed by Ecology. For those sites that do experience increased costs, the actual incremental increase in cost will be small to moderate, depending on the contaminants present at the site and will be more than offset by the benefits.

In regard to the "additional analytical testing requirements" comment, the rule for the first time does specify substances and applicable analytical testing requirements for different petroleum products. Also, the applicable methods to determine the petroleum concentrations are identified. This is provided in Table 830-1. The table summarizes the necessary testing to have sufficient data for meeting cleanup standards for different petroleum products in different media (soil, water, and air). The existing rule is not clear what testing would be sufficient to provide the necessary data. This information will reduce unnecessary testing, avoid costly and possibly very difficult re-sampling, and provide certainty that the correct tests have been conducted. This table was added to benefit the public and Ecology staff. It represents the contributions of many members of the TPH Project Oversight Group.

Some compounds in Table 830-1, such as MTBE and naphthalenes, have been added to the Method A tables so it is important to tell people the circumstances under which testing would be expected. Nonetheless, even without the proposed change to the rule, testing for these compounds can be required and the table does not "add new requirements." The purpose is to make it clear what products should be tested and under what circumstances. Consequently, the correct data will be available for the cleanup levels being used. Not testing for these at the right time and place could result in cleanup standards for the site not being met.

Ecology disagrees that there will be a $14,178 increase in soil analytical costs as estimated by PLIA. The assumption that 20 samples during the site assessment and an additional 13 months of performance monitoring will be required at a typical is not true. While this may be the case at some sites, it would be unusual. This may happen with some sites, but not most sites. It would not likely be "typical."

It is assumed that there will be 10 analytes rather than 5. This may not often be the case and if it is, often additional analytes can be added for no to little additional cost. Most of the analytes in ground water are "VOAs" (volatile organic analysis). Often these are all part of the same analysis. The additional cost would not likely be much.

GQ 20.3.2
Consideration of the potential impact of the rule amendments on the cleanup and analytical costs for a site contaminated with heating oil.

(2547)

Response:
One commentor characterized the potential impact of the rule amendments on the cleanup costs for a site contaminated with heating oil. Ecology has reviewed the analysis presented by the commentor and respectfully disagrees with his characterization of the potential impact. As discussed previously, Ecology believes that the cleanup cost associated with using Method A under the current rule should be compared with the cost associated with using Method A under the proposed rule. Similarly, Ecology believes that the cleanup cost associated with using Method B under the current rule should be compared with the cost associated with using Method B under the proposed rule.

With respect to cleanups conducted using Method A: After considering the analysis presented by the commentor, Ecology believes the impact of the rule amendments on cleanup and analytical costs projected by the commentor constitutes an overestimate. Based on a review of heating oil cleanups that have had reports submitted to Ecology, most sites contaminated with home heating oil should be exempt from having to do conduct a site-specific terrestrial ecological evaluation because the evaluation should end under WAC 173-340-7492(2)(a)(i). For most sites with heating oil contamination, the cleanup removes essentially all soil contamination or the remaining area of contamination after cleanup is less than 350 square feet.

With respect to analytical costs under Method A, for the first time there will be a clear and specific exemption in the rule applying to home heating oil. Previously BTEX might have been tested for at home heating oil sites even though it is not a likely contaminant of home heating oil. This amendment exempts soil and ground water from testing for BTEX no matter which Method is used to set the cleanup level (See footnote (7)(b) in Table 830-1). Thus, for Method A, only one analytical test for home heating oil should be usually necessary: NWTPH-Dx ($80 per sample). Not analyzing for BTEX saves $70 for each sample and the NWTPH-Dx method is $220 less per sample than the EPH analysis.

Typical Analytical Costs for Petroleum Contaminated Soils – Method A (per sample)			
Hazardous Substance	**Old Requirements**	**New Requirements**	**Additional Cost**
Method A--Diesel Range Organics (DRO) (home heating oil only)	$80-$150 • NWTPH-Dx ($80) • BTEX ($70) (case-by-case)	$80 • NWTPH-Dx ($80)	Zero to $70 less

With respect to cleanups conducted using Method B: After considering the analysis presented by the commentor, Ecology believes the impact of the rule amendments on cleanup and analytical costs projected by the commentor constitutes an overestimate. Again, based on a review of heating oil cleanups that have had reports submitted to Ecology, most sites contaminated with home heating oil should be exempt from having to do conduct a site-specific terrestrial ecological evaluation because the evaluation should end under WAC 173-340-7492(2)(a)(i). For most sites with heating oil contamination, the cleanup removes essentially all soil contamination or the remaining area of contamination after cleanup is less than 350 square feet.

With respect to analytical costs under Method B, as can be seen in a following table, the additional cost of a soil sample, compared to the older requirements of the Interim TPH Policy, does not increase for any petroleum product. The only possible additional new compound is MTBE and it will only be tested in soil if found in the ground water. If there is an additional cost for MTBE, it will be minimal. Other pathways or compounds may need to be tested for in some circumstances, but these are not new requirements.

Typical Analytical Costs for Petroleum Contaminated Soils – Method B/C (per sample)			
Hazardous Substance	**Old Requirements**	**New Requirements**	**Additional Cost**
Method B & C--Diesel Range Organics (DRO) (home heating oil only)	$300-$370 • EPH ($300) • BTEX ($70) (case-by-case)	$300 • EPH ($300)	Zero to $70 less

GQ 20.3.3
Consideration of the potential impact of the rule amendments on the analytical costs for a site contaminated with GRO or DRO.

(2548)

Response:
One commentor characterized the potential impact of the rule amendments on the analytical costs for a site contaminated with GRO or DRO. Ecology has reviewed the analysis presented by the commentor and respectfully disagrees with his characterization of the potential impact.

Shown below are the unit costs as provided by Sound Analytical Services:

	Method A	**Method B Method C**	**Cost**	**Combined Cost**
Benzene	X	X	$70	
TEX	X	X	$70	
n-hexane		X	$70	$140
EDB/EDC	X	X	$100	
MTBE	X	X	$100	
CPAHs	X	X	$175	
Naphthalenes	X	X	$175	$175
Lead	X	X	$28	
NWTPH-Gx	X		$65	
NWTPH-Dx	X		$80	
VPH		X	$90	
EPH		X	$300	

As can be seen, several analytes can be combined without proportionally adding to the cost. The significant cost difference between Method A and Methods B &C are the VPH and EPH

analyses. These are not "new" however; they have been used for over 4 years. Even though the analytical cost may be higher than the "NWTPH" methods, using these methods can lower the total cost of the cleanup due to higher site-specific cleanup levels.

Shown below are two tables comparing the typical additional costs for each Method:

Typical Analytical Costs for Petroleum Contaminated Soils – Method A (per sample)			
Hazardous Substance	**Old Requirements**	**New Requirements**	**Additional Cost**
Method A--Gasoline Range Organics (GRO)	$135 • BTEX ($70) • NWTPH-Gx ($65)	$135 • BTEX ($70) • NWTPH-Gx ($65)	Zero
Method A--Diesel Range Organics (DRO) (other than home heating oil)	$80-$150 • NWTPH-Dx ($80) • on a site-by-site basis, possibly BTEX ($70)	$150 • NWTPH-Dx ($80) • BTEX ($70)	Zero to $70
Method A--Diesel Range Organics (DRO) (home heating oil only)	$80-$150 • NWTPH-Dx ($80) • BTEX ($70) (case-by-case)	$80 • NWTPH-Dx ($80)	Zero to $70 less

Typical Analytical Costs for Petroleum Contaminated Soils – Method B or Method C (per sample)			
Hazardous Substance	**Old Requirements**	**New Requirements**	**Additional Cost**
Method B & C--Gasoline Range Organics (GRO)	$160 • VPH ($90) • BTEX ($70)	$160 • VPH ($90) • BTEX ($70)	Zero
Method B & C--Diesel Range Organics (DRO) (other than home heating oil)	$370 • EPH ($300) • BTEX ($70)	$370 • EPH ($300) • BTEX ($70)	Zero
Method B & C--Diesel Range Organics (DRO) (home heating oil only)	$300-$370 • EPH ($300) • BTEX ($70) (case-by-case)	$300 • EPH ($300)	Zero to $70 less

"Typical analytical costs" means analytical cost for a soil sample where there is no known release or suspected release to ground water and the human health "direct contact" pathway is the only pathway being evaluated. If additional hazardous substances are found in the ground water, or there are other pathways, then there will be additional analytical requirements. For instance, with

gasoline range organics, analysis for MTBE in the soil or ground water could cost $30 in addition to the analysis for BTEX.

As can be seen, the additional analytical testing, on a per sample basis, is not large.

GQ 20.3.4
Consideration of the potential impact of the rule amendments on the analytical costs for a site contaminated with naphthalenes and cPAHs.

(2549, 2550, 2551, 2589)

Response:
One commentor characterized the potential impact of the rule amendments on the analytical costs for a site contaminated with naphthalenes and cPAHs. Ecology has reviewed the analysis presented by the commentor and respectfully disagrees with his characterization of the potential impact.

The testing requirements for cPAHs and naphthalenes have been clarified. Testing for the cPAHs is not required in most common diesel range products such as diesel No.1, diesel No. 2, home heating oil, jet fuel, and kerosene (see footnote #(13) in Table 830-1). As noted in the second comment, naphthalene testing in soil and ground water will not be normally required for DRO when Method A is used. Soil testing for naphthalenes is only required when the vapor pathway is evaluated or when they are found in the ground water (see footnote #(14) in Table 830-1). This should achieve the "significant cost savings" noted in the comment.

In regard to the suggestion of removing Table 830-1 from the amendments, please see the earlier discussion regarding this table. Also, the table is in the rule rather than in guidance since it not only communicates the testing necessary to demonstrate compliance with cleanup standards, it also provides specific exemptions from testing.

GQ 20.3.5
Consideration of the potential impact of the rule amendments on the cost of pollution liability insurance.

(21, 42, 43, 44, 45, 46, 47, 48, 1234, 1290, 2475, 2552, 2577, 2578, 2665)

Response:
Several commentors expressed concern regarding whether the rule amendments would increase the cost of pollution liability insurance. However, insurance company representatives have not indicated that their rates will actually increase, only that they will need to do a study to determine if rates warrant increases. Any expectation that pollution liability insurance premiums will increase is based on expectations regarding the impact of the rule amendments on the cost of cleanup. Insurance company representatives have stated that their projections were based on the estimated cost increases projected by PLIA of 40 to 50% in soil and 20% in ground water and an assumption that the 20% maximum increase in cleanup costs projected in the SBEIS as an upper

limit increase will apply to all sites. They have also indicated that they do not have sufficient information to project actual premium increases, if any, as that will depend on the claims submitted after adoption of the new rule. Since those initial projections, Ecology has done a more detailed cost analysis and projected much smaller increases of 2 to 11% at gasoline contaminated sites and possibly substantial savings at diesel and heavy oil contaminated sites. Of course, no cost impact will be experienced if a site has no leaks, which should be the case for newer facilities that are properly constructed and operated.

Chapter 21 References

AECL (Atomic Energy of Canada Limited), 1990. *A Critical Compilation and Review of Default Soil Solid/Liquid Partition Coefficients, Kd, for Use in Environmental Assessments*, by D.H. Thibault, M.I. Sheppard, and P.A. Smith, Whiteshell Nuclear Research Establishment, Pinawa, Manitoba.

Allen, H.E., Yu-Tung, C. Sanders, P.F. et al. 1995. Soil Partition Coefficients for Cd by Column Desorption and Comparison to Batch Adsorption Measurements. *Env. Sci. Technol.*, Vol. 29, No. 8. 1887-1891.

American Petroleum Institute, *Characteristics of Dissolved Petroleum Hydrocarbon Plumes, Results From Four Studies*, December 1998, Version. 1.1.

ASTM, 1995. Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites. ASTM E 1739-95. *American Society for Testing and Materials.*

ATSDR, 1991. Toxicological Profile for Ethylene Dibromide, TP 91/13. Agency for Toxic Substances and Disease Registry, 1991.

Baes, CF (III), and R.D. Sharp, 1983. A proposal for estimation of soil leaching and leaching constants for use in assessment models. *J. Environ. Qual. 12(1): 17-28.*

Battelle Memorial Institute 1989. *Chemical Data Bases of the Multimedia Environmental Pollutant Assessment System (MEPAS): Version 1.* PNL Laboratory, operated by Battelle Memorial Institute.

Borden, 1995. Robert C. Borden, Carlos A. Gomez and Mark T. Becker. Geochemical Indicators of Intrinsic Bioremediation. *Groundwater*, Volume 33, Number 2. March-April, 1995.

Brannon, J.M., Patrick, W.H. 1987. Fixation, Transformation, and Mobilization of Arsenic in Sediments. *Environ. Sci. Technol*., Vol. 21, No. 5, 450-459.

Brownfields/TPH Project Phase 2, Task 4, Subtask 4.2.1 Technical Memorandum (August 22, 1997.

Calder, L.M. 1988. *Chromium contamination in ground water. In: Chromium in the Natural and Human Environments.* J.O. Nridgu and E.Bieboer, eds. Wiley-Interscience, New York.

Calebrese, et. al. 1997a. Calabrese, E.J., Stanek, E.J., Pekow and Barnes, R.M. 1997. Soil ingestion estimates for children residing on a Superfund site. *Ecotoxicology and Environmental Safety*, 36: 258-268.

Calebrese, et. al., 1997b. Calabrese, E.J., Stanek, E.J., James, R.C., and Roberts, S.M. 1997. Soil ingestion: a concern for acute toxicity in children. *Environmental Health Perspectives*, 105: 1354-1358.

CalEPA, 1994. Benzo(a)pyrene as a toxic air contaminant. Part B: Health Assessment. Office of Environmental Health Hazard Assessment, California Environmental Protection Agency, Berkley, CA, July, 1994.

Canadian Council of Ministers of the Environment (CCME) *Canada-wide Standards for Petroleum Hydrocarbons in Soil*, Dec. 2000.

Carsel, R.F., R.S. Parrish, R.L. Jones, J.L. Hansen, and R.L. Lamb. 1988. Characterizing the uncertainty of pesticide leaching in agricultural soils. *J. of Contam. Hyd*. 2:111-124.

Clements, 1995. *Washington Facts: A Comprehensive Look at Washington Today – County by County.* Clements Research II, Inc. Dallas, TX, 1995.

Cline, P.V., J.J. Delfino, and P.S.C. Rao 1991. Partitioning of Aromatic Constituents into Water from Gasoline, and Other Complex Solvent Mixtures. *Environ Sci. Technol*. 25, 914-920.

Cougherty, P.J., Jackson, D., and Thorne, M.C. 1985. *Radionuclide Distribution and Transporting Terrestrial and Aquatic Ecosystems: A Compendium of Data.* A.A. Balkem, Netherlands, Vol. 6.

Duwamish Coalition, 1999. *The Duwamish Brownfields/TPH Project Final Report*, April 1999.

Ecology, 1991. *Responsiveness Summary on the Amendments to the Model Toxics Control Act Cleanup Regulation Chapter 173-340 WAC*, Feb. 1991. (1991 RS)

Ecology, 1992. *Statistical Guidance for Ecology Site Managers*. Publication #92-54, Aug. 1992.

Ecology, 1993a. *Implementation Memo #3.* Department of Ecology Memorandum dated November, 24, 1993.

Ecology, 1993b. *Statistical Guidance for Ecology Site Managers. Supplement S-6. Analyzing site or background data with below-detection limit or below PQL values (censored data sets).* August, 1993. Attached to February, 19, 1998 memo.

Ecology, 1997a. *Interim Interpretive and Policy Statement Cleanup of Total Petroleum Hydrocarbons (TPH).* Publication #ECY97-600, January 30, 1997.

Ecology, 1997b. *Water Quality Program Policy 1-11*, June, 1997 revision.

Ecology, 1997c. *Audit/Quality Control of Independent (Voluntary) Cleanups – Review of Site Hazard Assessment (SHA)/Site Investigation Procedures*, Nov. 1997.

Ecology, 1999a. *Draft: Analysis and Selection of fish Consumption Rates for Washington State Risk Assessments and Risk-based Standards*. Publication #99-200. Mar. 1999.

Ecology, 1999b. Report on Ground water contamination that affects drinking water in Washington State. Prepared by the Dept. of Ecology and Dept. of Health. April 1999.

Ecology, 1999c. *Terrestrial Environmental Evaluation Study Report*, Publication #99-604, Nov. 1999.

Ecology, 2000a. Occurrence of Methyl Tertiary-Butyl Ether (MTBE) in Ground water at Leaking Underground Storage Tank Sites in Washington. Prepared by the Department of Ecology. July 2000.

Ecology, 2000b. *Proposed Strategy to Continually Reduce Persistent, Bioaccumulative Toxins (PBTs) in Washington State*. Publication #00-03-054. Dec. 2000.

Ecology, 2001a. *Calculation of TPH Surface Water Cleanup Levels*. File memorandum by Pete Kmet. February 1, 2001.

Ecology, 2001b. *Memorandum from Tim Nord, Sections Manager, Toxics Cleanup Program, through Jim Pendowski, Program Manager, Toxics Cleanup Program, to Tom Fitzsimmons, Director, Department of Ecology, re Amendments to the MTCA Cleanup Regulation, Feb. 8, 2001*. (APA Memo)

Ecology, 2001c. *Estimates of the Probable Costs and Benefits of the Amendments to the MTCA Cleanup Regulation*, Feb. 12, 2001. (CBA)

Ecology, 2001d. *Least Burdensome Alternative Analysis for the Amendments to the MTCA Cleanup Regulation (LBA Analysis*), Feb. 12, 2001. (LBA Analysis)

Frontier Hard Chrome, 1991. Ecology Frontier Hard Chrome site files.

Gustafson, J.B., J. G.Tell, and D. Orem 1997. *Selection of Representative TPH Fractions based on Fate and Transport Considerations, TPH National Criteria Working Group, Volume 3*, Amherst Scientific Publisher.

Henderson, Thomas, 1994. Geochemical Reduction of Hexavalent Chromium in the In the Trinity Sand Aquifer. *Ground Water*, Vol. 32, No. 3. May-June, 477-486.

Hoag, G.E., and Marley, M.C., 1986. Gasoline Residual Saturation in Unsaturated Uniform Aquifer Materials. *Journal of Environmental Engineering*, Vol. 112, No. 3, pp. 586-604.

Hydrometrics, Inc., 1993. Asarco, Tacoma Plant Remedial Investigation, August 1993.

Johnson, J.E. and J.C. Kissel, 1996. Prevalence of Dermal Pathway and Dominance in Risk Assessment of Contaminated Soils: A Survey of Superfund Risk Assessments, 1989 - 1992. *Human and Ecological Risk Assessment*: Volume 2, No. 2, pp. 356-365.

Karickhoff, S.W., 1984. "Organic Pollutant Sorption in Aquatic systems, *J. Hydraulic Engineering*, 1106:707-735.

King, R.M. and Roberts, L., 1998. Testing the Chemical Assumptions in the TPH Interim Policy for Protectiveness. Report prepared for the Department of Ecology.

Kmet, 1999. Physical Properties of Hazardous Substances in the Method A Tables. Memo to MTCA rule file by P. Kmet, Department of Ecology, dated December 9. 1999.

Lee, L.S., M. Hagwall, J.J. Delfino, and P.S.C. Rao, 1992. Partitioning of Polycyclic Aromatic Hydrocarbons from diesel Fuel into Water. *Environ Sci. Technol*. 26, 2104-2110.

Lawrence Livermore National Laboratory, 1997. *Response to U.S. EPA Comments on the LLNL/UC LUFT Cleanup Recommendations and California Historical Case Analysis*, January 1997.

Mariner, P.E., J. Minquan, and R.E. Jackson, 1997. An Algorithm for the Estimation of NAPL Saturation and Composition from Typical Soil Chemical Analyses. *Ground Water Monitoring and Remediation.* 17, 122-129.

Masscheleyn, pH, Pardue, J.H., Delanue, R.D., and Patrick, W.H. 1992. Chromium Redox Chemistry in a Lower Mississippi Valley Bottomland Hardwood Wetland. *Environ. Sci. Technol*., Vol. 26, No. 6, 1217-1226.

McLaren, R.G. and Crawford, D.V., 1973. Studies on Soil Copper. II. The Specific Adsorption of Copper by Soils, *J. Soil Sci*. Vol. 24, 443-452.

Mercer, J.W. and Cohen, R.M., 1990. A Review of Immiscible Fluids in the Subsurface: Properties, Models, Characterization and Remediation. *J. of Contaminant Hydrol*. 6 (1990) 107-163. Ecology's default residual saturation values were obtained from Table 3 (p. 120) of this study.

Mott, H.V., 1995. A Model for Determination of the Phase Distribution of Petroleum Hydrocarbons at Release sites. *Ground Water Monitoring and Remediation.* 15, 157-167.

MTCA Policy Advisory Committee, 1996a. *Cleaning up MTCA Sites to Protect the Environment, A Guide to the Model Toxics Control Act Environmental Evaluation Process for Soil Contamination*, Nov. 5, 1996. (PAC User's Guide)

MTCA Policy Advisory Committee, 1996b. *Final Report of the Model Toxics Control Act Policy Advisory Committee*, Dec. 15, 1996. (Final PAC Report)

Nikolaidis, N.P., Robbins, G.A. et al., 1994. Vertical Distribution and Partitioning of Chromium in a Glaciofluvial Aquifer. *Ground Water Monitoring Review*. V. 14, 150-159.

Ostendorf, D.W., Leach, L.E., Hinlein, E.S. and Xie, Y., 1991. *Field Sampling of Residual Aviation Gasoline in Sandy Soil. Ground Water Monitoring and Remediation*, Spring, pp.107-120.

Park, H.S. and San Juan, C., 2000. A Method for Assessing Leaching Potential for Petroleum Hydrocarbons Release Sites: Multiphase and Multisubstance Equilibrium Partitioning. *Soil and Sediment Contamination*, v. 9, Issue 6, p. 611-632.

Peters, R.W. and Shem, L., 1992. Adsorption/Desorption Characteristics of Lead on Various Types of Soil. *Env. Progress*, Vol. 11, No. 3, August, 234-240.

Piwoni, M.D.and P. Banerjee, 1989. Sorption of volatile organic solvents from aqueous solution onto subsurface solids. *J. Contam. Hyrdrol*. 4(2):163-179.

PTI, 1995. *Final Report, Technical Review of Distributional Analysis Approaches for Cancer Potency Factors*, CAOU-03-05, PTI Environmental Services, July 1995.

Puls, R.W. and Powell, R.M. 1992. Transport of Inorganic Colloids through Natural Aquifer Material: Implications for Contaminant Transport. *Env. Sci. Tech*. Vol. 26. No. 3, 614-621.

Radian Corp., 1991. *Evaluation of Soil Remedial Levels for Frontier Hard Chrome, Vancouver, Washington.* Draft Technical Memorandum, October, 1990.

Sakata, M., 1987. Relationship between Adsorption of Arsenic (III) and Boron by Soil Properties. *Env. Sci. Tech*. 21, No.11, 1126-1130.

Schwarzenbach, R.P., and Westall, J., 1981. Transport of Organic Compounds from Surface Water to Ground Water. Laboratory Sorption Studies. *Env. Sci. Tech*. Vol 15, No.11., 1360-1367.

Science Applications International Corporation (SAIC), 1991. "*Soil Cleanup Standards Task 3.1: Draft Evaluation of Available Leaching Tests*". Prepared by SAIC for Washington Department of Ecology, April 27, 1991.

Science Applications International Corporation (SAIC), 1992. "*Soil Cleanup Standards Task 3.3: Leach Testing to Estimate Soil Cleanup Levels*". Prepared by SAIC for Washington Department of Ecology (report includes information on the SAIC double-ring infiltrometer study for Ecology). February, 5, 1992.

Sidle, R.C., and Kardos, L.T., 1977. Adsorption of Copper, Zinc, and Cadmium by a Forest *Soil. J. Environ. Qual.*, Vol. 6, No. 3, 313-317.

Sims, et al., 1986. *Contaminated Surface Soils In-Place treatment Techniques*, Noyes Publication.

Stollenwerk, K.G., and Grove, D.B., 1985. Adsorption and Desorption of Hexavalent Chromium in an Alluvial Aquifer near Telluride, Colorado. *J. Environ. Qual*. V. 14, 150-155.

Univ. of California, 1998. Health and Environmental Assessment of MTBE. Report to the Governor and Legislature of the State of California. University of California-Davis. November 12, 1998.

U.S. EPA, 1987. *Data Quality Objectives For Remedial Response Activities, Development Process.* OSWER Directive 9355.0-7B, EPA 540/G-87/003. U.S. EPA. March 1987.

U.S. EPA, 1997. *Compendiums of Test Methods for the Determination of Toxic Organic Compounds in Ambient Air*, EPA 625/R-96/010b, U.S. EPA, 1997.

U.S. EPA, 1989. *Exposure Factors Handbook.* EPA/600/8-89/043.

U.S. EPA, 1990. *Risk Assessment Guidance for Superfund: Volume I -Human Health Evaluation Manual (Part A).* Publication # 9285.7-01/FS. April 1990.

U.S. EPA, 1991a. *Conducting Remedial Investigations / Feasibility Studies for CERCLA Municipal Landfill Sites. Office of Emergency and Remedial Response.* OSWER Directive 9355.3-11. EPA/540/P-91/001. USEPA. Feb. 1991.

U.S. EPA, 1991b. *Technical Support Document for Water Quality-based Toxics Control.* EPA/505/2-90-001. March 1991.

U.S. EPA, 1991c. OSWER Directive 9285.6-03. *Technical memorandum: Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors."* March 25, 1991.

U.S. EPA, 1991d. *Risk Assessment Guidance for Superfund: Volume I -Human Health Evaluation Manual (Part B), Development of Risk Based Preliminary Remediation Goals. Interim Guidance.* Publication # 9285.7-01BFS. Dec. 1991.

U.S. EPA, 1991e. *Risk Assessment Guidance for Superfund: Volume I -Human Health Evaluation Manual (Part C, Risk Evaluation of Remedial Alternatives).* Publication # EPA/540/R-92/004. December 1991.

U.S. EPA, 1991f. Batch-Type Procedures For Estimating Soil Adsorption of Chemicals, Roy et al., U.S. EPA Technical Resource Document, EPA 530/SW-87/006-F

U.S. EPA, 1992. *Federal Register Notice* Volume 57, No. 104. Friday, May 29, 1992. Guidelines for Exposure Assessment. Pages 22888 - 22938.

U.S. EPA, 1993. *Reference Dose (RfD): Description and Use in Human Health Risk Assessments: Background Document 1A*, March 15, 1993.

U.S. EPA, 1994. *Technical Background Document for Draft Soil Screening Level Guidance*, Office of Solid Waste and Emergency Response, Publication 9355.4-14-1, EPA-540/R-94/018, March 1994.

U.S. EPA, 1995. *CMTP Background Document for Metals 1995. Volume 1: Methodology*. (EPA CMTP = EPA's Composite Model for Leachate Migration with Transformation Products). EPA Office of Solid Waste.

U.S. EPA, 1996. *EPA Soil Screening Guidance: Technical Background Document*. EPA/540/R-95/128 May, 1996.

U.S. EPA, 1997a. *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments.* Interim Final. EPA 540-R-97-006.

U.S. EPA, 1997b. *Policy for Use of Probabilistic Analysis in Risk Assessment*. May 15, 1997.

U.S. EPA, 1997c. *Exposure Factors Handbook, Volume I: General Factors.* EPA/600/P-95/002Fa. August, 1997.

U.S. EPA, 1997d. *Exposure Factors Handbook, Volume II: Food Ingestion Factors.* EPA/600/P-95/002Fb. August, 1997.

U.S. EPA, 1997e. *Exposure Factors Handbook, Volume III: Activity Factors.* EPA/600/P-95/002Fc. August 1997.

U.S. EPA, 1997f. Drinking Water Advisory: Consumer Acceptability Advice and Health Effects Analysis on Methyl Tertiary Butyl Ether (MTBE), United States Environmental Protection Agency, Office of Water, EPA-822-F-97-009, December 1997.

U.S. EPA, 1998a. Draft Water Quality Criteria Methodology Revisions: Human Health. *Federal Register,* Vol. 63, No. 157, August 14, 1998.

U.S. EPA, 1998b. *Interim Final Guidance: Developing Risk-Based Cleanup Levels At Resource Conservation and Recovery Act Sites in Region 10*, EPA 910/R-98-001, January 1998.

U.S. EPA, 1999. *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites.* OSWER Directive 9200.4-17P. April, 1999.

U.S. EPA, 2000. Letter from Patricia Cirone, USEPA Region 10 to Curtis Dahlgren, date March 16, 2000.

USGS, 1996. Final Draft Report: Fuel Oxygenates and Water Quality: A Summary of Current Understanding of Sources, Occurrence in Natural Waters, Environmental Behavior, Fate and Significance. United States Department of the Interior. March 15, 1996.

Van den Berg, M., et. al., 1998. Toxic equivalency factors (TEFs) for PCBs, PCDDs, and PCDFs for humans and wildlife. Environ. Health Perspect. 106(12): 775-792.

Weyerhaeuser / Dupont Site Investigation, 1994. Ecology site files (work performed by Hart Crowser).

White, 1999. White, Jim W. *Hazards of Short-Term Exposure To Arsenic Contaminated Soil.* Washington State Department of Health. January 1999.

World Book, 1994. *The World Book Encyclopedia*. 1994.

Yates, 1995. *Washington State Atlas and Databook*, fourth edition.