Issue Summaries

Summaries of issues
related to updating the

MTCA Cleanup Regulation

and

Sediment Management Standards

Fall 2009

MTCA & SMS Issue Summaries

Ecology announced in February 2009 the beginning of a rule-making effort for revising and updating the Models Toxics Control Act (MTCA) Cleanup Regulation and cleanup portions of the Sediment Management Standards (SMS) rule. Ecology chose issues based on a combination of input from stakeholders, interested parties, Ecology staff, pressing need, and resources available. These Issue Summaries provide a foundation for further discussion.

- ABC Framework for Cleanup Levels
- Use and Scope of Method A
- Terrestrial Ecological Evaluations
- Remedy Selection
- Human Health Risk Assessment Methods and Policies
- Fish Consumption Rates for High Exposure Population Groups
- Vapor Intrusion
- Cleanup Levels for Lead Contaminated Soils
- Institutional Controls and Periodic Reviews
- Freshwater Sediment Standards
- Other Toxic, Radioactive, Biological or Deleterious Substances
- Background Concentrations in Setting Sediment Cleanup Standards
- Integrating the Sediment Management Standards and Model Toxics Control Act Rules
- Human Health Risks in Setting Sediment Cleanup Standards
- Ecological Risks from Bioaccumulative Chemicals in Sediment

Glossary

ABC Framework for Cleanup Levels

Issue

What steps (if any) should Ecology take to simplify and clarify procedures for establishing cleanup levels in the Model Toxics Control Act (MTCA) cleanup regulation?

Problem Statement

Prior to beginning the rule making process, Ecology held a number of scoping meetings. Most people attending the scoping meetings appeared to believe that the MTCA rule framework was not broken and, consequently, did not require a major overhaul.[1] However, Ecology consistently heard that the rule is unnecessarily long and complex. Many of those comments centered on the methods and procedures for establishing cleanup levels:

- Too Many Methods for Establishing Cleanup Levels: The rule currently has five methods (Method A, Standard and Modified Method B, and Standard and Modified Method C) for establishing cleanup levels. Several people stated that the rule provides too many options for establishing cleanup levels. In their opinion, the rule also lacks a clear roadmap for choosing the appropriate method, which contributes to confusion and cleanup delays. Several people pointed out that three of the options (Modified Method B, Method C, and Modified Method C) are rarely, if ever, used.
- Incomplete or Inadequate Attention to Important Exposure Pathways: Some people expressed the opinion that the current approach for establishing media-specific cleanup levels does not result in cleanup levels that take into account all relevant exposure pathways. They believe the current rule framework (tables and media-specific equations) serves as a barrier to considering exposure pathways like vapor intrusion and the ground water-to-surface water pathway.
- Length and Complexity: Several people expressed concerns that the length of the rule and/or individual sections makes it more difficult to understand key rule requirements.
- Limited Integration of Requirements for Human Health and Ecological Protection: Many people stated that it was hard to understand how to use the results from the Terrestrial Ecological Evaluations to establish soil cleanup levels based on ecological protection. This concern is discussed in a separate issue summary (Terrestrial Ecological Evaluations).

[1] In this issue summary the terms MTCA cleanup regulation and MTCA rule are used interchangeably and refer to Chapter 173-340 WAC.

Background

Ecology originally adopted cleanup standards in 1991. The original MTCA cleanup regulation provided three methods for establishing cleanup levels.

- ***Method A*** can be used to establish cleanup levels at relatively small sites that involve few contaminants. Cleanup levels must be at least as stringent as (1) requirements in other applicable state and federal laws and regulations (e.g., drinking water standards); and (2) ground water and soil cleanup levels are listed in Tables 720-1, 740-1, and 745-1.
- ***Method B*** can be used to establish cleanup levels at any site. Under Method B, cleanup levels must be at least as stringent as (1) requirements in other applicable state and federal laws and regulations; and (2) cleanup levels calculated using the equations in WAC 173-340-720 through 173-340-750.
- ***Method C*** can be used to establish cleanup levels in limited situations—typically for soil cleanup levels for industrial land uses. Method C cleanup levels must be at least as stringent as (1) requirements in other applicable state and federal laws and regulations; and (2) cleanup levels calculated using the equations in WAC 173-340-720 through 173-340-750.

In February, 2001, Ecology completed significant changes to the cleanup standards. The 2001 amendments to the MTCA cleanup regulation included two additional methods (Modified Methods B and C) for establishing cleanup levels. The methods and policies for establishing Modified Method B and C cleanup levels are very similar to the standard methods. The primary differences are (1) the modified methods provide the flexibility to use chemical- or site-specific information to modify certain toxicological and exposure parameters and (2) the equations for the modified soil cleanup levels consider both soil ingestion and dermal contact exposures.

Rulemaking Options Being Considered

Ecology is considering several options for addressing this issue during the current rulemaking process. These include:

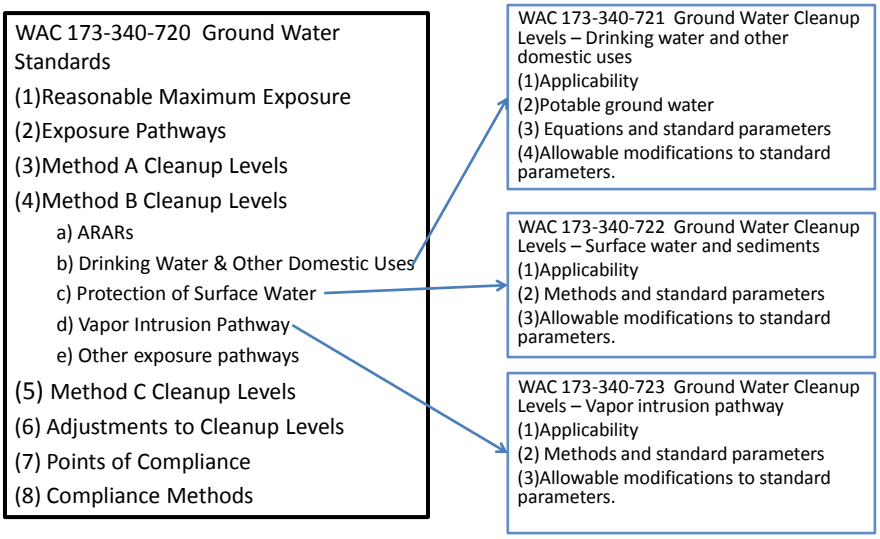
<u>Eliminate Modified Method B and Modified Method C Provisions</u>: Under this option, Ecology would eliminate the Modified Method B and Modified Method C provisions. The rule text would be revised to allow people to consider site-specific information for a limited number of factors (e.g., gastrointestinal absorption fraction) when using the standard Method B. This is currently allowed under WAC 173-340-708 and is similar to the provisions in the 1991 rule.

<u>Eliminate Method C</u>: Under this option, Ecology would eliminate the Method C provisions.

<u>Exposure Pathway Format</u>: Under this option, Ecology would retain three methods of establishing cleanup levels (A, B, and C). However, each media-specific cleanup level section would be organized around exposure pathways that provide better linkage to the conceptual site model prepared during the RI/FS (See Figure 1). Several other states (e.g., Michigan and Wisconsin) have rules that use this approach. The rule language would be supplemented with pathway-specific cleanup level tables that would be posted on the Ecology website as part of a

modified CLARC database.[2] This would be modeled on the cleanup tables prepared by the Oregon Department of Environmental Quality. These tables would facilitate the screening evaluations typically performed during the remedial investigation and feasibility study process.

Figure 1: Exposure Pathway Format



Get Rid of ABC Framework: Under this option, Ecology would modify the rule to provide one method for establishing cleanup levels. The method would include a standard set of equations/procedures with clear direction on which parameters could be modified on a site-specific basis. Each section would be organized around exposure pathways similar to approaches used by Michigan and Wisconsin. This option is similar to the exposure pathway format, but does not include cleanup level tables in the rule. Under this option, Ecology would post pre-calculated standards based on those equations on the Ecology website.

Factors to Consider When Selecting an Option

Developing amendments to the MTCA rule will require considering and balancing of a number of issues and interests. Ecology believes that the following factors need to be considered when evaluating options for addressing this issue:

[2] Ecology's searchable database, Cleanup Levels and Risk Calculation (CLARC), is available through the Toxics Cleanup Program pages of the Ecology web site.

- How frequently have people used Method C or Modified Method C to establish cleanup levels (other than industrial soils)? Has anyone used Method C since the 2001 rule amendments introduced the remediation level concept?
- How frequently have people used Modified Method B to establish soil cleanup levels that take into account the dermal contact pathway?
- How frequently have people used or tried to use Modified Method B to establish cleanup levels based on the other factors identified in the MTCA rule? For example, are people using new or modified toxicity values, adjusting gastrointestinal absorption fractions or inhalation correction factors (WAC 173-340-720), or using modified toxicity equivalence factors?
    - If yes, how frequently?
    - Are people able to successfully establish cleanup levels based on site-specific information?
    - Did using Modified Method B to incorporate site-specific information make a practical difference in cleanup requirements?
- Would reducing the number of words and/or reorganizing the media-specific sections result in a more understandable rule?
- Would reorganizing the media-specific sections around exposure pathways facilitate more efficient information collection and evaluation during the remedial investigation and feasibility study phase?
- What are the current web-based options for providing information (relative to capabilities in 1991 when the original cleanup standards were completed)?
- What approaches are being used by other successful state cleanup programs?
- Do these options create additional implementation issues or problems (e.g., unintended consequences)?
- Are there complementary changes to other rule provisions that would be needed to support greater emphasis on exposure pathways?
    - Remedial investigation provisions (e.g., conceptual site model)
    - Remedy selection
    - CLARC database
    - Other?
- Are there other options that Ecology should consider when evaluating ways to simplify and clarify the MTCA procedures for establishing cleanup levels?

Use and Scope of Method A

Issue

Should Ecology consider revising the Model Toxics Control Act (MTCA) cleanup regulation to make it easier to use Method A at a broader range of sites?

Problem Statement

Under the current MTCA rules, there are three methods (Methods A, B and C) for establishing cleanup levels.[1] Method A was designed to provide an easy-to-use method for sites that involve a small number of contaminants.

Most people believe that the Method A cleanup level tables facilitate cleanup actions by providing simple answers. However, people have identified several problems with the current rule provisions in terms of facilitating cleanup actions:

- The current tables contain too few chemicals.
- The current rule places too many constraints on the use of table values.
- The current rule does not provide simple answers that address all relevant exposure pathways and health endpoints (e.g., vapor intrusion, terrestrial ecological risks).

On the other hand, some people believe the current Method A tables complicate efforts to establish protective cleanup levels because:

- The Method A tables are a barrier to considering all relevant exposure pathways.
- The Method A tables are a barrier to using new toxicity information.

Background

Under the current MTCA rules, there are three methods (Methods A, B and C) for establishing cleanup levels. Ecology originally intended that ***Method A*** would be used at relatively small sites that involve few contaminants. Specifically, WAC 173-340-704(1) states that Method A may be used at the following types of sites:

> ***(a)*** *Sites undergoing a routine cleanup action as defined in WAC 173-340-200; or*
> ***(b)*** *Sites where numerical standards are available in this chapter or applicable state and federal laws for all indicator hazardous substances in the media for which the Method A cleanup level is being used.*

[1] In this issue summary the terms MTCA cleanup regulation and MTCA rule are used interchangeably and refer to Chapter 173-340 WAC.

The rule defines a **"Routine cleanup action"** as "…a remedial action meeting all of the following criteria:

- *Cleanup standards for each hazardous substance addressed by the cleanup are obvious and undisputed, and allow for an adequate margin of safety for protection of human health and the environment;*
- *It involves an obvious and limited choice among cleanup action alternatives and uses an alternative that is reliable, has proven capable of accomplishing cleanup standards, and with which the department has experience;*
- *The cleanup action does not require preparation of an environmental impact statement; and*
- *The site qualifies under WAC 173-340-7491 for an exclusion from conducting a simplified or site-specific terrestrial ecological evaluation, or if the site qualifies for a simplified ecological evaluation, the evaluation is ended under WAC 173-340-7492(2) or the values in Table 749-2 are used.*

Under Method A, cleanup levels must be at least as stringent as the following:

(a) *Concentrations of individual hazardous substances listed in Tables 720-1, 740-1, or 745-1 in this chapter;*

(b) *Concentrations of individual hazardous substances established under applicable state and federal laws;*

(c) *Concentrations that result in no significant adverse effects on the protection and propagation of terrestrial ecological receptors using the procedures specified in WAC 173-340-7490 through 173-340-7493, unless it is demonstrated under those sections that establishing a soil concentration is unnecessary; and*

(d) *For individual hazardous substances deemed indicator hazardous substances for the medium of concern under WAC 173-340-708(2) and not addressed under (a) and (b) of this subsection, concentrations that do not exceed natural background levels or the practical quantitation limit, whichever is higher, for the substance in question.*

The rule includes three tables that provide Method A cleanup levels for frequently encountered contaminants in ground water (Table 720-1), soil (Table 740-1) and industrial soils (Table 745-1).

New Scientific and Regulatory Information Since 2001 Rule Revisions

Since the 2001 rule revisions, there have been several important scientific and regulatory developments relevant to the current rulemaking process. EPA has updated the toxicity values for several hazardous substances listed in the Method A tables.

Rulemaking Options Being Considered

Ecology is considering several options for addressing this issue during the current rulemaking process. These include:

Limited Revisions to Method A: Under this option, Ecology would make limited changes to the Method A values using the Method B equations and new toxicity information. Changes would be limited to revisions needed to incorporate new standards (e.g., drinking water standards) or updated EPA toxicity values. Table 1 (below) illustrates how the use of new standards and/or toxicity values would impact some of the current Method A ground water cleanup levels. Under this option, Ecology would maintain the current constraints on the use of Method A.

Revised Method A Applicability Requirements: Under this option, Ecology would revise the criteria for deciding how and when Method A could be used to establish cleanup levels for individual sites. For example, Ecology could revise the rule to eliminate the concept of routine cleanup actions and revise the rule to reflect the current use of Method A in a wide range of situations.

Expanded Method A Tables: Under this option, Ecology would publish Method A values for other hazardous substances that have been found at Washington cleanup sites. Ecology would also expand the tables to include multiple columns that include cleanup levels for different pathways (for example, direct contact, soil to ground water, vapor intrusion, ecological protection). Site managers and investigators would need to decide which pathways were applicable and select the most stringent value as the Method A cleanup level. This approach is similar to guidance materials published by the environmental agencies in Oregon, Michigan, and New Jersey.

Get Rid of Method A: Under this option, Ecology would remove the Method A tables from the rule. Ecology would modify the rule to provide one method for establishing cleanup levels. The method would include a standard set of equations/procedures with clear direction on which parameters could be modified on a site-specific basis. Each section would be organized around exposure pathways similar to approaches used by Michigan and Wisconsin. Under this option, Ecology would post pre-calculated standards for multiple pathways on the Ecology Website.

Factors to Consider When Selecting an Option

Developing amendments to the MTCA cleanup regulation will require considering and balancing a number of issues and interests. Ecology believes that the following factors need to be considered when evaluating options for addressing this issue:

- What types of sites are currently using Method A to establish cleanup levels?
- When have Method A values been used in combination with Method B values (for example, using Method A for lead and Method B for other substances)?
- What constraints (if any) should be placed on the use of Method A because of unaddressed risk issues (additive risk, cleanup requirements for high fish consumers, dermal exposure in soil, and impacts to surface water and sediment from contaminated ground water)?
- Should Ecology consider expanding the list of substances included in the Method A tables? If so, which substances should Ecology considering adding to the tables?

- If Ecology were to consider reducing the number of substances included in the Method A tables, which substances would be the highest priority to retain in the rule?
- When using Method A, are people evaluating the potential for vapor intrusion problems? Is there a presumption that Method A values are sufficiently protective of indoor air?
- How frequently has it been necessary to adjust cleanup levels for individual substances based on total site risk requirements? How has that worked?

Table 1: Comparison of Current Method A Ground Water Cleanup Levels and Revised Method A Ground Water Cleanup Levels Calculated using Method B Equations and Current Toxicity Values Included in the CLARC database

Substance	Current Method A Levels (ug/L)	Revised Method A Levels (ug/L)	Rationale
Tetrachloroethylene	5	0.8	The current Method A cleanup level is based on the maximum contaminant level (MCL). The CLARC database includes an updated cancer slope factor (0.54 kg-day/mg) developed by the California Environmental Protection Agency and endorsed by EPA's National Center for Environmental Assessment.[2] Using this value, the revised Method A cleanup level would be 0.8 ug/L (MCL adjusted for a 10^{-5} cancer risk).
Toluene	1,000	640	The current Method A cleanup level is based on the maximum contaminant level (MCL). EPA published a new reference dose (0.08 mg/kg/day) in 2005.[3] Using this, value, the revised Method A cleanup level would be 640 ug/L (MCL adjusted for a hazard index of 1).
Trichloroethylene	5	2.4	The current Method A cleanup level is based on the maximum contaminant level (MCL). The CLARC database includes an updated oral reference dose (0.0003 mg/kg/day) that was developed by EPA's National Center for Environmental Assessment.[4] Using this value, the revised Method A cleanup level would be 2.4 ug/L (MCL adjusted for a hazard index of 1).
Vinyl Chloride	0.2	0.3	The current Method A cleanup level is based on the maximum contaminant level (MCL) adjusted for a 10-5 cancer risk. The CLARC database includes a new cancer slope factor (1.5 kg-day/mg) that applies the EPA cancer risk guidelines published in 2005.[5] The revised Method A cleanup level would be 0.3 ug/L (MCL adjusted for 10^{-5} cancer risk).

[2] Cleanup Levels and Risk Calculation (CLARC) database – Guidance on Toxicological Information. Tetrachloroethylene Toxicity Information (Perc, PCE, Perchloroethylene) CAS #127-18-4. Available on Ecology's Toxics Cleanup Program website.
[3] Environmental Protection Agency. 2005. Toxicological Review of Toluene. Published in IRIS database.
[4] Cleanup Levels and Risk Calculation (CLARC) database – Guidance on Toxicological Information. Recommended Trichloroethylene (TCE) Toxicity Values and MTCA Cleanup Levels CAS #79-01-6. Available on Ecology's Toxics Cleanup Program website.
[5] Cleanup Levels and Risk Calculation (CLARC) database – Guidance on Toxicological Information for Vinyl chloride. Available on Ecology's Toxics Cleanup Program website.

Terrestrial Ecological Evaluations

Issue

What rule revisions are needed (if any) to clarify and update the terrestrial ecological evaluation process under the Model Toxics Control Act (MTCA)?

Problem Statement

The purpose of terrestrial ecological evaluations (TEEs) as required by the MTCA cleanup regulation is ensuring protection of plants and animals. Since 2001, the TEE process has been used at a wide range of sites. While Ecology does not maintain statistics, most sites appear to be qualifying for an exemption. Most of the remaining sites have performed a simplified TEE. Only a handful of sites have conducted site-specific TEE's. Given this distribution, it appears that the overall process is working as originally intended. However, a number of implementation problems appear to contribute to cleanup delays and inefficiencies:

- People are sometimes unaware of the TEE provisions until late in the remedial investigation/feasibility study.
- Many consultants and site managers find it difficult to understand and interpret the requirements for performing a TEE.
- The MTCA cleanup regulation lacks a clear roadmap explaining how the results of the TEE can be used to establish cleanup levels and select remedies.
- The TEE soil screening values do not reflect toxicity data developed since the mid-1990s.

Overview

The TEE sections (WAC 173-340-7490 through 7494) were added to the MTCA rule in 2001 to provide a process for evaluating impacts to plants and wildlife. [1] This implemented recommendations from the MTCA Policy Advisory Committee to the Washington legislature.[2]

The purpose of a terrestrial ecological evaluation is to protect land-based plants and animals from exposure to contaminated soil. There are three options:

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[1] This Issue Summary uses the terms MTCA cleanup regulation and MTCA rule interchangeably; both refer to Chapter 173-340 WAC.

[2] Final Report of the Model Toxics Control Act Policy Advisory Committee, December 15, 1996. http://www.ecy.wa.gov/programs/tcp/mtca_pac/mtcapac.html

1. Evaluate and document whether an exemption applies. A site with very little habitat or little opportunity for plants and animals to be exposed to the contamination is exempt from conducting further evaluation.
2. Determine whether the site qualifies for a simplified TEE. Sites with limited habitat of modest quality and no endangered or threatened species qualify for the simplified TEE.
3. Conduct a site-specific TEE. This is required for sites with high quality habitat or endangered or threatened species. This may also be voluntarily conducted at any site.

New Scientific and Regulatory Information Since 2001 Rule Revisions

A large amount of new scientific information has been developed on the toxicity and bioavailability. Over the last several years, EPA has published Ecological Soil Screening Levels (EcoSSLs) for 17 metals and 4 organic compounds frequently found at Superfund sites.

Rulemaking Options Being Considered

Ecology is considering several options for addressing this issue during the current rulemaking process. These include:

Editorial and Simple Structural Changes: Under this option, Ecology would not make any significant revisions to the MTCA rule. Ecology would make editorial and structural changes to clarify the TEE requirements. Examples of these types of changes are listed in Table 1 below.

Updating the Ecological Screening Tables: Under this option, Ecology would revise the soil screening concentrations and wildlife exposure model based on current scientific information and EPA regulatory guidelines.[3] Examples of these types of changes are listed in Table 2 below.

Integrating, Policy Clarifications and Decision Roadmap: Under this option, Ecology would make modest revisions to the MTCA rule to better integrate the TEE process (for example, clarifying how the TEE process fits into setting cleanup standards and remedy selection). Ecology would clarify certain policy issues. Examples of these types of changes are listed in Table 3 below.

Combination: Under this option, Ecology would make revisions to integrate the TEE process with other parts of the rule, clarify certain policy issues and update the TEE tables using current scientific information and regulatory guidance.

[3] WAC 173-340-900 Tables 749-2 through 749-5.

Factors to Consider When Selecting an Option

Developing amendments to the MTCA cleanup regulation will require considering and balancing a number of issues and interests. Ecology believes that the following factors need to be considered when evaluating rulemaking options:

- Issues identified when implementing the current rule provisions.
- Whether the changes result in a more understandable process.
- New scientific information on the bioavailability and toxicity of hazardous substances developed since 2001.
- New regulatory policies and guidance developed by EPA and other states.
- Whether particular options comply with the requirements of the Administrative Procedures Act.

Table 1: Editorial and Simple Structural Changes to Clarify TEE Requirements		
Issue	Under Consideration	Comment
Rule Structure: Parts of Sections 7490-7494 are confusing and repetitive.	These Sections would benefit from targeted reorganization, such as: • Consolidating and moving provisions that pertain throughout the TEE Sections to Section 7490, such as provisions related to institutional controls. • Moving the criteria for site-specific TEE's to the site-specific TEE Section (7493). • Moving the TEE provisions closer to the RI/FS requirements.	Editorial changes.

Table 2: Updating TEE Tables Based on New Scientific Information		
Issue	Under Consideration	Comment
Tables 749-2 and 749-3: These tables no longer reflect the latest scientific information.	There are a number of options that could be used to update these tables: • Use threshold reference values (TRVs) data and bioaccumulation factors (BAFs) in EPA database to update table values using the same policies and procedures that were used in 2001. • Use TRVs based on EPA's approach of basing them on NOAELs instead of MTCA's approach of using the LOAELs. This would be a policy change. • Substitute EPA TEE screening values for values in these tables, where available. EPA uses different policy choices and a wildlife exposure model than was used in MTCA.	EPA has not established EcoSSLs for all of the hazardous substances in the MTCA tables. Using EPA EcoSSL's policy would result in some values being based on different policies and procedures than other values in the MTCA tables.

Dioxins: The TEE tables (Table 749-2 & 3) contain dioxin and furan screening levels but no reference is made to use of TEFs. This implies the total of all dioxin and furan congeners must be compared against these screening levels.	Should the rule include a table of mammalian toxicity equivalency factors (TEFs) from the World Health Organization (WHO) and a footnote describing their use for TEEs?	This is consistent with current practice.

Table 3: Integration, Policy Clarifications and Decision Roadmap

Issue	Under Consideration	Comment
Undeveloped Land Definition: It is unclear what types of "roads" qualify for dividing up habitat.	• Should the language be amended to incorporate WSDOT road classifications? See: www.wsdot.wa.gov/mapsdata/todo/functionalclass.htm	This is basically a question of whether or not the road disrupts the activities of potential receptor species at the site. Even a road that is heavily traveled during daylight hours may not disrupt habitat if seldom used at night.
Net environmental benefit: Sometimes the soils and sediments that are contaminated are located in heavily forested areas or wetlands that would be destroyed to achieve protective cleanup levels. The current rule doesn't allow this to be factored into cleanup level determinations.	• Should the rule allow the potential impacts to existing species to be taken into account when establishing cleanup levels based on ecological protection and/or selecting remedies?	Could lead to less complete cleanups in ecologically sensitive areas. Institutional controls are ineffective in controlling plant and animal exposures. May need to compensate for natural resource damages to habitat productivity.
Point of Compliance: The relationship between the remedy selection process and use of a conditional POC is unclear.	• Should the rule clarify that conditional points of compliance must be justified with a disproportionate-cost analysis.	Conditional points of compliance could also be useful in preserving high-value habitat within the site.
Determining Compliance: TEE Sections do not explicitly state that compliance monitoring requirements and statistical methods in Section 740 apply to TEE soil cleanup levels. This has been questioned at some sites.	• Should the rule be revised to clarify that Section 740(7) applies to TEE soil cleanup levels?	May need flexibility for site-specific compliance method requirements (e.g., different compliance methods may be needed for wetland restoration).
"Site Definition": When determining the size of a site under Section 7491, some have confused "site" with "property".	• Clarify provision.	"Site" is any area hazardous substances have come to be located and is not limited by the property boundary.

Table 3: Integration, Policy Clarifications and Decision Roadmap (continued)		
Issue	Under Consideration	Comment
Simplified TEE's: The role of the table values and bioassays in determining if a TEE can be ended and in establishing cleanup levels is unclear.	• Clarify provision.	
Site-Specific TEE's: Sites with extensive off-property prime habitat may not be required to conduct a site-specific TEE when the habitat is off the PLP's property.	• Should the rule be revised to clarify that sites with such habitat must do a site-specific TEE?	Changes are required to protect ecological receptors that may use nearby contaminated areas.
Intermittent Streams and Wetlands: It is unclear what cleanup standard applies to the substrate in intermittent streams and wetlands: soil or sediment.	• Apply the more stringent of the MTCA soil standards (TEE or Human Health) and sediment standards to intermittent/seasonal streams and wetlands?	This issue is not limited to TEEs. What standard to apply may differ depending on how long standing water is present and other standards used to delineate wetlands/intermittent streams.
Tables 740-1 and 745-1: The TEE requirements are sometimes ignored because they are not captured in this table.	• Should the Method A tables include a TEE column and appropriate descriptive footnotes? • If yes, which screening values (Table 749-2 or 749-3) should be used?	If the Table 749-2 values are used, most TEE values will be less stringent than the current Method A values. Use of these values would be consistent with the intent that Method A be used for simple sites.

Remedy Selection

Issue

What rule revisions, in any, are needed to clarify and update the remedy selection process under the Model Toxics Control Act (MTCA)?

Problem Statement

The remedy selection process under MTCA involves several subjective standards. These provisions purposely provide Ecology site managers with wide discretion in determining the extent of cleanup required at a site and the technology to be used for the cleanup. This can lead to protracted negotiations with potentially liable parties (PLPs). Success depends heavily on the PLP consultant's and Ecology site manager's negotiating skills and command of technical issues.

Most of the debate around remedy selection centers on provisions requiring "use of permanent solutions to the maximum extent practical" and a "reasonable restoration timeframe." While it is not possible to change remedy selection into a cookbook process, there are a number of provisions that could be clarified to streamline the process.

Background

The MTCA statute and rule require remedies to meet certain minimum requirements.[1] These requirements include:

- Protect human health and the environment
- Comply with cleanup standards
- Comply with applicable state and federal laws (ARARs)
- Provide for compliance monitoring
- Use permanent solutions to the maximum extent practicable
- Provide for a reasonable restoration timeframe
- Consider public concerns

[1] In this issue summary the terms MTCA cleanup regulation and MTCA rule are used interchangeably and refer to Chapter 173-340 WAC. The MTCA statute is codified as Chapter 70.105D RCW.

In addition, there are several narrative standards contained within Section 360 of the MTCA rule. This process and several specific provisions were heavily negotiated during the 2001 MTCA rule-making process.

Rulemaking Options Being Considered

Ecology is considering several options for addressing this issue during the current rulemaking process. These include:

Editorial and Simple Structural Changes: Under this option, Ecology would not make any significant revisions to the rule. However, Ecology would make editorial and structural changes to clarify the remedy selection requirements. Examples of these types of changes being considered are listed in Table 1 below.

Modest Policy Clarifications: Under this option, Ecology would make modest revisions to provide for submittal of better information and to clarify several of the remedy selection requirements. Examples of some of the types of changes being considered are listed in Table 2 below.

Significant Policy Revisions: Under this option, Ecology would change current language and add new presumptions intended to speed up the remedy selection process. Examples of some of the types of changes being considered are listed in Table 3 below.

Combination: Under this option, Ecology would make revisions to incorporate elements of all three of the above options.

Factors to Consider When Selecting an Option

Developing amendments to the MTCA cleanup regulation will require considering and balancing a number of issues and interests. Proposed amendments must also satisfy several regulatory goals, including the following:

- Providing for the selection of cleanup actions that meet the minimum statutory requirements.
- Providing consistent standards and methodologies for assessing and managing risk.
- Providing flexibility to address site-specific factors.
- Promoting efficient and cost-effective cleanup of contaminated sites.
- Improving the clarity and usability of the rule.

Table 1: Editorial and Simple Structural Changes to Clarify Requirements		
Current Provision	**Under Consideration**	**Comment**
Minimum Requirements: The distinction between threshold and other criteria adds unnecessary complexity.	Should the seven criteria be renumbered into one list?	This is a distinction without a purpose. All criteria still have to be met. Renumbering should simplify the analysis.
Non-permanent groundwater cleanup actions: Conditions for use of non-permanent groundwater cleanup actions do not reflect all requirements in other parts of rule.	Add to 360(2): • Alternative water supply • Institutional controls • Periodic reviews • Financial Assurance	Would help clarify what conditions must be met for groundwater containment remedies.
Reasonable Restoration Time Frame: Currently identified as one of minimum criteria that remedies must meet with detailed discussion near end of Section 360.	Should this subsection be moved up and made more prominent in remedy selection process?	Moving up would emphasize this requirement and correspond better to when it is considered in the remedy selection process.
PMEP Evaluation Criteria: Costs and benefits not distinguished in current rule language.	Consider reordering criteria to distinguish which are costs and which are benefits as follows: • Cost-related factors include construction costs, long-term costs, and implementability • Benefit-related factors include protectiveness, permanence, long-term effectiveness and management of short-term risks.	Should help streamline disproportionate-cost analyses.

Table 2: Modest Policy Clarifications		
Current Provision	**Under Consideration**	**Comment**
Disproportionate Cost Test: 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.	Should standard be clarified? "Costs are disproportionate to benefits if the incremental costs of <u>a higher cost</u> alternative over that of a lower cost alternative <u>substantially</u> exceed the incremental degree of benefits achieved by the <u>higher cost</u> alternative over that of the lower cost alternative."	2001 responsiveness summary noted that previous standard of "substantial and disproportionate" is subsumed within "disproportionate". This is not obvious from current language.
Cost Analysis: Current rule does not specify an inflation rate or rate of return for disproportionate-cost evaluations.	Add default inflation rate and rate of return for present worth analyses. (Currently researching options.)	To provide more consistent disproportionate cost analyses across sites.

Feasibility Study Contents (Section 350)	Should Section 350 be amended to: • More explicitly describes the steps in the remedy selection process • List the contents of a feasibility study • Require feasibility studies to map the location, mass, and concentrations of residual contamination for each cleanup alternative?	Should speed up remedy selection since these are often points of confusion. Mapping the residual contamination would help speed up remedy selection as most sites do not submit this information and it must be created by Ecology staff. Should also lead to more complete investigations, avoiding supplemental investigations.

Table 3: Significant Policy Revisions		
Current Provision	**Under Consideration**	**Comment**
Institutional Controls: The rule states that institutional controls must demonstrably reduce risks to ensure a protective remedy. This demonstration should be based on a quantitative scientific analysis where appropriate.	Should the "quantitative scientific analysis" requirement be eliminated?	Insufficient information current exists to conduct this analysis.
Reasonable Restoration Time Frame: Currently identified as one of minimum criteria that remedies must meet.	Add a presumption that remedies that restore a site within X (5) years are presumed to meet a reasonable restoration timeframe?	This presumption may not be stringent enough for sites with minor contamination.
Climate Change/Carbon Footprint: Not addressed in current criteria.	Should greenhouse gas emissions and the impact of climate change such as sea level rise be factored into the remedy selection process?	Carbon footprint may lead to more containment remedies since these tend to have the least initial carbon emissions.
PMEP Outcome: While the factors for selecting a permanent remedy are spelled out in detail, and some obvious expected outcomes are spelled out in Section 370, the outcome of this process is highly variable and highly dependent on the information provided and negotiation process.	Should a presumption be added to streamline the PMEP analysis? For example, if the remedy selected removes or treats X% (90-95%?) of the contamination, it is presumed to be permanent to the maximum extent practicable.	Applying the same % to all sites may be difficult given the wide variety of sites. Would need to be clear that this presumption would not override other minimum requirements (e.g., must still meet cleanup standards). How is the % reduction measured? (% weight? % risk reduction? % volume?). Another issue is whether the % reduction is measured for each medium or the overall site.
Demonstrating a Remedy is Protective: Section 360 provides a detailed discussion of	Should a new subsection be added to Section 360 describing how to	Exposure scenarios vary widely for different remedies and site

restoration timeframe and PMEP but does not describe how to determine a remedy is protective of human health and the environment when containment is used.	determine if containment remedies are protective of human health and the environment? Options range from evaluation factors to consider -- to default equations based on maintenance workers and other short term exposure scenarios.	and resource uses. This may be difficult to do given the wide range of remedies and sites.
Expectations (Section 370): The regulatory status of the expectations in Section 370 is unclear.	Should the rule require consideration of all expectations in Section 370 as part of remedy selection process?	Would help PLP's consultants understand what remedies Ecology is looking for.

Human Health Risk Assessment Methods and Policies

Issue

What changes (if any) should Ecology make to the Model Toxics Control Act (MTCA) cleanup regulation given current scientific information and regulatory guidance on human health risk assessment methods?

Problem Statement

The risk assessment methods in the MTCA cleanup regulation are based on scientific information and regulatory guidance available at the end of the 1990s. [1] Since the 2001 amendments, there have been several important scientific and regulatory developments relevant to establishing risk-based cleanup levels. This information raises several questions about the current MTCA cleanup regulation:

- Whether MTCA terms and definitions need to be updated based on recent EPA guidance?
- Whether (and if so, how) multiple exposure pathways (e.g., ingestion, dermal contact, and inhalation) should be considered when establishing soil cleanup levels?
- Whether the exposure parameters used when calculating risk-based cleanup levels should be revised to incorporate early-life stage exposure pathways and parameters corresponding to critical windows of susceptibility for the developing fetus, infants, and young children where cancer may be expressed later in life?
- Whether the toxicological parameters used when calculating risk-based cleanup levels should account for the potential that early life exposure to chemical carcinogens may increase the risk of developing cancer later in life?
- Whether the methods and policies used to establish risk-based cleanup levels for indoor and outdoor air need to be revised based on recent EPA guidance?

Background

The MTCA cleanup regulation provides methods and policies and procedures establishing cleanup levels based on human health protection. The original cleanup standards were adopted

[1] In this issue summary the terms MTCA cleanup regulation and MTCA rule are used interchangeably and refer to Chapter 173-340 WAC.

in 1991. The risk assessment methodologies included in the original rule were based on the scientific and regulatory guidance available at that time. Key features include:

- Cleanup levels are based on protecting the most sensitive populations, including pregnant women, developing fetuses, and children.
- Cleanup levels for ground water, surface water, soil, and air are based on the "reasonable maximum exposure" that a person might encounter. The reasonable maximum exposure is designed to represent a high end (but not worst case) estimate of individual exposures.
- Cleanup levels corresponding to the reasonable maximum exposure are based on exposure parameters (e.g., soil ingestion rate, body weight) included in EPA guidance.
- Cleanup levels are based on toxicological parameters (cancer slope factors and reference doses) developed by EPA scientists.

Ecology reviewed the available scientific literature and regulatory guidance when preparing the 2001 rule amendments. Based on that review, Ecology updated the risk assessment methods used to establish cleanup levels. During that rulemaking, Ecology modified the methods for establishing soil cleanup levels to include consideration of both soil ingestion and dermal contact. For petroleum mixtures, the standard equation includes both pathways. For other chemicals, dermal contact is evaluated only when changes to the standard equation results in site-specific cleanup levels that are significantly higher than those calculated using standard equations.

New Scientific and Regulatory Information Since 2001 Rule Revisions

Since the 2001 rule revisions, there have been several important scientific and regulatory developments relevant to this rulemaking issue.

- EPA Risk Assessment Guidance: EPA has published several new guidance materials relevant to the human health risk assessment methods used to establish cleanup levels. This includes cancer risk assessment guidelines, methods for evaluating dermal exposure, child exposure assessment, and methods for evaluating inhalation risks.[2 3 4 5]
- National Research Council (NRC) Reports: Several NRC expert panels have prepared reports and recommendations on risk assessment methods and policies.[6 7] NRC scientific

[2] U.S. Environmental Protection Agency. 2005. Guidelines for Carcinogen Risk Assessment. Risk Assessment Forum. EPA/630/P-03/001F.

[3] Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final July 2004. EPA/540/R/99/005.

[4] U.S. Environmental Protection Agency. 2006. Child-Specific Exposure Factors Handbook (External Review Draft). National Center for Environmental Assessment. Office of Research and Development. EPA/600/R/06/096A.

[5] Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment) Final January 2009. EPA/540/R/070/002.

[6] National Research Council. 2008. Science and Decisions: Advancing Risk Assessment. Committee on Improving Risk Analysis Approaches Used by the U.S. EPA. National Academy Press. Washington DC.

panels have also completed reports and recommendations on risk assessment issues surrounding particular chemicals.[8]

- World Health Organization Report: An international scientific panel completed an evaluation of the disproportionate health risks to children from exposure to chemicals.[9]
- Risk Equations: EPA Regions 3, 6, and 9 and the Oak Ridge National Laboratory (ORNL) have jointly developed risk-based equations that evaluate the toxicity and assess the risks from concurrent ingestion, dermal, and inhalation routes of exposure to chemical contaminants. [10]

Rulemaking Options Being Evaluated

Ecology is considering several options for addressing these issues during the current rulemaking process. These include:

Update Terms and Definitions: Under this option, Ecology would revise the rule to maintain consistency with EPA 2005 cancer risk guidelines and 2009 inhalation risk assessment guidance.

Concurrent Exposure: Under this option, Ecology would modify the rule to more explicitly define when and how dermal contact must be considered when establishing soil and ground water cleanup levels for some or all chemicals. Ecology is evaluating dermal and inhalation routes of exposure in risk based cleanup decisions. This includes evaluating whether and how to account for dermal and inhalation exposures that occur concurrently with incidental soil ingestion when establishing soil cleanup levels.

Modifying the MTCA Cleanup Equations Based on New EPA Inhalation Risk Guidance: Under this option, Ecology would modify the equations in WAC 173-340-750 to reflect recent EPA inhalation risk guidance. Specifically, EPA stopped using oral – to – inhalation extrapolation because the inhalation toxicity values from the National Center for Environmental Assessment (NCEA) are now available on the Integration Risk Information System (IRIS). Ecology is considering discontinuing the assumption that the adverse effects from oral and inhalation exposures and the corresponding toxicity values are equivalent. This would lead Ecology to modify the MTCA cleanup equations to use the inhalation toxicity values directly. This would also include modifying the MTCA equations to reflect the toxicity metrics in the EPA

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[7] NRC review of OMB risk assessment review

[8] National Research Council. 2006. Health Risks from Dioxin and Related Compounds: Evaluation of the EPA Reassessment. Committee on EPA's Exposure and Human Health Reassessment of TCDD and Related Compounds. National Academy of Sciences. National Academy Press. Washington DC.

[9] World Health Organization, 2006. Principles For Evaluating Health Risks In Children Associated with Exposure To Chemicals, Environmental Health Criteria 237.

[10] EPA Region 3/6/9 Risk Based Equations: http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm

guidance.[11] Ecology is considering modifying the MTCA cleanup equations to use the inhalation toxicity values directly in the equations.

Early-Life Stage Exposure and Risks: Under this option, Ecology would modify the rule to incorporate recent EPA guidance on early-life stage exposure. Ecology is currently evaluating the need for age adjustments to account for differences in exposure patterns between children and adults for carcinogens. Ecology is also considering age dependent adjustment factors for carcinogens that have an early life exposure that may express a carcinogenic response later in life. Consideration of age adjustment factors will change the exposure duration currently used by MTCA to establish soil risk based cleanup levels.

Factors to Consider when Selecting Options

Developing amendments to the MTCA cleanup regulation will require considering and balancing a number of issues and interests. Ecology believes that the following factors need to be considered when evaluating options for addressing this issue:

- How frequently have people used Modified Method B to establish soil cleanup levels that take into account the dermal contact pathway?
- How frequently have people used Modified Method C to establish soil cleanup levels that take into account the dermal contact pathway?
- Will addressing these issues be consistent with federal and state regulations and technical information and guidance?
- Will addressing these issues help establish consistent standards and methodologies for establishing cleanup levels protective of human health?

Proposed amendments must also satisfy several regulatory goals, including the following:

- Providing for the selection of cleanup actions that protect human health and the environment.
- Developing scientifically and legally defensible cleanup standards.
- Providing consistent standards and methodologies for assessing and managing risk.
- Providing flexibility to address site-specific factors.

[11] Currently, the EPA toxicity metrics (Reference Concentrations (RFCs) and Inhalation Unit Risks (IURs, InhURs)) must be converted to Reference Doses (RfDs) and Cancer Slope (Potency) Factors which are the toxicity metrics used in the MTCA rule. The Supplemental Guidance for Inhalation Risk Assessment recently published by EPA uses RfCs in units of mg/m^3 and IURs in units of $(\mu g/m^3)^{-1}$ directly in the equations for establishing cleanup levels from the inhalation exposure pathway.

Fish Consumption Rates for High Exposure Population Groups

Issue

What rule revisions are needed to incorporate new scientific information and federal guidance on the health risks for people consuming large amounts of fish and shellfish?

Problem Statement

The Model Toxics Control Act (MTCA) cleanup regulation includes methods for establishing surface water cleanup levels that are based on preventing health risks associated with the consumption of contaminated fish and shellfish.[1] The reasonable maximum exposure (RME) for MTCA surface water cleanup standards is based on a recreational angler exposure scenario.

Many sites being addressed under MTCA are located in the Usual and Accustomed (U&A) fishing areas for one or more tribes. Studies have shown that tribal members often consume much higher amounts of fish and shellfish than recreational anglers. Studies have also shown that other population groups (e.g., Asian-Pacific Islanders) residing near MTCA sites often consume fish and shellfish at much higher rates than recreational anglers. Consequently, exposure estimates based on a recreational angler scenario will generally underestimate fish and shellfish exposure for these population groups.

Ecology currently considers fish consumption rates for tribal populations and other high exposure groups when developing site-specific cleanup levels under the MTCA and the Sediment Management Standards (SMS) rules. This case-by-case approach can be resource intensive, can produce decisions that result in different levels of protection at different sites and often contributes to delays in cleanup decisions and actions.

Background

Under the Model Toxics Control Act (MTCA) Cleanup Regulation, cleanup levels are based on estimates of the "reasonable maximum exposure" (RME).[2]

- The RME represents a high end (but not worst case) estimate of individual exposures. It provides a conservative estimate that falls within a *realistic* range of exposures.
- The RME takes into account both current and reasonably foreseeable future conditions.

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[1] The terms MTCA cleanup regulation and MTCA rule are used interchangeably and refer to Chapter 173-340 WAC.

[2] MTCA defines the RME as the "…the highest exposure that can be reasonably expected to occur for a human or other living organisms at a site under current and potential future site use." CERCLA provides a similar definition "…the highest exposure that is reasonably expected to occur at a Superfund site…"

- The RME is defined as reasonable because it is a product of several factors that are an appropriate mix of average and upper-bound estimates. RME estimates typically fall between the 90th and 99.9 percentile of the exposure distribution.[3]

The MTCA rule includes methods for establishing surface water cleanup levels that are based on preventing health risks associated with the consumption of contaminated fish and shellfish. As noted above, the RME for MTCA surface water cleanup standards is based on a recreational angler exposure scenario. The rule also provides the flexibility to establish more stringent surface water cleanup levels when Ecology determines that such levels are "...necessary to protect other beneficial uses or otherwise protect human health and the environment..." (WAC 173-340-730(1)(e)). Ecology uses a similar case-by-case approach when establishing sediment cleanup standards under MTCA and the Sediment Management Standards.

There are several sites where Ecology has concluded that a recreational angler exposure scenario is not appropriate for situations involving population groups who consume much larger amounts of fish and shellfish. These groups include Native Americans, Asian Pacific Islander populations, and subsistence fishers. Ecology has discussed this issue with the MTCA Science Advisory Board and the Board has agreed with Ecology's overall conclusions. Ecology's conclusion is based on the following factors:

- The MTCA default exposure parameters are based on an exposure scenario (recreational fisher) that is significantly different than the exposure scenario for most tribal populations, Asian Pacific Islanders, and subsistence fishers.

- EPA-Region 10 has published a Decision-Making Framework for selecting and using tribal consumption data to establish cleanup requirements at federal Superfund sites.[4] The framework identifies a four-tiered hierarchy of preferred data sources. Under the EPA Framework, exposure estimates for particular tribes can be based on fish consumption surveys from other tribes (Suquamish or Tulalip Tribes) with similar dietary habits. The exposure parameters specified in the EPA Region 10 Decision-Making Framework are significantly different than the MTCA default exposure parameters.

- EPA exposure guidance materials include exposure parameters based on tribal exposure scenarios. The EPA *Exposure Factor Handbook* recommends, for tribal exposure scenarios, an average ingestion rate of 70 g/day and a 95th percentile ingestion rate of 170 g/day.[5] For children, the EPA *Child-Specific Exposure Factors Handbook* identifies weighted average (21 g/day), 90th percentile (60 g/day) and 95th percentile (78 g/day) values, respectively, for the tribal exposure scenario.[6] These child-specific rates for

[3] U.S. Environmental Protection Agency. 2004. An Examination of EPA Risk Assessment Principles and Practices. EPA/100/B-04/0001.
[4] EPA Region 10 Framework for Selecting and Using Tribal Fish and Shellfish Consumption Rates for Risk-Based Decision Making at CERCLA and RCRA Cleanup Sites in Puget Sound and the Strait of Georgia, August 2007. Page 6.
[5] U.S. Environmental Protection Agency. 1997. Exposure Factors Handbook. National Center for Environmental Assessment. Office of Research and Development. August 1997. Available at: http://www.epa.gov/ncea/efh/.
[6] U.S. Environmental Protection Agency. 2006. Child-Specific Exposure Factors Handbook (External Review Draft). National Center for Environmental Assessment. Office of Research and Development. EPA/600/R/06/096A.

Native American children are significantly higher than estimates for recreational fish intake. The exposure parameters specified in these EPA guidance materials are significantly different than the MTCA default exposure parameters.

- Several Northwest tribes have developed surface water quality standards that are based on human health protection. The fish consumption rates used to develop those standards range from 6.5 to 170 g/day. More recent standards have generally used consumption rates much higher than the MTCA rule default fish consumption rate of 54 g/day.

New Scientific and Regulatory Information Since 2001 Rule Revisions

Since the 2001 rule revisions, there have been several important scientific and regulatory developments relevant to the current rulemaking process.

- Ecology has established cleanup standards at several sites that are based on tribal fish consumption scenarios. These represent site-specific interpretations of the narrative standards in the MTCA and SMS rules. In general, fish consumption rates used at these sites range from 50 to 300 g/day.

- EPA-Region 10 has published a Decision-Making Framework for selecting and using tribal consumption data to establish cleanup requirements at federal Superfund sites.[7] The framework identifies a four-tiered hierarchy of preferred data sources. Under the EPA Framework, exposure estimates for particular tribes can be based on fish consumption surveys from other tribes (Suquamish or Tulalip Tribes) with similar dietary habits.

- Ecology asked the MTCA Science Advisory Board to review a site-specific consumption rate prepared by the Lower Elwha Klallam Tribe (LEKT). The LEKT recommended that Ecology establish cleanup requirements for the former Rayonier mill site in Port Angeles developed using the EPA Decision-Making Framework. The Board agreed with Ecology's conclusion that it was inappropriate to establish cleanup levels using a recreational exposure scenario.

- The Oregon Environmental Quality Commission approved the Oregon Department of Environmental Quality (ODEQ) plan to update Oregon's water quality standards for toxic pollutants using a new fish consumption rate of 175 g/day. This culminated a multi-year effort where ODEQ worked with EPA and the Confederated Tribes of the Umatilla Indian Reservation to conduct a series of public workshops exploring options. In reaching a decision on an updated value, the Oregon Environmental Quality Commission considered the results of an evaluation of available studies prepared by an expert advisory committee, the Human Health Focus Group.[8] The Focus Group identified six studies that

[7] EPA Region 10 Framework for Selecting and Using Tribal Fish and Shellfish Consumption Rates for Risk-Based Decision Making at CERCLA and RCRA Cleanup Sites in Puget Sound and the Strait of Georgia, August 2007. Page 6.

[8] Oregon Department of Environmental Quality. 2008. Human Health Focus Group Report: Oregon Fish and Shellfish Consumption Rate Report. Water Quality Division-Standards and Assessment. June 2008.

they believe provide a scientific basis for establishing health protective requirements. The Focus Group summarized their conclusions in a table which is included at the end of this issue summary.

Rulemaking Options Being Considered

Ecology is considering several options for addressing this issue during the current rulemaking process. These include:

Narrative Standard: Under this option, Ecology would modify the MTCA rule to establish a clear narrative standard that includes an exposure scenario for tribal and other high exposure population groups. Cleanup levels would continue to be based on site-specific determinations.

Develop Guidance Materials: Under this option, Ecology would prepare guidance materials for implementing the current rule provisions. Guidance could be issued without regulatory changes or in tandem with regulatory changes. Guidance would be updated if needed after rule revisions are complete.

Criteria for Site-Specific Determinations: Under this option, Ecology would amend the MTCA rule to explicitly require site-specific determinations based on the narrative standards in the MTCA and SMS rules. The rule revisions would also include criteria and factors that would need to be considered when implementing the narrative standards.

Default Fish Consumptions Rates: Under this option, Ecology would amend the MTCA rule to establish default fish consumption rates for sites located within Usual and Accustomed (U&A) areas or areas regularly used by other groups consuming large amounts of fish/shellfish. This option would also define factors that could be considered when modifying the default value for individual groups and sites.

Factors to Consider When Selecting Options

Developing amendments to the MTCA cleanup regulation will require consideration of a number of issues and interests. Ecology believes that the following factors need to be considered when evaluating this issue:

- Scientific information on tribal fish and shellfish harvesting and consumption habits and patterns, including study designs, results, and factors relevant to interpreting the study results (for example, evidence of suppressed consumption rates or resource switching).
- Scientific information on fish and shellfish harvesting and consumption habits and patterns for other high exposure population groups (for example, Asian Pacific Islanders).
- Federal and tribal regulatory requirements and guidance applicable to this issue (for example, consumption rates underlying federal and tribal water quality standards).
- Requirements in other state and federal laws and regulations. This includes methods and policies used to characterize fish consumption rates and the use of that information in regulatory decision-making.

- Whether other exposure parameters (for example, body weight, exposure duration, and fish diet fraction) should be adjusted when calculating cleanup levels.
- Whether particular options comply with key requirements of the Administrative Procedures Act.

The following table is from the Human Health Focus Group Report: Oregon Fish and Shellfish Consumption Rate Report. Water Quality Division-Standards and Assessment. June 2008.

Table 3. Adult Fish Consumption Rates (gram per day) Recommended by the Human Health Focus Group for Oregon Human Health-Based Water Quality Criteria. (As printed in Oregon DEQ 2008)

Group	Species included in consumption rate evaluation		Statistic					
		N	Mean	Median	Percentile			
					75th	90th	95th	99th
Tulalip Tribe	Anadromous and estuarine finfish and shellfish	73	72	45	85	186	244	312
Suquamish Tribe	Anadromous and estuarine finfish and shellfish	284	214	132	NA	489	NA	NA
Squaxin Island Tribe	Anadromous and estuarine finfish and shellfish	117	73	43	NA	193	247	NA
Columbia River Tribe	Freshwater and anadromous finfish	512	63	40	60	113	176	389
Asians & Pacific Islanders	Anadromous and estuarine finfish and shellfish	202	117	78	139	236	306	NA
U.S. General Population	Freshwater, anadromous, estuarine and marine finfish and shellfish	2585	127	99	NA	248	334	519

N = Number of Adults
NA = Statistical value not available
Adults are 18 years or older for all surveys except Suquamish; Suquamish adults were 16 years or older.
All values reported in this table are described in Table 1 (located at the end of this document)
Tulalip Tribes and Squaxin Island Tribe from Toy et al. 1996.
Suquamish Tribe from Suquamish. 2000.
Columbia River Treaty Tribes from CRITFC. 1994.
The Columbia River Tribes did not report marine fish consumption;
The 75, 90, 95, and 99th percentiles are interpolated from percentiles reported in CRITFC. 1994.
Asian Pacific Islanders from Sechena et al. 1999.
US General Population from US EPA. 2002b.

Vapor Intrusion

Issue

What rule revisions, if any, are needed to clarify requirements for evaluating and responding to the potential for vapor intrusion threats?

Problem Statement

The migration of gas-phase chemicals through the subsurface and, potentially, into overlying buildings is referred to as vapor intrusion. The Model Toxics Control Act (MTCA) cleanup regulation refers to the possibility that subsurface contamination could pose a threat to indoor air quality, and requires that certain actions be taken to evaluate this possibility.[1]

However, the current regulations are unclear regarding requirements for assessing the vapor intrusion pathway during the remedial investigation (RI). Furthermore, the rule lacks clear direction for establishing cleanup levels protective of indoor air quality.

Cleanup proponents and Ecology site managers are unclear regarding how vapor intrusion should be assessed during the RI, what approaches should be used to respond to the threat if indoor air indeed appears to be unacceptably impacted, and how to establish that the pathway is not causing unacceptable impacts.

The Department of Ecology is considering whether rule revisions are needed to clarify requirements. Ecology is also considering:

- If and how to incorporate new scientific information and new state and federal guidance into the rule.
- How to identify predictable methods for evaluating and responding to potential health risks posed by vapor intrusion.

Background

In 1991, Ecology first published rules implementing the Model Toxics Control Act. The 1991 cleanup regulation included a few general provisions applicable to the subsurface movement of vapors. Ecology completed significant changes to the MTCA rule in February 2001. These amendments include new provisions to more specifically address the vapor intrusion pathway.

[1] See particularly WAC 173-340-740(3)(b)(iii)(C).

The MTCA cleanup regulation provides three ways to establish cleanup standards for soil. Method A was intended for simple sites with few hazardous substances. Method B applies to all sites and consists of two approaches: standard and modified. The standard method uses default values and formulas. The modified method uses chemical or site-specific values in those same formulas. Method C applies to specified site uses or conditions (typically industrial sites).

Soil concentrations that protect human health are typically determined by evaluating the following pathways:

- Direct contact with contaminated soil (via ingestion and dermal absorption).
- Contaminants leaching from soil into groundwater at concentrations exceeding groundwater cleanup levels (the leaching pathway).

Groundwater cleanup levels are typically determined by evaluating the following pathways:

- Ingestion of the groundwater as drinking water.
- Contaminants in the groundwater migrating into surface water and sediment.

Certain contaminants can volatize from groundwater or subsurface soils and potentially move as vapor through the soil. Method A soil and groundwater cleanup values have not been checked to determine if they are sufficiently protective of the vapor pathway. The vapor pathway is not normally evaluated under MTCA unless certain triggering criteria are met.

This lack of specificity in the regulation has led to confusion and concern among Ecology site managers and the regulated community who understand that vapors should be evaluated but are uncertain as to requirements under Washington law.

The MTCA cleanup regulation:

- Lacks definitions of vapor intrusion and soil gas.
- Does not specifically state that the vapor intrusion pathway be investigated during the remedial investigation and feasibility study.
- Does require that the remedial investigation evaluate air quality impacts.[2]
- Includes a general requirement that cleanup levels for a specific media (for example, groundwater) must be established at concentrations that do not directly or indirectly cause violations of cleanup levels for other media (surface water, sediments, soil, or air), but lacks specifics,

Establishing Cleanup Standards

Soil Cleanup Standards Lack Specificity Regarding VI

Requirements for establishing soil cleanup standards are provided in WAC 173-340-740 and 745. Ecology can establish soil cleanup levels more stringent than values otherwise established in these sections if necessary to protect human health. The example provided is a site where

[2] WAC 173-340-350(7)(c)(D)

concentrations must be established that eliminate or minimize the potential for vapor accumulation in buildings or other structures.

For soil contaminated with volatile organic compounds, these sections require that the soil to vapor pathway be evaluated under three scenarios. Two of the scenarios concern petroleum contamination. The third scenario arises when volatile organic compound (VOC) levels in soils are "significantly higher" than concentrations established to protect groundwater as a drinking water source. [3]

When using Modified Method B or C, chemical specific or site specific adjustments can be made to the parameters used in calculating soil cleanup levels. If these modifications result in significant higher cleanup levels, then the rule requires that the dermal adsorption pathway and the soil to vapor pathway also be evaluated.

Evaluating When Soil Cleanup Levels Protect Indoor Air

Sections 740 and 745 present the evaluation methods that may be used to determine soil cleanup levels protective of indoor and ambient air. Four methods are listed:

- Measure soil vapor and demonstrate that vapors do not exceed air cleanup levels
- Measure ambient and/or indoor air and demonstrate that air does not exceed air cleanup levels
- Use a model to demonstrate that air cleanup standards will not be exceeded
- Other methods, approved by the department, to demonstrate that air cleanup standards will not be exceeded

Groundwater

The MTCA cleanup regulation includes requirements for establishing groundwater cleanup standards. It generally states that groundwater cleanup levels must not cause violations of air cleanup standards.

The regulation allows Ecology to establish groundwater cleanup levels more stringent than values otherwise established in section 720 if necessary to protect human health. This provision applies to all hazardous substances including volatile organic compounds, semi-volatile compounds, and inorganic compounds. An example provided is a site where concentrations must be established that eliminate or minimize the potential for vapor accumulation in buildings or other structures.

[3] WAC 173-340-200 includes the following VOC definition: **"Volatile organic compound"** means those carbon-based compounds listed in EPA methods 502.2, 524.2, 551, 601, 602, 603, 624, 1624C, 1666, 1671, 8011, 8015B, 8021B, 8031, 8032A, 8033, 8260B, and those with similar vapor pressures or boiling points. See WAC 173-340-830(3) for references describing these methods. For petroleum, volatile means aliphatic and aromatic constituents up to and including EC12, plus naphthalene, 1-methylnaphthalene and 2-methylnaphthalene.

Air

The MTCA Cleanup Regulation includes requirements for establishing cleanup standards to protect air quality.[4] Although vapor intrusion is not specifically mentioned, the air cleanup standards apply to both ambient air and air within any building, utility vault, manhole, or other structure large enough for a person to fit into.

New Scientific and Regulatory Information

Since the 2001 rule revisions, there have been several important scientific and regulatory developments associated with evaluating and responding to vapor intrusion problems.

EPA 2002 Draft Guidance: EPA has published draft guidance for assessing and responding to vapor intrusion problems (EPA, 2002). While EPA decided not to finalize this document, the draft guidance provides a screening process for identifying chemicals that are sufficiently toxic and volatile to pose a potential vapor intrusion threat. Several EPA regional offices have developed guidance on this issue.[5]

EPA Research and Information Compilation: The EPA draft guidance document includes physical, chemical and toxicological information for a wide range of volatile hazardous substances. EPA has continued efforts to evaluate empirical data and has created a large database on vapor attenuation factors.[6] Conferences are held annually by several organizations that feature vapor intrusion-related research topics.

ITRC Guidance Document: The Interstate Technology and Regulatory Council (ITRC) has published a vapor intrusion guidance document.

ASTM Vapor Intrusion Standard: The American Society for Testing and Materials (ASTM) has issued a standard related to vapor intrusion concerns during property transactions.

Several states have developed comprehensive state-specific guidance materials for evaluating and responding to vapor intrusion problems. These states include California, Massachusetts, New Jersey, New York, and others.

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[4] WAC 173-340-750 provides air cleanup standards for use in determining if air emissions at a site pose a threat to human health or the environment.

[5] Recommendations for Human Health Risk-Based Chemical Screening and Related Issues at EPA Region 10 CERCLA and RCRA sites, EPA Region 10, April 17, 2007.

[6] Dawson, USEPA Region 8, Analysis of Empirical Attenuation Factors in EPA's Expanded Vapor Intrusion Database, presented at Air & Waste Management Association (A&WMA) conference on Vapor Intrusion, "Learning from the Challenges," Sept. 26-28, 2007, Providence, RI.

In Washington, Ecology has begun to see the vapor intrusion pathway become an issue at more sites. Specifically, vapor intrusion has been a major issue at several sites in the Georgetown area of Seattle and a large site in the Vancouver area.

Rulemaking Options Being Considered

Ecology is considering several options for addressing vapor intrusion in the MTCA cleanup regulation. These include:

Develop Guidance Materials: Guidance could be issued without regulatory changes or in tandem with regulatory changes. Guidance would be updated if needed after rule revisions are complete.

[Ecology intends to issue vapor intrusion guidance in early 2010. The guidance addresses:

- The conditions under which vapor intrusion assessment is needed
- How to assess vapor intrusion cost-effectively during the remedial investigation
- Measures available for "mitigating" vapor intrusion
- Procedures for deriving subsurface cleanup levels protective of indoor air quality
- Instructions for, and limitations on, using the Johnson and Ettinger vapor intrusion model]

Minor Rule Revisions to Clarify Regulatory Terms: Under this option, Ecology would only make minor revisions to the current rule in order to clarify certain terms. In particular, Ecology would clarify the term "significantly" in the phrase *"…concentration is significantly higher than a concentration derived for protection of ground water for drinking water beneficial use under WAC 173-340-747(4)…."* This option could include reorganization to make the requirements easier to understand, but would include little or no substantive changes.

Adding a New Section to the MTCA Cleanup Regulation: Ecology is considering adding a new section devoted to vapor intrusion. The new section would include requirements for establishing subsurface media cleanup levels protective of indoor air quality (via this pathway). Changes in other sections would clarify the need for assessing the potential for vapor intrusion at sites contaminated with volatile, toxic substances.

Revising Existing Rule Sections: Revisions could establish default policies and methods for a number of sections. (See Table 1.)

Table 1: Options under consideration

Current Provision (WAC 173-340)	Under Consideration	Comment
-200 definitions: Volatile substances definition limited to organics measured with certain analytical methods	Expand the term to include criteria for vapor pressure, boiling point, and Henry's Law constant.	This change would reflect how volatile substances are currently defined in CLARC.

-350 remedial investigation: Vapor intrusion is not specifically mentioned. Nor is there a requirement to perform a vapor intrusion assessment when site contaminants include VOCs.	Revise WAC 173-340-350(7)(D) so that a vapor intrusion assessment is required during the RI if site contamination is volatile.	The trigger for an assessment would be consistent with forthcoming guidance.
-704 Method A Vapor intrusion is not mentioned. It is not clear whether Method A table CULs are protective of indoor air.	Option 1: Limit use of Method A cleanup levels at sites where the remedial investigation finds vapor movement is a concern in groundwater and/or soil. Option 2: Revise the Method A groundwater and soil cleanup levels to take into account the vapor intrusion pathway.	Revising the Method A cleanup levels to account for vapors could lower these cleanup levels considerably, depending on the assumptions made in the calculations. This could render use of these values impractical at many sites.
-720 groundwater cleanup levels: Methods for deriving groundwater cleanup levels, protective of indoor air quality, are not described. The point of compliance discussion does not directly consider vapor off-gassing from groundwater.	Add sections describing the alternative approaches for ensuring that Method B and C groundwater cleanup levels are protective of indoor air quality. Revise -720(8) to account for the groundwater point of compliance when vapor intrusion is a concern.	It is not obvious at present (in the regulations) how PLPs should establish groundwater cleanup levels at a site to protect indoor air quality or measure compliance. This could be stated clearly.
-740 & 745 soil cleanup levels: Methods for deriving soil cleanup levels, protective of indoor air quality, are described in WAC 173-340-740(3)(c)(iv)(B) (with similar provisions in 745). However, using one of these methods is only required if certain conditions are met. Few specifics are provided for evaluating compliance for sites with soil vapor issues.	Revise the triggering criteria for evaluation of soil vapors so that the VI pathway must be evaluated in most circumstances where volatile contaminants are present, similar to how the terrestrial ecological exposure pathway is handled (screening/exclusion criteria, simplified evaluation methods, site-specific evaluation options). Consider adding more specific methods for determining compliance when soil vapors are an issue at a site.	Means of establishing VI-protective cleanup levels in 740(3)(c)(iv)(B) (and similar provisions in 745) are fairly inclusive and many not need to be significantly modified. However, EPA studies indicate it is difficult to draw a correlation between soil and vapor concentrations. Thus, determining compliance by measuring soil concentrations may not work well.
745 air cleanup levels: Formulas for deriving air cleanup levels are provided in the rule. Limited specifications are provided for measuring compliance.	Ecology plans to evaluate the air cleanup level formulas and compliance methods for conformance with the latest methods used by EPA and other states.	Background air concentrations for certain chemicals is a major issue in urban areas. How to handle background when determining cleanup levels will also likely need to be addressed.

Factors to Consider When Selecting an Option

Developing amendments to the MTCA cleanup regulation will require considering and balancing a number of issues and interests. Proposed amendments must also satisfy several regulatory goals, including the following:

- Providing for the selection of cleanup actions that protect human health and the environment.
- Developing scientifically and legally defensible cleanup standards.
- Providing consistent standards and methodologies for assessing and managing risk.
- Providing flexibility to address site-specific factors.
- Promoting efficient and cost-effective cleanup of contaminated sites.
- Providing enhanced opportunities for public involvement.
- Improving the clarity and usability of the rule.
- Availability of analytical methods.
- Availability of sufficient toxicity information to establish cleanup levels.

Cleanup Levels for Lead-Contaminated Soils

Issue

What rule revisions (if any) are needed given current scientific information on child and adult health risks associated with lead exposure?

Problem Statement

There have been numerous scientific and regulatory developments since the 2001 amendments to the Model Toxics Control Act (MTCA) cleanup regulation. Ecology believes it is appropriate to review the cleanup standards for lead contaminated soils. The rationale includes:

- The current standard is based on preventing child exposure to soil that might cause blood lead concentrations greater than 10 ug/dL. There have been several studies completed since 2001 that have reported adverse health effects at blood lead levels below 10 ug/dL.
- In 2004, the MTCA Science Advisory Board recommended that Ecology review whether the underlying basis for the current MTCA cleanup level remains consistent with the MTCA statutory directives.

Background

The Ecology developed the MTCA Method A soil cleanup standard for lead (250 mg/kg) when the initial cleanup standards were published in 1991. This standard is applicable to all types of land uses including current and potential future residential properties, schools, parks and other areas where young children may be present on a regular basis.

Ecology reviewed the scientific basis for the Method A value for lead when preparing the 2001 rule revisions. Ecology used the Integrated Exposure Uptake and Biokinetic (IEUBK) model to predict the mean blood lead level and the probability that child blood lead levels would exceed 10 ug/dL (P_{10}) at different soil lead levels. Ecology found that a soil level of 250 mg/kg (MTCA Method A cleanup level) corresponds to a P_{10} value of 1- 5%. Based on that review, Ecology elected not to revise the Method A soil cleanup level for lead.

New Scientific and Regulatory Information Since 2001 Rule Revisions

Since the 2001 rule revisions, there have been several important scientific and regulatory developments relevant to this rulemaking issue.

- Scientific Studies: There have been many studies completed since 2001 that have evaluated the health risks associated with lead exposure. These studies provide scientific

evidence that the physical and mental development of children can be adversely affected at blood lead levels below 10 ug/dL.[1] These studies also indicate that the dose-response relationship for lead and effects on neurological development (as measured by IQ scores) is non-linear with a steeper slope at lower blood lead concentrations.

- Refinements to Child Lead Exposure Models: Since the 2001 rule revisions, EPA has refined the Integrated Exposure Uptake and Biokinetic (IEUBK) model and developed an initial version of the All-Ages Lead Model (AALM).
    - The IEUBK model provides a tool for evaluating child health risks associated with exposure to lead-contaminated soils. Since the 2001 rule revisions, EPA has published guidance for addressing lead contamination at federal cleanup sites and made several modifications to the IEUBK model in order to incorporate newer information on lead exposure.[2]
    - EPA has also developed a new lead model (the All Ages Lead Model[3]) that is designed to evaluate health risks for all age groups. The AALM is a tool for estimating changes in lead concentrations in blood and other tissues/organs with different environmental exposures. As of March 2009, EPA was still working on several issues identified by the AALM Review Panel before releasing a revised version of the model for general use.
- MTCA Science Advisory Board Review of Areawide Soil Contamination Strategy: In 2004, Ecology asked the Board to review the scientific basis for soil guidelines that were part of a strategy to implement recommendations from a statewide task force. As part of that review, the Board recommended that Ecology review available scientific information and evaluate whether the current standard is consistent with the MTCA statutory and regulatory policies.

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[1] Bellinger, D.C. and Needleman, H.L. (2003) Intellectual impairment and blood lead levels [letter]. N. Engl. J. Med. 349: 500; Canfield, R.L., Henderson, C.R., Cory-Slechta, D.A., Cox, C., Jusko, T.A. and B.P. Lanphear. 2003. Intellectual Impairment in Children with Blood Lead Concentrations below 10 ug per Deciliter. N Engl. J. Med. 348: 1517-1526; Te´llez-Rojo, M.M.; Bellinger, D.C.; Arroyo-Quiroz, C.; Lamadrid-Figueroa, H.; Mercado-Garcı´a, A.; Schnaas-Arrieta, L.; Wright, R.O.; Herna´ndez-Avila, M.; Hu, H. (2006) Longitudinal associations between blood lead concentrations < 10 µg/dL and neurobehavioral development in environmentally-exposed children in Mexico City. Pediatrics 118: e323–e330; Chen A, Dietrich KN, Ware JH, et al. 2005. IQ and blood lead from 2 to 7 years of age: Are the effects in older children the residual of high blood lead concentrations in 2-year-olds? Environ Health Perspect113(5):597-601. Chiodo LM, Jacobson SW, Jacobson JL. 2004. Neurodevelopmental effects of postnatal lead exposure at very low levels. Neurotoxicol Teratol 26(3):359-371.

[2] EPA has published several version of the IEUBK model since 2001. The refinements in each new version generally represent small changes to incorporate EPA's ongoing work on lead exposure and/or improvements in the model software. EPA has also published an updated users manual (EPA. 2002a. User's Guide for the Integrated Exposure Uptake Biokinetic Model for Children (IEUBK) Windows version. EPA 540-K-01-005) and guidance on specific topics (e.g. EPA. 2003. IEUBK Model Mass Fraction of Soil in Indoor Dust [M_{sd}] Variable. Produced by the Technical Review Workgroup for Lead.)

[3] EPA/National Center for Environmental Assessment. 2005. Guidance Manual for the All-Ages Lead Model (AALM) Draft Version 1.05. Prepared by NCEA. Research Triangle Park, North Carolina.

- Scientific Review of Federal Blood Lead Screening Guidelines: In 2004, the Centers for Disease Control and Prevention (CDCP) asked the Advisory Committee on Childhoood Lead Poisoning Prevention (ACCLPP) to review the federal blood lead screening guidelines in light of more recent scientific studies on the relationships between blood lead concentrations and neurological development. The ACCLPP concluded that "…[r]esearch conducted since 1991 has strengthened the evidence that children's physical and mental development can be affected at [blood lead levels] <10 µg/dL.'' [4] After considering the advisory committee findings, CDCP (2005) revised their statement on *Preventing Lead Poisoning in Young Children* to recognize the evidence of adverse health effects in children with blood lead concentrations below 10 ug/dL. Specifically, CDCP noted that no "safe" threshold for blood Pb had been identified and emphasized the importance of preventative measures.
- Review of the Scientific Basis for the National Ambient Air Quality Standards (NAAQS) for Lead: In November 2004, EPA initiated a review of the air quality criteria for lead. That process was completed in November 2008 when EPA published a final rule revising the primary and secondary NAAQS for lead. In the final rule, EPA elected to lower the primary standard from1.5 ug/m^3 to 0.15 µg/m^3.[5] There are several key EPA conclusions that are relevant to the review of the MTCA standard for lead (1) young children remain the sensitive population and neurological development remains the primary health concern; (2) there are several health effects are associated with blood Pb levels that are well below 10 ug/dL and EPA concluded that there is now no recognized safe level of lead in children's blood; and (3) EPA chose to use an air-related IQ loss of 2 points as an "acceptable" or "target" public health goal.
- Updates to ATSDR Toxicological Profile for Lead: In August 2007, the Agency for Toxic Substances and Disease Registry (ATSDR) completed an extensive review of toxicological and epidemiological studies on lead health effects.[6] Consistent with the ACCLPP and EPA reviews, ATSDR noted that several studies have been published in recent years that support the view that there is no apparent threshold in the relationship between blood lead levels and neurobehavioral functions.
- Chemical Action Plan for Lead: In early 2005, Ecology published a rule that describes methods and policies for identifying persistent and bioaccumulative toxins (PBT) and procedures developing strategies for reducing and phasing-out PBT uses and exposures. Ecology identified lead compounds as a PBT and worked with the Department of Health

[4] Advisory Committee on Childhood Lead Poisoning Prevention (ACCLPP) (2007) Interpreting and managing blood lead levels <10 µg/dL in children and reducing childhood exposures to lead: Recommendations of CDC's Advisory Committee on Childhoood Lead Poisoning Prevention. Morbidity and Mortality Weekly Report. 56(RR–8). November 2, 2007.

[5] U.S. Environmental Protection Agency. 2008. National Ambient Air Quality Standards for Lead. Final Rule. 73 FR 66964-67602. November 12, 2008.

[6] Agency for Toxic Substances and Disease Registry /Department of Health & Human Services (USHHS). 2007. Toxicological Profile for Lead (Update).

to develop a draft chemical action plan for public review in 2008.[7] In that document, Ecology and Health acknowledged that recent scientific information indicates that there are health risks at blood lead levels below 10 ug/dL and the draft action plan includes a recommendation that the Toxics Cleanup Program work with the MTCA Science Advisory Board and the Department of Health to review and (as appropriate) revise the MTCA soil cleanup standard for lead.

- DOH Expert Panel Recommendations: The Washington State Department of Health convened an expert panel in June 2008 to review and, as appropriate, update DOH's guidelines related to lead exposure in children. The expert panel recommended that "…[t]he Department of Health should review and strengthen its guidelines regarding the appropriate medical responses for elevated blood lead levels." In their report, the panel stated "… that there is no known "safe" threshold for lead. It also recognizes that lead levels between 5 and 9 µg/dL can be harmful to children…"[8]
- Draft California Public Health Goal (PHG) for Lead: The California Office of Environmental Health Hazard Assessment (OEHHA) has recently proposed updates to California's public health goal for lead in drinking water (0.2 ug/dL)[9] and soil-screening guidelines for lead contaminated soils (80 mg/kg for residential use and 320 mg/kg for commercial/industrial use).[10] In both cases, OEHHA elected to replace the 10 ug/dL "level of concern" with a source-specific "benchmark change" of 1 ug/dL. Both proposals draw heavily from earlier work by OEHHA to identify a toxicity reference value for lead.[11]

Rulemaking Options Being Considered

Ecology is considering several options for addressing this issue during the current rulemaking process. These include:

[7] Department of Ecology and Department of Health. 2008. Washington State Lead Chemical Action Plan (Public Review DRAFT). Publication # 08-07-009.

[8] Department of Health. 2008. Expert Panel Recommendations Child Lead Exposure. Environmental Health Division. Olympia WA.

[9] Office of Environmental Health Hazard Assessment. 2009. Draft Public Health Goal for Lead in Drinking Water. Office of Environmental Health Hazard Assessment, California Environmental Protection Agency, Sacramento, CA.

[10] Office of Environmental Health Hazard Assessment. 2009. Revised California Human Health Screening Level for Lead (Review Draft). Office of Environmental Health Hazard Assessment, California Environmental Protection Agency, Sacramento, CA.

[11] Office of Environmental Health Hazard Assessment. 2007. Development of health criteria for school risk assessment pursuant to Health and Safety Code Section 901(g): Child-specific benchmark change in blood lead concentration for school risk assessment. Office of Environmental Health Hazard Assessment, California Environmental Protection Agency, Sacramento, CA.

No Rule Changes: Under this option, Ecology would not modify the Method A soil cleanup level for lead this included in the current MTCA rule. The Method A soil cleanup level for unrestricted site uses would remain 250 mg/kg.

Use IEUBK Model to Develop Updated Method A Value for Unrestricted Land Uses: Under this option, Ecology would use the IEUBK model to develop an updated Method A soil cleanup level for lead. The updated value would take into account recent scientific information on lead exposure and health risks.

Use Other Models to Update Method A Value for Unrestricted Land Uses: Under this option, Ecology would use another lead model to update the Method A value. Ecology could use a slope factor model to predict changes in blood lead concentrations using simple linear relationships between blood lead levels and either lead uptake (biokinetic slope factor) or lead intake (intake slope factor). Under this approach, Ecology would evaluate the soil and dust exposure at different soil concentrations and establish a soil cleanup level based on incremental risks. This approach has been used by ATSDR and agencies in California and New Jersey to establish lead standards and guidelines. Ecology could also use the All Ages Lead Model when EPA scientists complete model revisions in response to comments from the EPA Science Advisory Board. Ecology could also use a cancer risk model to update the soil cleanup level using a cancer slope factor developed by the California Office of Environmental Health Hazard Assessment.

Update Method A value for industrial soils: Under this option, Ecology would use the EPA adult lead model, a cancer risk model using the OEHHA cancer slope factor or (if available) the EPA All Ages Lead Model to update the industrial soil cleanup level for lead.

Factors to Consider When Selecting an Option

Developing amendments to the MTCA cleanup regulation will require considering and balancing of a number of issues and interests. Ecology believes that the following factors need to be considered when evaluating rulemaking options:

- New scientific information and expert committee reports on the health effects in children at low levels of lead exposure.
- New scientific information and expert committee reports on the health effects in adults at low levels of lead exposure.
- New scientific information and expert committee reports related to the exposure and uptake from lead-contaminated soils.
- New evaluation tools and models that are available to characterize exposure and health risks associated with lead-contaminated soils.
- Regulatory policies and decisions made by other state and federal agencies.
- Whether particular options comply with key requirements of the Administrative Procedures Act.

Institutional Controls and Periodic Reviews

Issue

What modifications to the institutional controls provisions in Sections - 420 and - 440 of the Model Toxics Control Act (MTCA) cleanup regulation are needed to update these sections based on experience to date and to comply with the Uniform Environmental Covenants Act and corresponding changes to MTCA?

Problem Statement

With the passage of the Uniform Environmental Covenants Act (UECA), the terminology and procedural requirements in Section 440 and other related Sections need to be updated. One of the statutory changes to MTCA in the same bill that passed UECA was to set a schedule for Ecology reviewing the performance of sites with institutional controls already in place ("periodic reviews"). Ecology is in the process of conducting these reviews. These reviews have identified a number of problem areas that need to be addressed. Furthermore, as Ecology staff have implemented the existing rule over the years, a number of issues have arisen needing clarification in the rule. These issues and proposed options for resolving them are summarized in table 1.

Background

The Model Toxics Control Act cleanup regulation includes a section specifically addressing the application of institutional controls at cleanup sites. Institutional controls are defined as 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 hazardous substances at a site. Institutional controls may include:

(a) Physical measures such as fences.
(b) Use restriction such as limitation on the use of property or resources or requirements that cleanup action occur if existing structures or pavement are disturbed or removed.
(c) Maintenance requirements for engineered controls such as the inspection and repair of monitoring wells, treatment systems, caps or ground water barrier systems.
(d) Education programs such as signs, postings, public notices, health advisories, mailings, and similar measures that educate the public and/or employees about site contamination and ways to limit exposure.
(e) Financial assurances.

Ecology estimates there are currently some 300 sites with institutional controls in place.

In 2007, the Legislature passed the Uniform Environmental Covenants Act (Chapter 64.70 RCW). This act imposes certain additional procedural requirements on activity or property use limitations ("environmental covenants") that are not reflected in the current rule.

Options

Ecology is considering the following potential changes to Sections 420 and 440 of the MTCA rule.

Current Provision Periodic Reviews (WAC 173-340-420)	**Under Consideration**	**Comment**
Periodic reviews are required for formal sites only and optional for sites in the voluntary cleanup program (VCP sites) .	Require for all sites, including VCP sites.	Reflects new requirement in 70.105D.030(7).
Periodic reviews are required when institutional controls and/or financial assurances are required as part of a cleanup action.	Add a requirement for periodic reviews of sites with interim actions.	Some sites can be in interim action status for years for a variety of reasons (recalcitrant PLP, technological limits, legal delays). May want to make at Ecology's discretion.
Timing of when a periodic review is conducted is unclear (5 years after initiation of cleanup action).	5 years after recording of the environmental covenant.	Reflects new requirement in 70.105D.030(7). Rule language also needs to address situations where a covenant is required but not implemented and, where alternative mechanisms are used.
Contents of periodic review not specified.	Add contents of periodic review.	2007 amendments to MTCA added minimum requirements for a periodic review. Rule should also reflect current practice.

Current Provision Periodic Reviews (WAC 173-340-420)	Under Consideration	Comment
Cost recovery for periodic reviews not explicitly addressed.	Clarify that periodic reviews are remedial actions subject to cost recovery under MTCA. There are several options: • Require that potentially liable persons (PLPs) proposing cleanups with periodic reviews to pay for these reviews up front at the time of the no further action (NFA) determination or settlement. • Add language to orders or decrees more clearly requiring payment for the costs of periodic reviews. • Add a payment provision to the environmental covenant. • Build costs of periodic reviews into Ecology's overhead rate.	As Ecology conducts periodic reviews, we are finding many properties have changed hands numerous times. This can sometimes make it difficult to recover costs for periodic reviews in subsequent years, particularly for independent cleanups.
Current Provision Institutional Controls (WAC 173-340-440)	**Under Consideration**	**Comment**
"Deed restrictions"	Throughout rule, replace with "environmental covenant" and update definition to be consistent with the statute.	Term used in UECA. May need to add language explaining procedures for past deed restrictions not recorded prior to UECA.
Section 440 of the MTCA rule specifies the procedures for imposing, modifying and removing deed restrictions.	Update to reflect the requirements in UECA.	RCW 64.70.090 and 64.70.100 address additional termination and amendment requirements.

Current Provision Institutional Controls (WAC 173-340-440)	Under Consideration	Comment
Deed restrictions on public right of ways not explicitly addressed.	Should Ecology provide for a specific alternative mechanism for restrictions on public ROWs?	Public and private ROWs (roads, utilities) are often impacted by contaminated sites. Deed restrictions may not always be the most effective way to limit digging in these areas and may face practical limitations in some contexts.
Section 440 specifies content of deed restrictions.	Update to reflect UECA requirements. (See attached.) **Option 1:** Only include mandatory UECA requirements. **Option 2:** Include mandatory and optional UECA requirements.	Many optional requirements are already required by MTCA. Should Ecology be the only holder of these covenants or are others allowed to be holders? Currently, by policy, Ecology is generally the holder.
PLPs must make a "good faith effort" to obtain deed restrictions on properties not owned by the PLP.	Should we clarify what "good faith effort" means? Should we clarify how this relates to non PLPs?	Is there a better way to address off-property activity and use restrictions?
Ecology is required to "notify and seek comment from" a city or county department with land use planning authority for real property subject to the restrictive covenant.	Update to reflect UECA requirement that Ecology "consult with" the city or county land use planning authority for the site and that Ecology "shall consider potential redevelopment and revitalization opportunities and obtain information regarding present and proposed land and resource uses, and consider comprehensive land use plan and zoning provisions applicable to the real property subject to the environmental covenant."	See RCW 70.105D.030(1)(f) and RCW 64.70.040(5).

Current Provision Institutional Controls (WAC 173-340-440)	Under Consideration	Comment
Not addressed	Should the rule clarify the status of pre-UECA deed restrictions and improperly worded or recorded covenants under UECA?	For example, covenants not including Ecology's signature or other minimum requirements specified in rule.
Financial assurance requirements waived as appropriate for PLPs that have sufficient financial resources available and in place to provide for the long-term effectiveness of engineered and institutional controls. Financial assurance waived when a PLP can demonstrate that requiring financial assurances will result in the PLPs for the site having insufficient funds to conduct the cleanup or being forced into bankruptcy.	Should these exemptions be re-examined? **Option 1:** No change from current rule. **Option 2:** Require all sites with institutional controls to post financial assurance covering at least the cost of future monitoring and periodic reviews. **Option 3:** Require all sites with institutional controls to post full financial assurance.	Current limitations result in few sites being required to post financial assurances at a time when more sites are using containment remedies and the financial stability of many companies has come into question nationally. Under Option 2 may need to add criteria for when other financial assurances would be required.

Factors to Consider When Selecting Options

Developing amendments to the MTCA cleanup regulation will require considering and balancing of a number of issues and interests. These amendments will need to consider several regulatory goals, including the following:

- Providing consistent standards and methods for managing institutional controls and periodic reviews.
- Providing flexibility to address site-specific conditions.
- Ensuring remedies are protective over the long term.
- Simplifying administrative procedures for implementation of institutional controls and periodic reviews.
- Improving the clarity and usability of the rule.

CURRENT MTCA REQUIREMENTS FOR RESTRICTIVE COVENANTS

(WAC 173-340-440(9)) [1]

(9) Restrictive covenants. Where required, the restrictive covenant shall:

(a) Prohibit activities on the site that may interfere with a cleanup action, operation and maintenance, monitoring, or other measures necessary to assure the integrity of the cleanup action and continued protection of human health and the environment;*

(b) Prohibit activities that may result in the release of a hazardous substance that was contained as a part of the cleanup action;*

(c) Require notice to the department of the owner's intent to convey any interest in the site. No conveyance of title, easement, lease, or other interest in the property shall be consummated by the property owner without adequate and complete provision for the continued operation, maintenance and monitoring of the cleanup action, and for continued compliance with this subsection;**

(d) Require the land owner to restrict leases to uses and activities consistent with the restrictive covenant and notify all lessees of the restrictions on the use of the property. This requirement applies only to restrictive covenants imposed after February 1, 1996;**

(e) Require the owner to include in any instrument conveying any interest in any portion of the property, notice of the restrictive covenant under this section;**

(f) Require notice and approval by the department of any proposal to use the site in a manner that is inconsistent with the restrictive covenant. If the department, after public notice and comment approves the proposed change, the restrictive covenant shall be amended to reflect the change; and**

(g) Grant the department and its designated representatives the right to enter the property at reasonable times for the purpose of evaluating compliance with the cleanup action plan and other required plans, including the right to take samples, inspect any remedial actions taken at the site, and to inspect records.**

[1] Items noted with a "*" are similar to mandatory requirements under UECA. Items noted with a "**" are similar to optional requirements under UECA.

CONTENTS OF AN ENVIRONMENTAL COVENANT UNDER CHAPTER 64.70 RCW [2]

Mandatory Requirements:

(1) An environmental covenant must:

(a) State that the instrument is an environmental covenant executed pursuant to this chapter;*

(b) Contain a legally sufficient description of the real property subject to the covenant;*

(c) Describe with specificity the activity or use limitations on the real property;*

(d) Identify every holder;*

(e) Be signed by the agency, every holder, and unless waived by the agency every owner of the fee simple of the real property subject to the covenant; and*

(f) Identify the name and location of any administrative record for the environmental response project reflected in the environmental covenant.**

Optional Requirements:

(2) In addition to the information required by subsection (1) of this section, an environmental covenant may contain other information, restrictions, and requirements agreed to by the persons who signed it, including any:

(a) Requirements for notice following transfer of a specified interest in, or concerning proposed changes in use of, applications for building permits for, or proposals for any site work affecting the contamination on, the property subject to the covenant;*

(b) Requirements for periodic reporting describing compliance with the covenant;**

(c) Rights of access to the property granted in connection with implementation or enforcement of the covenant;*

(d) Narrative descriptions of the contamination and remedy, including the contaminants of concern, the pathways of exposure, limits on exposure, and the location and extent of the contamination;**

(e) Limitations on amendment or termination of the covenant in addition to those contained in RCW 64.70.090 and 64.70.100;**

(f) Rights of the holder in addition to its right to enforce the covenant pursuant to RCW 64.70. 110;**

(g) Other information, restrictions, or requirements required by the agency, including the department of ecology under the authority of chapter 70.105D RCW.**

(3) In addition to other conditions for its approval of an environmental covenant, the agency may require those persons specified by the agency who have interests in the real property to sign the covenant.**

[2] Items noted by a "*" are already required in some form under the current rule or through the covenant boilerplate. Items noted by a "**" are not routinely required under the current rule or boilerplate.

Freshwater Sediment Standards

Issue

How should the Sediment Management Standards rule be revised to provide sediment standards in fresh water environments?

Problem Statement

Currently the Sediment Management Standards (SMS) rule outlines specific standards and decision-making processes to protect biological resources and clean up contaminated sediment. The SMS rule includes adopted chemical and biological standards for marine sediments but lacks adopted freshwater chemical standards and approved freshwater bioassays with their respective endpoints. Instead, the SMS has only a narrative standard for freshwater systems.

There are many contaminated freshwater sediment sites in the state of Washington under the Model Toxics Control Act (MTCA) or Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) oversight. Because of the lack of adopted freshwater standards, the narrative standard requires a site-specific evaluation to determine cleanup standards. This site-specific process can create inconsistency on how freshwater sediment sites are cleaned up.

The SMS narrative language (which allows for the development of site-specific cleanup levels) is an Applicable or Relevant and Appropriate Requirement (ARAR) under a CERCLA cleanup. However, the U.S. Environmental Protection Agency (EPA) prefers adopted chemical and biological standards as ARARs for CERCLA cleanups.

Since the SMS were adopted in 1991, a variety of published research papers and developmental documents[1][2][3][4] have addressed freshwater sediment standards and sediment quality guidelines. The Department of Ecology (Ecology) has used these documents as guidance to develop cleanup standards at freshwater sites and to aid in the development of freshwater sediment quality values.

[1] Ecology. 1995. Summary of guidelines for contaminated freshwater sediments. Washington State Department of Ecology, Environmental Investigations and Laboratory Services Program, Olympia, WA. Publication No.: 95-.308.
[2] Ecology. 1997. Creation and analysis of freshwater sediment quality values in Washington State. Washington State Department of Ecology, Environmental Investigations and Laboratory Services Program, Olympia, WA. Publication No.: 97-323a.
[3] SAIC and Avocet Consulting. 2002. Development of freshwater sediment quality values in Washington State, Phase I Final Report. Prepared by SAIC, Bothwell, WA and Avocet Consulting, Kenmore, WA for the Washington State Department of Ecology, Olympia, WA. Publication No.: 02-09-050.
[4] Avocet Consulting. 2003. Development of freshwater sediment quality values in Washington State, Phase II Final Report. Prepared by Avocet Consulting, Kenmore, WA for the Washington State Department of Ecology, Olympia, WA. Publication No.: 03-09-088.

The Regional Sediment Evaluation Team (RSET), a multi-state and federal collaboration, is applying a statistical approach consistent with current literature to data sets from Washington, Oregon, and Idaho. A published report on the results is expected in 2009. This report, as well as the published literature, may provide useful guidance for Washington State to develop freshwater chemical and biological standards.

The issue of how the SMS can more clearly address development of cleanup levels for protection of human health is addressed in the issue paper "Addressing Human Health Risks When Setting Sediment Cleanup Standards."

Overview

The SMS does not provide numeric standards to evaluate freshwater contaminated sediments. Instead, Ecology conducts site specific evaluations for freshwater sediments cleanups using guidance. This has caused inconsistency across the state. In addition, the lack of clear freshwater sediment standards limits how the EPA uses the SMS at Federal sediment cleanup sites in Washington.

Significant work has been done to develop freshwater sediment standards to protect biological resources. A number of agencies have developed guidance to use freshwater sediment quality values to conduct sediment cleanup, while a few have adopted standards into law. Ecology has developed several guidance documents on freshwater sediment quality values which are used to conduct sediment cleanup. RSET will publish a document this year that may be helpful for Washington State to develop freshwater numeric and biological standards.

Ecology is considering revisions to the SMS rule to provide freshwater sediment standards. This issue paper provides a summary of issues related to protecting biological resources in freshwater sediment. The options being considered include:

- Do nothing and continue case-by-case evaluation.
- Develop numeric freshwater sediment standards only.
- Develop biological freshwater sediment standards only.
- Develop both numeric and biological freshwater sediment standards.

Options

1. **Develop Numeric Chemical Freshwater Sediment Standards Only:** A number of approaches will be considered to develop numeric chemical standards including:

    a. Review Sediment Quality Guidelines published in recent scientific literature and previous developmental documents (see footnotes 1-4).

    b. Evaluate the different approaches for developing freshwater numeric standards: floating or flat percentile of Apparent Effects Threshold, Effects Range Low and Effects Range Medium.

    c. Evaluate the numeric standards produced by RSET in 2009.

2. **Develop Biological Freshwater Sediment Standards Only.** A number of approaches will be considered to develop biological standards which will include the adoption of American Standard for Testing and Materials approved freshwater biological evaluation tests, performance standards, and related biological effects standards. This process could include:

    a. Adopt the freshwater bioassays used in the freshwater sediment chemistry data evaluation by RSET.

    b. Adopt the freshwater bioassays that have been reviewed and recommended by RSET.[5]

    c. Adopt benthic community assessments as a biological evaluation test similar to the SMS marine standards.

    d. Review current, published scientific literature and other agency (State, Tribe and Federal) regulations for approved biological evaluation tests.

    e. Seek input from Ecology personnel and the public for appropriate biological tests or standards.

3. **Develop Both Numeric Chemical and Biological Freshwater Sediment Standards**. The process to develop both standards would follow the options listed previously for each of the respective standards.

[5] RSET. 2009. Draft of the Final Sediment Evaluation Framework for the Pacific Northwest. https://www.nwp.usace.army.mil/pm/e/rset.asp

4. **Clarify how chemical or biological standards will be applied to evaluate contaminated sediment sites.**

    a. Adopted chemical or biological standards would be set at the Sediment Quality Standard and Cleanup Screening Level and would apply to the following sections of the SMS:

        i. WAC 173-204-310: Performing the initial designation.
        ii. WAC 173-204-315: Potential confirmatory analysis.
        iii. WAC 173-204-510: Screening of sediment station clusters of potential concern.
        iv. 173-204-530: Hazard Assessment.

    b. Option for evaluating freshwater contaminated sediment sites if only numeric chemical standards are adopted: Continue following the designation procedure in WAC 173-204-310 and allow the biological tests used to be based on Best Professional Judgment and Best Available Science.

    c. Options for evaluating freshwater contaminated sediment sites if only biological standards are adopted:

        i. Use Best Professional Judgment based on all available site data to determine if biological tests are needed.
        ii. Biological tests are required at all freshwater contaminated sediment sites.
        iii. Continue following the designation procedure in WAC 173-204-310. Any chemical screening levels developed must be approved by Ecology on a case-by-case basis.
        iv. Determine the minimum number of chronic and acute biological tests required for a confirmatory designation.

Factors to Consider When Selecting an Option

The development of the amendments will involve the consideration and balancing of a number of issues and interests. The proposed options will also be developed to satisfy several, sometimes conflicting, regulatory goals, including the following:

- Whether the option provides for the selection of cleanup actions that protect human health and the environment.
- Whether the option provides for developing scientifically and legally defensible cleanup standards.

- Whether the option provides consistent standards and methodologies for assessing and managing risk.
- Whether the option provides flexibility to address site-specific factors.
- Whether the option promotes efficient and cost-effective cleanup of contaminated sites.
- Whether the option provides enhanced opportunities for public involvement.
- Whether the option improves the clarity and usability of the rule.
- Whether the option complies with key requirements of the Administrative Procedures Act.

Other Toxic, Radioactive, Biological and Deleterious Substances

Issue

How can Ecology best clarify the regulatory connection between sediments that exceed the biological Sediment Management Standards (SMS) and the definition of "hazardous substance" under the Model Toxics Control Act (MTCA)?

Problem Statement

Clarifying Connection Between Sediment Quality Designation and MTCA: Ecology is interested in clarifying the connection between the SMS sediment quality designations and the definition of "hazardous substance" under MTCA, in order to minimize any confusion about how the two schemes fit together. Ecology has sufficient authority under existing law to address "other toxic, radioactive, biological and deleterious substances" under the SMS. However, Ecology is considering making the connections between MTCA and the SMS in this area clearer in order to minimize any ambiguity as to the scope of MTCA authority to address such substances.

Other toxic, radioactive, biological or deleterious substances in the aquatic environment can:

- Be chemical, biological or physical in nature.
- Cause biological toxicity but may not be within the SMS chemistry suite or may not be analyzed or detected in the laboratory.
- Be toxic to aquatic life due to an unidentified chemical(s) or synergistic effects from multiple chemicals.
- Create degradation by-products that can be toxic to aquatic life.
- Overload the sediment with organic matter causing oxygen depletion and toxic buildup of ammonia and sulfide.
- Bury the natural sediment substrate and impair habitat for the benthic community and aquatic vegetation.
- Are dependent on a number of site-specific factors.

Overview

The SMS rule was established to guide contaminated sediment cleanup under the regulatory authority of MTCA. The SMS contains both biological criteria and numeric criteria for a suite of 47 chemicals for marine sediments. The SMS also has narrative criteria including "other toxic, radioactive, biological and deleterious substances." The intent of the narrative criteria was to include substances found to cause or contribute to failure of the SMS biological criteria, but not included within the SMS numeric criteria. Ecology is considering rule revisions to clarify that violation of the SMS biological criteria are addressed as cleanups under MTCA. For example, the presence of degrading wood waste in the aquatic environment has been shown to impact the benthic community, resulting in violations of the SMS biological criteria (WAC 173-204-315), and necessitating cleanup under the SMS.

Background

The SMS were adopted in 1991 to implement Ecology's responsibilities under several laws, including MTCA (70.105D RCW) and the Water Pollution Control Act (90.48 RCW). Because the SMS were promulgated under both laws, the rule has a dual use. For the purposes of conducting cleanup, the SMS was established to guide contaminated sediment cleanup under MTCA. Specifically, the SMS are used to:

- Set standards for sediment quality (there are numeric chemical criteria, biological criteria, and narrative standards).
- Assess the nature and extent of sediment contamination.
- Provide a decision process for the cleanup of sediment contamination.

The SMS contain two different levels of criteria for establishing protective contaminant concentrations in sediment.

- The Sediment Quality Standards (SQS). At or below this level, it is unlikely that biological resources are impacted. This is the goal and serves as the objective for cleanup actions.

- The Cleanup Screening Levels (CSL), Minimum Cleanup Levels or Maximum Chemical Criteria for Sediment Impact Zones. Levels between the SQS and CSL are likely to cause minor adverse impacts to biological resources. Levels above the CSL, will likely result in severe impacts to biological resources. The different names correspond to how the criteria are used in three different situations, but the criteria are the same.

These criteria apply to both biological effects and chemical concentrations for 47 chemicals for marine sediments. The SQS are considered protective of biological

resources for acute and chronic toxicity. For freshwater sediments, the SMS includes a narrative criteria, but not numerical standards. In addition, the WAC 173-204-200(17), -310(3) has a provision to designate sediments as exceeding the SMS by "other toxic, radioactive, biological or deleterious substances" criteria. This includes contaminants which are not identified in the suite of the 47 SMS chemicals of WAC 173-204-320 through 173-204-340.

Options

How can Ecology best clarify the connection between the "other toxic, radioactive, biological and deleterious substances" provisions of the SMS, and the definition of "hazardous substances" under MTCA?

- Clarify the MTCA rule definition of hazardous substances to include substances that cause failure of one or more sediment toxicity tests as hazardous substances.
- Clarify the SMS definition of other toxic, radioactive, biological and deleterious substances to better reflect the MTCA hazardous substance definition.
- Revise the MTCA and/or SMS rule to identify other toxic, radioactive, biological and deleterious substances in the aquatic environment as hazardous substances.

Factors to Consider When Selecting an Option

The development of the amendments will involve the consideration and balancing of a number of issues and interests. The proposed options will also be developed to satisfy several, sometimes conflicting, regulatory goals, including the following:

- Whether the option provides for the selection of cleanup actions that protect human health and the environment.
- Whether the option provides for developing scientifically and legally defensible cleanup standards.
- Whether the option provides consistent methods for assessing and managing risk.
- Whether the option provides flexibility to address site-specific factors.
- Whether the option promotes efficient and cost-effective cleanup.
- Whether the option provides enhanced opportunities for public involvement.
- Whether the option improves the clarity and usability of the rule.
- Whether the option complies with key requirements of the Administrative Procedures Act.

Background Concentrations In Setting Sediment Cleanup Standards

Issue

How should we consider background concentrations in the Sediment Management Standards (SMS) when making decisions about sediment cleanup standards at cleanup sites?

Overview

The purpose of the SMS is to reduce and ultimately eliminate adverse effects on biological resources and significant threats to humans from surface sediment contamination. It is also important to consider the very real issue of widespread contamination. Ecology recognizes the need to protect people and the environment and understands certain practical limitations about how much sediment contamination we can actually clean up using remediation technologies.

Contaminants from both man-made and natural sources are widespread in the State's waters. It may not be feasible to clean up some chemical contaminants in sediment as much as we would like to protect people and the environment. Some contamination may be technically impossible or cost prohibitive to clean up to the very low concentrations that fully protect humans and the environment. This is especially so for chemicals that biomagnify and are eaten by other fish, people, and animals. Considering background concentrations when setting sediment cleanup standards is one way to address practicality in cleaning up sites.

The SMS do not provide details on how to address human health risks from sediment contamination, or how to consider background chemical concentrations when setting sediment cleanup standards. Model Toxics Control Act regulation procedures for soil and water cleanup levels to protect human health are often applied to setting sediment cleanup standards. The regulations have different approaches for how cleanup standards are selected and how background is defined. These create confusion during the cleanup process.

Ecology is considering options to solve this problem and bring clarity to the regulations for cleaning up contaminated sediment sites.

- How cost and feasibility are considered in the cleanup process, including the selection of sediment cleanup standards.

- Whether to use MTCA definitions for *natural* and *area background*, or to develop a new background definition for sediment cleanup standards.
- Whether procedures need to be defined to determine background sediment chemical and tissue concentrations, and how to compare site chemical concentrations to background concentrations.

Problem Statement

Sediment cleanup goals based on acceptable human health risk levels may be below background chemical concentrations. This may be especially true for contaminants that bioaccumulate in aquatic organisms and biomagnify in the food chain. In some cases, risk-based cleanup goals for bioaccumulative contaminants are also below current laboratory capabilities to detect them. Determining background concentrations is critical for establishing site-specific sediment cleanup standards that are both practicable and as protective as possible.

Some contaminants are so widespread that it may not be feasible to achieve fully protective concentrations under current cleanup regulations. When setting sediment cleanup standards, Ecology may choose to consider whether it is technically possible to clean up large areas of a waterbody, such as an entire bay.

Setting practical sediment cleanup standards allows more cleanup actions to be completed in a shorter amount of time, resulting in overall reduction of human health risks and environmental impacts. Our goal is to clean up contaminated sites quickly and efficiently, while protecting people and the environment.

Sediment background is generally more difficult to determine than soil background. Soil has relatively less movement than sediment. Sediment is moved by the water, and may be transported over large areas causing widespread sediment contamination. Contaminants tend to be higher near urban areas and the nearshore environment. Urban areas can have many diffuse nonpoint sources contributing to sediment contamination.

The Model Toxics Control Act (MTCA) rule approach for background was developed for soils, while the SMS does not specify how background will be considered in setting sediment cleanup standards. In the MTCA rule, the cleanup standard can be set at *natural background* if natural background is higher than the concentration associated with the MTCA rule acceptable human health risk level.[1] *Natural background* is defined in the MTCA rule as "the concentration of hazardous substance consistently present in the environment that has not been influenced by

[1] The risk levels described in MTCA rule are the lowest concentration based on: 1.) a $1x10^{-6}$ risk level for any one carcinogenic chemical and single exposure pathway, and 2.) $1x10^{-5}$ risk level for all carcinogenic chemicals combined and multiple exposure pathways, and 3.) a hazard quotient of 1 multiple for non-carcinogenic chemicals and/or multiple exposure pathways.

localized human activities."[2] There has been difficulty in determining what *natural background* concentrations are for sediment because of the ambiguity in what is meant by "localized human activities".

In some cases, MTCA rule Method C allows cleanup standards for surface water, groundwater, or air to be set at area background, but a number of conditions apply. The cleanup must still comply with applicable state and federal laws, have used all practicable methods of treatment, and not exceed an estimated excess cancer risk of one in one hundred thousand (1×10^{-5}).[3]

The SMS rule does not specify how background is defined when setting sediment cleanup standards for human health protection. In rare cases where there are elevated concentrations from nonanthropogenic sources, an area background may be used.[4]

These differences in SMS and MTCA rules create confusion when making decisions at sediment cleanup sites.

Options

How should background concentrations be considered when making decisions about sediment cleanup standards?

The issue of background in setting sediment cleanup standards at cleanup sites is entwined with the issues of human health, and the decision-making process for setting cleanup standards and remedy selection. Human health considerations in setting sediment cleanup standards are covered in more detail in a separate paper, but are discussed briefly here.

There are three regulatory layers related to background considerations in setting sediment cleanup standards: 1) decision-making framework 2) definition of background 3) background statistical methods and sample locations. Each of these aspects is explained in more detail below.

[2] WAC 173-340-200. "**Natural background** means the concentration of hazardous substance consistently present in the environment that has not been influenced by localized human activities. For example, several metals and radionuclides naturally occur in the bedrock, sediments, and soils of Washington State due solely to the geologic processes that formed these materials and the concentration of these hazardous substances would be considered natural background. Also, low concentrations of particularly persistent organic compounds such as polychlorinated biphenyls (PCBs) can be found in surficial soils and sediment throughout much of the state due to global distribution of these hazardous substances. The low concentrations would be considered natural background. Similarly, concentrations of various radionuclides that are present at low concentrations throughout the state due to global distribution of fallout from bomb testing and nuclear accidents would be considered natural background."

[3] WAC 173-340-706 (1) (a) and WAC 173-340-706 (2).

[4] WAC 173-204-320 (6) Puget Sound marine **nonanthropogenically affected sediment quality criteria**. Whenever the nonanthropogenically affected sediment quality is of a lower quality …than the applicable cleanup screening levels or minimum cleanup levels criteria established under this section, the existing sediment chemical and biological quality shall be identified on an area-wide basis as determined by the department and used in place of the standards of WAC 173-204-520.

1. Decision-making framework.

The decision-making framework provides a regulatory approach for making decisions about setting cleanup standards and choosing cleanup action alternatives. This topic is described in more detail in the Human Health Issue Paper and the MTCA Integration Paper. Ecology would like to clarify how considering background concentrations will fit within the framework.

2. Definition of background.

Ecology is considering different definitions of background in setting sediment cleanup standards.

- Do nothing and continue using the MTCA rule definition of *natural background* for setting sediment cleanup standards.
- Adopt in SMS the MTCA rule definition of *natural background* for setting sediment cleanup standards.
- Adopt in SMS the MTCA rule definition of *area background* for setting sediment cleanup standards.
- Define *background* applicable to sediment cleanup standards, which may include differentiating between basins, or urban and non-urban areas.

3. Statistical methods and background sample locations.

Ecology is evaluating whether these technical details should be addressed in regulation or would be better addressed in guidance. To determine appropriate background concentrations, some of the relevant questions include:

Which locations are appropriate reference locations for background samples relevant to cleanup sites?

Ecology is considering a number of options:

- For natural background in Puget Sound, sample locations in Puget Sound main basin far from urban influences and local sources.
- For Puget Sound, use different reference locations for urban and non-urban areas, or sub-basins.
- For other environments, use all lakes and rivers lumped together, or look at waterbodies individually.

How many samples will be needed to perform a robust statistical analysis? How will non-detects be treated in the statistical analysis?

Ecology is considering a number of options:

- Ecology collects data at reference sites and publishes a background concentration based on concentrations at the reference site.
- Each individual project collects data from an approved reference site. The minimum number of background samples required is specified either in guidance or in rule.

- Ecology is evaluating whether non-detect data should be included in the statistical analysis using simple substitution, such as method detection limit or ½ method detection limit.
- Ecology is evaluating whether non-detect data are included in the statistical analysis using statistical methods that estimate the distribution of non-detect values.

What statistical tests should be used to compare site data to background concentrations? What are appropriate metrics?

Ecology is looking into a number of related questions:

- What level of uncertainty is acceptable?
- Should we compare central tendencies such as mean, median, or confidence interval on the mean?
- Should we compare levels at the upper end of data, such as the 90th percentile, or mean plus two standard deviations?
- What method(s) do we use to compare data from a cleanup sites to data sets representing background?
- How do we compare exposure point concentrations in the area of concern to a background datasets?
- What statistical software that can be used for the analysis such as MTCAstat, MyEIM, or ProUCL?[5]

Factors to Consider When Selecting an Option

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

- Providing for the selection of cleanup actions that protect human health and the environment.
- Developing scientific and legally defensible cleanup standards.
- Providing consistent standards and methodologies for assessing and managing risk.
- Providing flexibility to address site-specific factors.

[5] "MTCA stat" is a statistical spreadsheet developed by Ecology for computing MTCA rule statistical methods. "MyEIM" is an analytical tool associated with Ecology's Environmental Information Management (EIM) database that provides statistical analysis of EIM environmental data. "ProUCL" is a free software statistical package developed by US EPA to test data distributions and compute Upper Confidence Limits (UCL) on the mean.

- Promoting efficient and cost-effective cleanup of contaminated sites.
- Improving the clarity and usability of the SMS and MTCA rules.
- Whether the option complies with key requirements of the Administrative Procedures Act.

Integrating the Sediment Management Standards and Model Toxics Control Act Rules

Issue

What rule revisions are needed (if any) to clarify processes and terminology for sediment cleanup actions under the Sediment Management Standards (SMS) and the Model Toxics Control Act (MTCA)?

Problem Statement

The SMS were adopted in 1991 to implement Ecology's responsibilities under several laws, including the MTCA (70.105D RCW) and the Water Pollution Control Act (90.48 RCW). Part V of the SMS rule establishes requirements for sediment cleanup standards. This part of the rule defines several administrative processes for implementing the cleanup requirements.

Sediment cleanup actions conducted under a MTCA order, agreed order or consent decree must comply with requirements in both the SMS rule and the MTCA Cleanup Regulation (Chapter 173-340 WAC). Establishing site-specific requirements that comply with both rules is confounded by several factors. These are described briefly then presented in tabular format for further detail.

- **Terminology:** The two rules use different terms to define similar concepts. Examples are provided in the table below. Differences in terminology occur in two main areas, criteria and report names.
- **Criteria:** Definitions and use of terms including cleanup standards, cleanup levels and remediation levels differ between SMS and the MTCA rule.
- **Report Names:** SMS and the MTCA rule have different names for required documents that have the same function.
- **Definitions:** The addition and updating of definitions will aid in clarifying the SMS.
    - Bioassay: This definition needs to be clarified to include test procedures or field analyses that measure the condition and/or response of living plants, animals, tissues, and other aquatic organisms to sediment. This includes biological toxicity tests and benthic community analysis.
    - Biological Toxicity Test: A definition needs to be added to include acute and chronic biological tests not including benthic community analysis. This would replace the commonly referred to term "bioassay."

- Chronic Bioassays: This definition needs to be added to clarify the term chronic and include both benthic community analysis and biological toxicity tests.
- Acute Bioassays: This definition needs to be added to clarify the term acute and include both benthic community analysis and biological toxicity tests.
- Sediment: A more comprehensive definition of sediment needs to be added to include marine, freshwater, and ephemeral conditions.
- Surface Sediment: This definition needs clarification to exclude the more comprehensive definition of sediment.
- Contaminated Sediment: This definition needs clarification to include the more comprehensive definition of sediment.

- **Cleanup Standards:** The SMS and MTCA rules both include methods and policies for establishing cleanup standards that are designed to protect human health and the environment. As noted above, the two rules use different terms for similar factors. However, the two rules also contain different decision-making frameworks that make it awkward to comply with both rules at the same time.

  - **SMS:** The SMS framework for developing site specific concentrations (protective of biota) for cleanup is based on a two tier structure, where the concentrations are established between the desired no-effects level and an upper bound of minor adverse effects. Under SMS, these levels are established (together with selecting the remedial alternative) giving consideration to cost, technical feasibility, and net environmental benefits.
  - **MTCA:** The MTCA rule specifies that cleanup standards must be based on an excess cancer risk of $1x10^{-6}$. [1] Cost and technical feasibility are not considered when setting cleanup standards.

- **Remedy Selection:** The two rules establish requirements for cleanup actions. In the SMS rule, these requirements are located in WAC 173-340-580 (Cleanup Action Decision). In the MTCA rule, the remedy selection requirements are located in WAC 173-340-360 (Selection of Cleanup Actions). The two rules contain overlapping requirements that are summarized in the table below. The most important difference is compliance with the statutory requirement that Ecology give preference to permanent solutions to the maximum extent practicable (RCW 70.105D.030(1)(b)). The MTCA rule includes this provision; the SMS rule does not.

- **Cleanup Time Frame:** The SMS needs to be clarified regarding what cleanup goal must be met within a specified time frame. This includes clarification that the SQS is the cleanup goal with certain caveats by harmonizing the following sections:

[1] The risk levels described in MTCA rule are $1x10^{-6}$ for any one carcinogenic chemical and single exposure pathway, and $1x10^{-5}$ for all of the carcinogenic chemicals combined and/or multiple exposure pathways, and a hazard quotient of 1 for single non-carcinogens and single exposure pathway, and a hazard index of 1 for multiple non-carcinogenic chemicals and/or multiple pathways. WAC 173-340-705 (2).

- WAC 173-204-580(3)(a)(ii) refers to a time frame of meeting cleanup standards within ten years.
- WAC 173-204-580(3)(b) allows for an extended time frame if certain conditions are met.
- WAC 173-204-570(3) requires that the minimum cleanup level is the maximum concentration of a contaminant allowed at the site by year ten after the cleanup action.
- WAC 173-204-570(2) requires that the cleanup objective must be the SQS as defined in WAC 173-204-320 through 340.
- WAC 173-204-570(4) allows for a cleanup standard to be set as close as practicable to the SQS but not to exceed the minimum cleanup level within a preferred 10 year time frame.

Table 1. TERMINOLOGY – Comparison of terminology between the SMS and MTCA. The same terms in both rules may have different definitions. In addition, different terms in both rules can represent the same function.

SMS	MTCA	Explanation
Sediment Quality Standard which is also the Sediment Cleanup Objective Narrative, chemical and biological criteria that identify sediments that have no acute or chronic adverse effects on biological resources and no significant health risk to humans. The SQS serves as the Sediment Cleanup Objective for all sediment cleanup actions.	**Cleanup Level** The concentration of a hazardous substance in soil, groundwater or surface water or sediment that is determined to be protective of human health under specified exposure conditions.	These terms identify the no adverse effects goal for a cleanup action under SMS and MTCA. MTCA specifies protection for human health at $1x10^{-6}$ excess cancer risk. The SMS narrative standard for human health does not specify a protection level. Both are established without consideration of costs or feasibility. Under MTCA, the Cleanup Level is the final concentration that must be achieved. Under SMS, the cleanup objective is the goal, but does not necessarily need to be achieved at the site if certain conditions are met.
Cleanup Standard Site specific concentration for a contaminant for which an exceedance triggers remedial action. Established between SQS and MCUL/CSL based on consideration of cost, technical feasibility and net environmental benefits.	**Cleanup Standard** Consist of the following: (a) Cleanup levels for hazardous substances present at the site, (b) The location where these cleanup levels must be met (point of compliance), and (c) ARARs - Other regulatory requirements that apply.	These terms represent similar concepts of establishing a final concentration to be achieved at the site. Under the SMS, consideration of cost and feasibility is allowed when developing the SMS Cleanup Standard. Cost and feasibility are not considered in setting the MTCA Cleanup Standard.
	Remediation Level Site specific concentration of a hazardous substance in soil, water, air, or sediment above which a particular cleanup action component will be required.	Achieving a remediation level at a site does not necessarily mean that the cleanup is complete.

SMS	MTCA	Explanation
Minimum Cleanup Level (MCUL)		Under SMS, the MCUL (or CSL) serves as an upper bound on adverse effects on benthic biota allowed after a cleanup. MTCA does not have a similar upper bound.
Human Health – Narrative - "…no significant health risk to humans"	**Human Health –** 10^{-6} risk level and a hazard quotient ≤ 1	MTCA states the upper bound of risk while the SMS narrative standard is less specific.

Table 2. COMPARISON OF REQUIREMENTS AND REPORTING DOCUMENTS UNDER SMS AND MTCA CLEANUP PROCESSES. The SMS and MTCA processes for decision-making are shown side-by-side, arranged by major function. This underscores the difference between the required deliverables and at what point cost is considered in developing a cleanup action under each rule.

	Sediment Management Standards 173-204 WAC	**SMS**	**MTCA**	**Model Toxics Control Act 173-340 WAC**
Report Names	*Sediment Cleanup Study* *SCS*[2] *Sediment Cleanup Report* *SCR*[2]			*Public Participation Plan* *PPP*[3] *Remedial Investigation* *RI*[4] *Feasibility Study* *FS*[4] *Cleanup Action Plan* *CAP*[5]
Public Participation	*SCS* must specify what, when, how public participation will occur.[2]	*SCS*	*PPP*	*340-600* is more specific about how public participation will be done, including a site-specific public participation plan, site register, public meetings.
Site Investigation	Site info and site map. Existing data and field investigations. Sediment Contaminant Sources Evaluate human health risk.[2]	*SCS*	*RI*	Site info and site map. Existing data and field investigations. Site conceptual model. Sources. Evaluate the following media: soil, ground water, surface water, air, sediment for each contaminant and exposure pathway.[4]
Setting Cleanup Levels (Cleanup Standards) Note there is a difference in terminology.	Based on human health risk assessment[2] and SQS criteria. Based on cost and feasibility, allows cleanup levels up to MCL for benthic toxicity.[6] Cost is considered when setting Cleanup Standards for sediments.	*SCS*	*RI*	Develop risk levels and hazard quotients for each chemical of concern using one of the following[7]: Method A – Uses tables & ARARs for simple sites. Method B – Universal method uses equations to calculate risk & hazard. May modify equations for site-specific parameters. Method C – Conditional – results in institutional controls

[2] WAC 173-204-560
[3] WAC 173-340-600
[4] WAC 173-340-350
[5] WAC 173-340-380
[6] WAC 173-204-570
[7] WAC 173-340-700 to WAC 173-340-760

	Sediment Management Standards 173-204 WAC	SMS	MTCA	Model Toxics Control Act 173-340 WAC
				including future use restrictions. Cost is not considered until the selection of alternatives for a site.
Developing Alternatives	Can use site units with individual cleanup standards. Alternatives may include a sediment recovery zone. May use a phased approach for screening and selecting alternatives.	*SCS*	*FS*	Must include permanent alternative for comparison.[4] Process for using remediation levels in developing cleanup alternatives.[8] Quantitative risk assessment of cleanup action alternatives to determine if protective of human health and the environment.[9]
Selection of Alternatives	Requirements[10]: • Protect human health and the environment • Comply with site cleanup standards • Comply with state and federal laws • Provide adequate monitoring • Consider public concerns • Provide landowner review • Provide reasonable time frame for completion of cleanup action Consider net environmental effects, relative cost-effectiveness of alternatives, technical effectiveness and reliability.[10] In SCS evaluation of cleanup actions	*SCR*	*CAP*	Minimum requirements[11]: • Protect human health and the environment • Comply with cleanup standards • Comply with state and federal laws • Provide for compliance monitoring Select action that will: • Use **permanent solutions to maximum extent practicable** (Disproportionate Cost Analysis). • Provide reasonable restoration time frame • Consider public concerns In DCA, consider protectiveness, permanence, cost, effectiveness over the long-term, management of short-term risks, technical and administrative implementability, and public concern.

[8] WAC 173-340-355
[9] WAC 173-340-357
[10] *WAC 173-204-580*
[11] *WAC 173-340-360*

	Sediment Management Standards 173-204 WAC	SMS	MTCA	Model Toxics Control Act 173-340 WAC
	must consider: overall protection of human health and environment, time to attain cleanup standard, short-term effectiveness, long-term effectiveness, ability to be implemented, cost, community concerns, waste minimization, and environmental impacts.[2]			

Overview

Decisions for sediment cleanup sites must comply with both the SMS and MTCA rules. Differences in the two rules cause confusion about how to comply with both. Ecology is considering revising the SMS and MTCA rules to clarify how to proceed at sediment cleanup sites. Some of the areas that are being considered include:

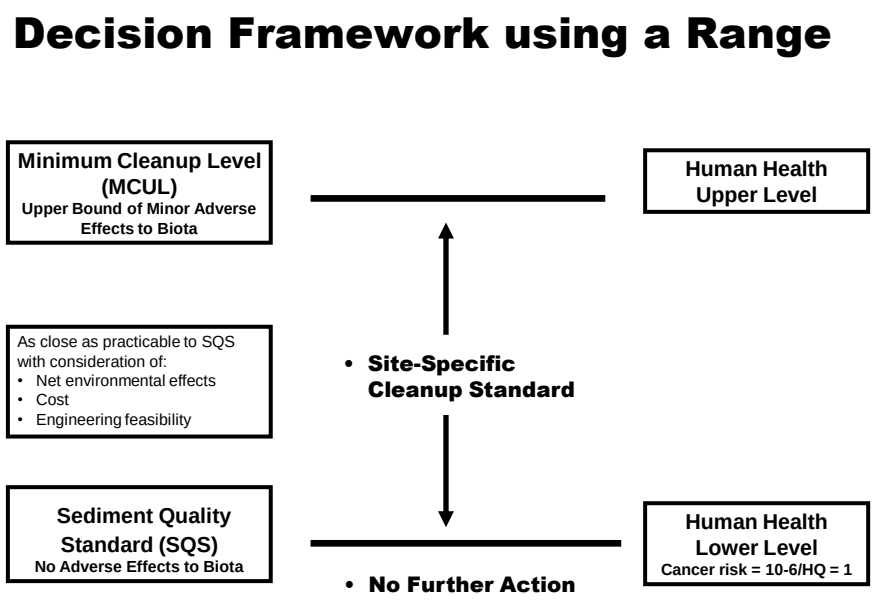
- Terminology - Including definitions and terms used for cleanup standards, required documents, and clarifying definitions.
- Cleanup Standards - Process for setting sediment cleanup standards at the site. How cost and feasibility are considered when setting sediment cleanup standards.
- Remedy Selection - Alignment of the process and requirements for remedy selection at sediment cleanup sites.
- Cleanup Time Frame - Time frame required for sediment cleanup levels to be met.
- Minor Housekeeping for Rule - Remove typos and clarify wording.

Options

- **Terminology:** Ecology has identified several options for dealing with differences in terminology:
  - Do nothing. Continue using the combined SMS and MTCA applicability.
  - Revise both SMS and the MTCA rules. Aligning the two rules could be accomplished by primarily focusing revisions in the SMS. Then the SMS would better reflect MTCA's use of document names and terms and more closely mirror the MTCA framework for setting standards and selecting remedial alternatives. This would still require revisions to the MTCA rule to clarify where and how MTCA defers to SMS.
- **Cleanup Standards**: Ecology has identified several options for harmonizing the cleanup standard methods and policies in the two rules:
  - Do nothing. Continue to use the SMS approach for establishing benthic toxicity cleanup standards (concentrations) between the SQS and MCUL criteria, then overlaying human health considerations on a case-by-case basis.
  - Develop guidance on how to implement the SMS ecological standards with the MTCA human health standards. For example, determine a site specific sediment concentration that protects human health at the default MTCA risk level of $1x10^{-6}$ (or background or PQL, whichever is highest). That value serves as the equivalent of the SQS (cleanup objective) for human health and is then carried into the SMS decision process. SMS requires selecting a site specific standard as close as practical to the SQS and not greater

than the upper bound of MCUL for benthic toxicity criteria (there is no similar upper bound for human health criteria).

- Decision Framework using a Single Concentration. This would entail establishing levels of protection for human health that reflect the MTCA standard and serve as a parallel to the SQS for benthic receptors. For protection of human health, concentrations may be lower than background, requiring methods discussed in the Human Health and Background Issue Papers to select this number (e.g., highest of $1x10^{-6}$ excess cancer risk, background or PQL). These concentrations will serve as the objective for remedial actions and are determined without consideration of cost or feasibility. The selection of site specific cleanup concentrations and remedial alternatives would strive to achieve these, using a tool such as a Disproportionate Cost Analysis for considering cost, feasibility and net environmental benefits.
- Decision Framework using a Range of Concentrations. Similarly to the SMS benthic toxicity criteria, a range of effects would be established for protection of human health and selection of a site specific cleanup concentration would have to be within that range. The decision framework for selection of a sediment cleanup concentration would require overlaying the current range for ecological criteria (SQS to MCUL) and the range for human health (human health lower level, to human health upper level) to ensure the value selected is at or below the lower of the human health upper level or MCUL (see figure below).



- **Remedy Selection**: Ecology has identified several options for harmonizing the remedy selection requirements in the two rules and the MTCA statute:
  - Do nothing. Continue to integrate the requirements in the two rules using an approach similar to the approach used in the cleanup action plan for the Whatcom Waterway sediment cleanup.

- Revise the SMS rule to incorporate the MTCA statutory preference for permanent solutions to the maximum extent practicable. Under this option, WAC 173-204-580 would include the preference for permanent solutions to the maximum extent practicable. This could be done in combination with revisions to the MTCA rule that state that compliance with the revised SMS requirements represents compliance with the MTCA rule requirements in WAC 173-340-360.

- Revise the MTCA rule to incorporate requirements that are specific to sediment cleanup actions. Under this option, WAC 173-340-360 would include the several sediment specific requirements (e.g. landowner review). This could be done in combination with changes to WAC 173-204-580 that specify that compliance with the MTCA rule provisions represents compliance with the SMS rule requirements for cleanup action decisions.

Factors to Consider When Selecting an Option

The development of the amendments will involve the consideration and balancing of a number of issues and interests. The proposed options will also be developed to satisfy several, sometimes conflicting, regulatory goals, including the following:

- Whether the option provides for the selection of cleanup actions that protect human health and the environment.
- Whether the option provides for developing scientifically and legally defensible cleanup standards.
- Whether the option provides consistent standards and methodologies for assessing and managing risk.
- Whether the option provides flexibility to address site-specific factors.
- Whether the option promotes efficient and cost-effective cleanup of contaminated sites.
- Whether the option provides enhanced opportunities for public involvement.
- Whether the option improves the clarity and usability of the rule.
- Whether the option complies with key requirements of the Administrative Procedures Act.

Human Health Risks In Setting Sediment Cleanup Standards

Issue

What Sediment Management Standards (SMS) rule revisions (if any) are needed to provide clear and predictable sediment cleanup standards that protect human health at contaminated sediment sites?

Overview

The intent of cleanup requirements in the MTCA and SMS rules is to protect human health and the environment. However, differences in the two rules make it unclear how to consider human health when setting sediment cleanup standards at cleanup sites. These differences include:

- **How cost and feasibility are considered in the cleanup process**. The SMS allows cost and feasibility to be considered when setting sediment cleanup standards, as well as in the remedy selection process. Cost is not considered when setting cleanup standards in the MTCA rule, but is considered during the remedy selection process.
- **How to determine acceptable levels of human health protection.** The MTCA rule has specific acceptable risk levels and procedures to protect human health for both soil and water contamination. The SMS, however, has narrative criteria that generally require "no significant human health threats" from sediment contamination.
- **How background concentrations of chemical contaminants are considered** when setting sediment cleanup standards, and how background is defined for sediments.

To clarify how to address human health risks when setting sediment cleanup standards, Ecology is considering revisions to the SMS rule. This paper discusses how and why Ecology is considering clarifying and harmonizing the two rules to protect human health from sediment contamination. As part of this evaluation, Ecology is considering a number of options related to:

1. How the decision for sediment cleanup standards will be made.

- Whether cost and feasibility will be considered when setting sediment cleanup standards, as well as in remedy selection.

- Whether sediment cleanup requirements will have the same level of human health protection as MTCA.
- How background will be used in setting sediment cleanup standards, and how it will be defined.
- What exposure pathways are significant for sediment sites.

2. **The technical and procedural details for setting sediment cleanup standards.**
   - What process will be used for setting sediment cleanup standards based on human health.
   - Will exposure equations be used to calculate risks to human health, or does enough information exist to develop tissue or sediment standards.
   - What are appropriate background reference locations and procedures for evaluating data.

Not all parts of the issue may be addressed in rule revision at this time. Some elements may be addressed through guidance. Some elements may be addressed in future rule revision processes.

Problem Statement

History

Ecology published the SMS rule in 1991. At that time, Ecology acknowledged the need for clearer requirements for human health protection and began to work on several technical and policy tasks to support rule amendments on that issue. Ecology initiated a process to amend the SMS rule in 1997. The 1997 process for rule amendments was highly controversial and Ecology halted the rulemaking process in 1999.

Several relevant scientific and regulatory developments have occurred since that time. These developments include extensive amendments to the Model Toxics Control Act (MTCA) rule in 2001 to clarify risk policies and define "Reasonable Maximum Exposure." New information and guidance documents that are relevant to human health protection have recently been published by other agencies.

Current Approach for Evaluating Human Health Protection.

The SMS at 173-204-570 WAC identifies the sediment cleanup objective as "no significant health threat to humans." However the SMS does not have details on how this objective should be accomplished.

Currently sediment cleanup standards to protect human health are decided based on the MTCA rule. The approach described in the MTCA rule includes a site-specific analysis of all potential exposure pathways in each medium based on current and future potential

land use. A cleanup level[1] (cleanup standard) is calculated that protects reasonable maximum exposure of any receptor at acceptable risk levels.

The acceptable risk levels described in the MTCA cleanup rule are:

- One in one million ($1x10^{-6}$) for any one carcinogenic chemical and single exposure pathway.[2]
- One in one hundred thousand ($1x10^{-5}$) for all of the carcinogenic chemicals combined and multiple exposure pathways.
- A hazard index of 1 for multiple non-carcinogenic chemicals and/or multiple exposure pathways.

The current approach for calculating sediment cleanup standards is to use the MTCA rule *cleanup level*[1]. This is the highest of any of the following:

- The lowest concentration, based on the risk level and hazard quotient as described above, for the most sensitive receptor.
- *Natural background* – a background area not influenced by "localized human activities."
- Practical quantitation limit – the lowest concentration that can be reliably measured within specified limits of precision and accuracy.

Calculating risk-based sediment cleanup standards is often based on the U.S. Environmental Protection Agency (EPA) exposure equations.[3] Site-specific parameters may be developed for these exposure equations.

In some cases, the MTCA rule does allow a higher cleanup standard of one in one hundred thousand ($1 x10^{-5}$) excess cancer risks for single or multiple chemicals at a site in groundwater, surface water or air. In this case, MTCA Method C may be used if it is not technically possible, regardless of cost, to meet the cleanup standards of MTCA Methods A or B.[4] MTCA Method C may also be used for soil at industrial sites.

The MTCA rule does not consider cost when setting cleanup standards. In cleanup sites on land, there is more flexibility in achieving the cleanup standards because of institutional controls that can limit exposure, and having points of compliance at the edge of the site. These controls are difficult to implement at sediment sites, so there is less flexibility.

[1] The MTCA term of *cleanup level* is roughly equivalent to the SMS term of *sediment cleanup standard*, meaning the concentration that must be achieved to complete cleanup at the site. In MTCA, *cleanup standard* means a *cleanup level* with a point of compliance and all applicable ARARs.
[2] A $1x10^{-6}$ risk level means an estimated risk of one additional cancer above the background cancer rate per 1,000,000 individuals.
[3] U.S. Environmental Protection Agency 1989. *Risk Assessment Guidance for Superfund Volume 1 Human Health Evaluation Manual (Part A).* EPA Document EPA/540/1-89/002.
[4] WAC 173-340-706 (1) (a) and WAC 173-340-706(2).

Differences between SMS and MTCA Rules for Human Health Protection

	MTCA Rule	SMS Rule
Decision-making framework	Cleanup standard is a single concentration.	Sediment cleanup standards are set within a range of concentrations.
Cost and feasibility consideration	Does not consider cost when setting cleanup standards. Costs are considered during the remedy selection phase.	Sediment cleanup standards are set within a range of concentrations, achieving concentrations as low as possible with consideration of cost and technical feasibility.
Media considered	Soil, surface water, groundwater, vapor.	Sediment
Pathways considered	Drinking water, fish consumption, direct contact (including incidental soil ingestion and dermal exposure), and inhalation.	None specified. When a sediment cleanup site takes human health into consideration, pathways are identified on a case-by-case basis.
Level of protection	The MTCA rule *cleanup level* is the highest of either: • Risk levels of 1×10^{-6} for any one carcinogenic chemical and single exposure pathway, and 1×10^{-5} for all of the carcinogenic chemicals combined and/or multiple exposure pathways, and a hazard index of 1 for multiple non-carcinogenic chemicals and/or multiple pathways. • *Natural background* • Practical quantitation limit. For surface and groundwater, MTCA Method C allows a maximum of 1×10^{-5} total excess cancer risk from the site, without consideration of cost. For soils and air, Method C is only used at industrial sites.	Human health narrative states "no significant health risk to humans." For cleanup standards based on benthic toxicity: Goal is "no effects." Maximum of "minor adverse effects" when considering cost and feasibility.

	MTCA Rule	SMS Rule
How level of protection is determined	Equations and default parameters for most single exposure pathways with a single contaminant. Some numeric criteria for simple sites (Method A).	Numeric criteria for 47 chemicals in Puget Sound – benthic invertebrates' toxicity only. Not specified for other pathways or receptors.
How multiple exposure routes are evaluated	Assumed to be additive unless scientific evidence is available to demonstrate otherwise.	Not specified.
How background is considered in setting cleanup levels.	"Natural background" defined as not influenced by localized human activities.	If non-anthropogenic background is above the Cleanup Screening Level (CSL), may develop area background. Otherwise, not specified.
What statistical analysis is used to determine background?	Assumed to be lognormal distribution, unless otherwise demonstrated. For lognormal distribution, background shall be lowest of: upper 90th percentile or 4 times 50th percentile. For normal distribution, background shall be lowest of: upper 80th percentile or 4 times 50th percentile. MTCA rule also allows other statistical approaches, with department approval.	Not specified.
How many samples are needed to determine background?	10 or more samples to determine natural background for soil. 20 or more samples to determine area background for soil.	Not specified.
How will non-detect concentrations be treated in determining background?	If < Method Detection Limit, use ½ Method Detection Limit. If between Method Detection Limit and Practical Quantitation Limit, use Method Detection Limit.	Not specified.

Options

When setting sediment cleanup standards, human health considerations are complex. The options identified range from doing nothing to revising the rule or developing guidance. The options considered focus on three areas: **1) Decision-making framework**, **2) Level of protection,** and **3) Procedures.** These options are described in more detail below.

1. <u>Decision-making framework in setting cleanup standards.</u>

The decision-making framework provides a regulatory approach for making decisions about setting cleanup standards and choosing remedial actions. MTCA and SMS rules currently have different approaches.

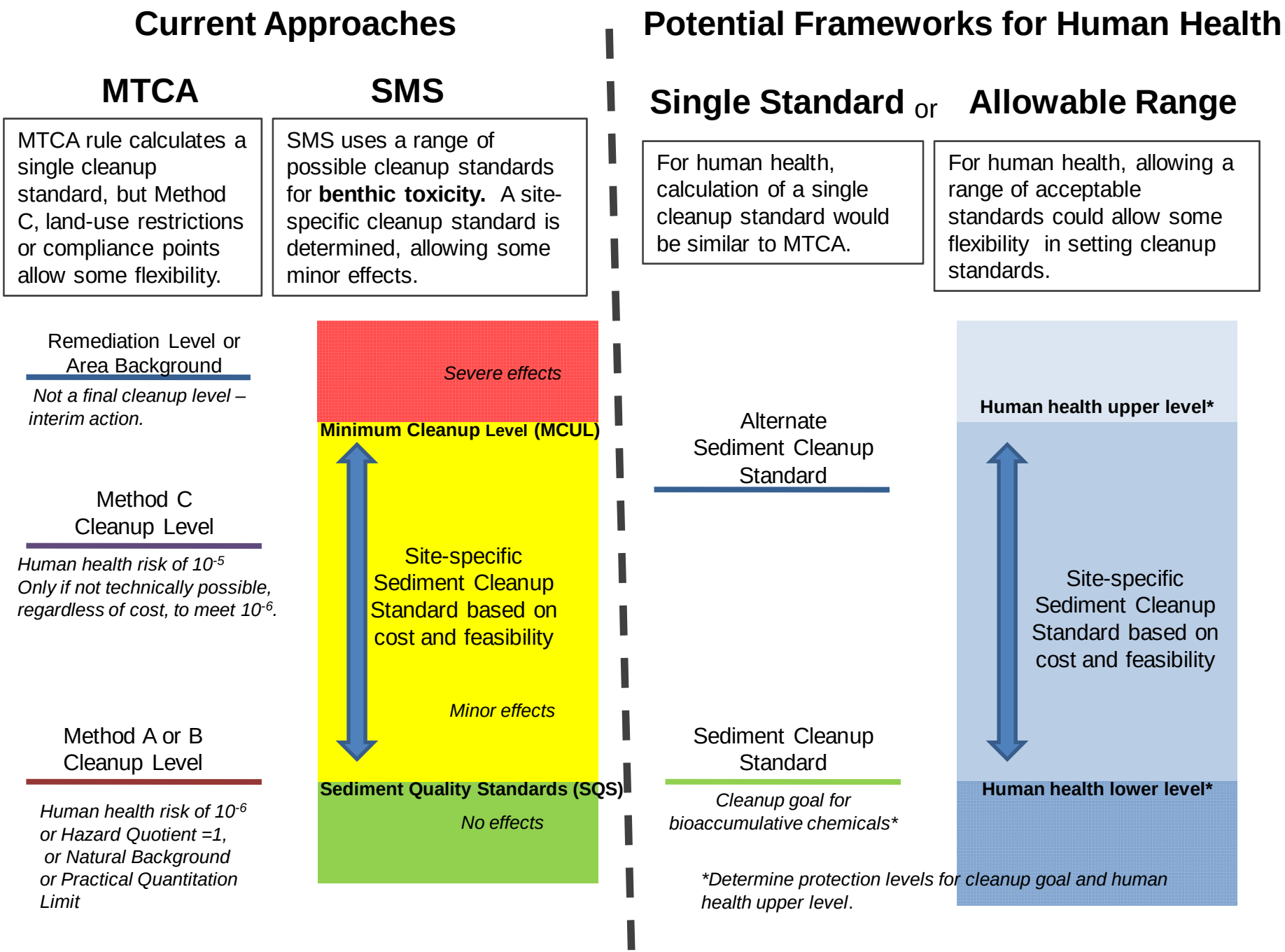
As shown in Figure 1, the MTCA rule uses a decision-making framework that calculates a single cleanup standard. Cost is not considered when setting the cleanup standard, but is considered when selecting the remedy. The SMS uses a framework that allows the cleanup level to be set within a range of concentrations, with consideration of cost and feasibility.

Ecology is considering a number of options for a decision-making framework.

- **Do nothing** and continue to address human health concerns on a site-specific basis.
- Develop **sediment cleanup standards based on one level of protection.**[5]
- **Allow an alternate level of protection** when developing sediment cleanup standards for sites where it is not technically possible to achieve the sediment cleanup goal.[6]
- Develop sediment cleanup standards that are **based on a range of acceptable values**. The lower end of the range would be the goal, while the upper end of the range would be a maximum acceptable level. The cleanup standards would be selected within the range, as close as possible to the lower concentration while considering certain factors, including cost and feasibility. This approach is similar to current SMS approach.

[5] This approach is similar to MTCA Method B cleanup levels as described in WAC 173-340-705.
[6] This approach is similar to MTCA Method C cleanup levels as described in WAC 173-340-706.

Figure 1. Comparison of potential frameworks for human health to current decision-making framework in the SMS and MTCA rules.



2. Level of protection.

A. What is the best approach for specifying the level of protection for human health?

The approach in the MTCA rule (and in EPA guidance) defines an acceptable level of human health protection based on incremental risk levels for carcinogenic chemicals or hazard quotients for non-carcinogenic chemicals. MTCA risk levels and EPA risk levels are different, with EPA allowing a wider range of acceptable risk.
To calculate a sediment cleanup standard from an acceptable risk level or hazard quotient/index requires addressing a number of considerations

- **How much exposure**? When setting cleanup standards, the MTCA rule says that exposure scenarios should be based on the reasonable maximum exposure for a human under current and potential future site use. A site-specific baseline risk assessment usually includes two human exposure scenarios: reasonable maximum exposure, and a central tendency exposure.
- **What exposure routes?** Potential exposure routes are food ingestion (including contaminants that have biomagnified in seafood), dermal contact, incidental ingestion, and inhalation.
- **How to consider** multiple exposure pathways**?** The MTCA rule allows a one in one hundred thousand (1×10^{-5}) risk level when considering multiple chemicals and exposure pathways.
- **How do sediment concentrations at a site relate to risks from chemicals that biomagnify in seafood (fish and shellfish) eaten by people?** This includes consideration of amounts and types of seafood consumed, tissue concentrations, and a myriad of factors that affect how tissue concentrations relate to sediment concentrations at a site.

Ecology is considering a number of options for setting the level of protection.

- **Do nothing** and retain the SMS rule narrative criteria.
- Identify the **acceptable risk levels (10^{-6} to 10^{-5}) that are consistent with the MTCA** rule.
- Specify **how sediment or tissue concentrations can be calculated** from risk levels.
- Identify a range of **acceptable risk levels (10^{-6} to 10^{-4}) consistent with theEPA** approach.
- Develop **criteria based on tissue concentrations**, with the focus on certain indicator species.

- Develop **exposure input parameters for the significant exposure pathways** and most susceptible human populations that tend to be the risk-drivers at sediment cleanup sites, such as tribal seafood ingestion exposure pathway.

B. How will background concentrations be considered when setting sediment cleanup standards?

Because sediment contaminants are widespread, it may not be technically feasible to achieve the level of human health protection that we would like. It may be appropriate to consider how widespread background concentrations of chemicals should be considered when setting sediment cleanup standards. This issue is addressed in more detail in the "Background Concentrations In Setting Sediment Cleanup Standards" Issue Paper, and is briefly summarized here.

The SMS rule does not specify how background is defined when setting sediment cleanup standards for human health protection. In rare cases where there are elevated concentrations from nonanthropogenic sources, an area background may be used.[7]

MTCA allows cleanup standards to be set at "natural background" which is not influenced by "localized sources." The ambiguity of this definition has caused difficulty in selecting appropriate reference locations for sediment.

Ecology is considering a number of options for defining background.

- **Do nothing.**
- Clarify what is meant by ***natural background*** for setting cleanup standards.[8]
- Use **another definition of background** specific to sediments. This may include differentiating between main and sub-basins, or urban and non-urban areas.

C. Which parts of the SMS rule should be revised?

In the rule revision we want to provide more detail on how to evaluate "no significant threats to human health." This narrative appears at several different places in the rule:

- 173-204-320 to -340 WAC Sediment Quality Standards.
- 173-204-420 WAC Sediment Impact Zone Maximum criteria.
- 173-204-520 WAC Cleanup Screening Levels criteria.
- 173-204-570 WAC Sediment Cleanup Standards.

[7] WAC 173-204-320 (6) Puget Sound marine **nonanthropogenically affected sediment quality criteria**. Whenever the nonanthropogenically affected sediment quality is of a lower quality …than the applicable cleanup screening levels or minimum cleanup levels criteria established under this section, the existing sediment chemical and biological quality shall be identified on an area-wide basis as determined by the department and used in place of the standards of WAC 173-204-520.
[8] See "Background" issue paper for more details.

The objective for revising the rule is to clarify and harmonize the SMS and MTCA rule for setting cleanup standards. Changing only the section on Sediment Cleanup Standards would be sufficient for harmonizing the two regulations.

However, revising all of the sections with human health criteria would provide greater consistency within the SMS rule. But this approach would bring up additional implementation issues in applying the human health criteria to NPDES permits and the site listing process. Since these parts of the rule are also promulgated under authority of the Water Pollution Control Act 90.48 RCW, we would have to ensure consistency with that statute.

Ecology recognizes that if only the sediment cleanup standards section address the human health pathways, then there will likely be more stringent standards for cleanup sites than for controlling sources from NPDES permits or for listing sites as cleanup sites. This could increase the potential for recontamination of sites that are cleaned up.

Ecology is considering a number of options regarding the SMS.

- Do nothing and retain the SMS rule narrative criteria.
- Revise the human health narrative criteria in all sections of the SMS rule.
- Revise the human health narrative criteria only in section WAC 173-204-570 Sediment Cleanup Standards.

3. Procedures – What are the processes and technical details needed to provide clear, consistent implementation?

Several complex technical issues need to be resolved to provide clarity in implementing the rule. These technical details may be addressed in the regulations or guidance. Some of the relevant questions include:

- How to determine sediment cleanup standards for a specific cleanup site?
    - What equations, acceptable risk level or hazard quotients, and exposure input parameters should be used when calculating risk-based cleanup levels?
    - How to determine "background" levels for comparison?

- How to evaluate different cleanup actions alternatives?
- How to determine compliance with cleanup standards after the cleanup is completed?

Ecology is considering a number of procedural options.

- **Do nothing** and continue to evaluate human health on a case-by-case basis.
- **Bioaccumulation testing methods and interpretation**. Determine contaminants in laboratory bioassays, field-exposed organisms, or field-collected organisms to determine potential risks from bioaccumulative pollutants.
- **Develop formulas in the SMS to calculate safe sediment concentrations** with acceptable risk levels or hazard quotients, reasonable maximum exposure input parameters, and biota-sediment accumulation factors (BSAF). This **approach is similar to the** MTCA rule formulas that are currently used for bioaccumulative chemicals in water. Default parameters and allowable modifications could be specified.
- **Develop guidance on specific issues** for human health risk assessments.
- **Guidance could focus on the following**:
    - When and how to perform baseline human health risk assessments at cleanup sites.
    - Exposure scenarios for significant sediment exposure pathways for humans.
    - Subpopulation sensitivity for bioaccumulative chemicals.
    - Estimating exposure from fish consumption.
    - Background concentrations or practical quantitation limit (PQL) for tissue or sediment concentrations.
    - Estimates of bioaccumulation factors (BSAF) or use of food web models.

- **Revise the SMS rule to address specific issues for** human health risk assessments:
    - Exposure scenarios for significant sediment exposure pathways for humans.
    - Subpopulation sensitivity for bioaccumulative chemicals.
    - Estimating exposure from fish consumption.
    - Background concentrations or PQL for tissue or sediment concentrations.
    - Estimates of bioaccumulation factors or use of food web models.

Factors to Consider When Selecting an Option

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

- Providing for the selection of cleanup actions that protect human health and the environment.

- Developing scientific and legally defensible cleanup standards.
- Providing consistent standards and methodologies for assessing and managing risk.
- Providing flexibility to address site-specific factors.
- Promoting efficient and cost-effective cleanup of contaminated sites.
- Improving the clarity and usability of the rule.
- Whether the option complies with key requirements of the Administrative Procedures Act.

Ecological Risks from Bioaccumulative Chemicals in Sediment

Issue

What Sediment Management Standards (SMS) rule revisions (if any) are needed to provide clear and predictable sediment cleanup standards that protect biota from bioaccumulative chemicals at sediment cleanup sites?

Problem Statement

History

The SMS were adopted in 1991 to implement Ecology's responsibilities under several laws, including the Model Toxics Control Act (MTCA) and the Water Pollution Control Act. At that time, chemical and biological criteria were developed to protect benthic organisms from acute and chronic toxicity. However, the chemical and biological criteria were not specifically established to protect the benthic community or other biota from bioaccumulative chemicals. Although some progress has been made regarding bioaccumulation and risks to human health, risk to biota from bioaccumulative chemicals is not clearly addressed in the SMS.

There has been discussion regarding whether or not protection of human health risks from bioaccumulative chemicals would be sufficient to protect biota. In February 2009, the Regional Sediment Evaluation Team (RSET) released an analysis of both human and ecological risks from bioaccumulative contaminants[1]. This included the development of target tissue levels for the protection of human health for a wide range of consumption levels for mammals and birds (target species). Target tissue levels (standards) for ecological receptors were developed for several options:

- Protection of populations not listed in the Endangered Species Act.
- Protection of individuals listed in the Endangered Species Act.
- Values for nearshore versus deep water conditions.

RSET concluded that, for most compounds tested, tissue levels to protect human health at general consumption rates (54 grams per day) were generally lower than levels needed to protect target species. However, this conclusion does not apply to subsistence fisher

[1] https://www.nwp.usace.army.mil/pm/e/rset/sef/2009_SEF-DraftFinal.pdf

consumption rates which are significantly higher than 54 grams per day. In addition, target tissue levels were not developed for fish. Therefore, protection of human health of subsistence fishers and ecological health of fish cannot be directly inferred by these results.

Current approach to evaluate ecological protection from bioaccumulative effects at contaminated sediment sites.

Currently, the process to develop cleanup levels protective of biota from bioaccumulative chemicals are conducted on a site-specific basis. To assess risk to biota, both aquatic (invertebrates and fish) and upland (mammalian and avian) target species impacted by contaminated sediments either directly or through the food web are identified. Bioaccumulation and trophic transfer of contaminants are then predicted using various models to develop target tissue levels. These models can include the "mammalian predator" model from MTCA Table 749-4 and a scientifically rigorous aquatic bioaccumulation model such as the Gobas model (http://www.rem.sfu.ca/toxicology/models/models.htm). The predicted target tissue levels are then compared to current scientific literature values to determine the risk to the target species.

Overview

The intent of the SMS rule is to reduce and ultimately eliminate adverse effects on biota and significant human health threats. The SMS has promulgated chemical and biological criteria to protect against non-bioacummulative adverse effects to biota, specifically acute and chronic toxicity to benthic organisms. The SMS has a stated intent to protect biota from bioaccumulative contaminants which is evident in the definition of "chronic" that includes adverse effects from bioaccumulation and biomagnification.

However, the SMS does not have promulgated criteria to protect biota from bioaccumulative effects. In addition, the SMS does not have a clear process on how to set cleanup standards to protect against bioaccumulative effects to biota.

The MTCA rule has a process to determine cleanup standards to protect against bioaccumulative effects through conducting a Terrestrial Ecological Evaluation. To be consistent with the MTCA rule, we are considering revisions to the SMS rule to clarify how to protect biota from bioaccumulative effects when setting cleanup standards.

Options

When setting sediment cleanup standards, risk considerations to biota are complex. However, most of the major issues (decision making framework, level of protection, procedures) are covered in detail in the issue paper, "Human Health Risks When Setting Sediment Cleanup Standards." This issue paper will only cover the options for protecting biota from bioaccumulative effects when setting cleanup levels at sediment cleanup sites.

These options include the following:

- Continue using the current approach to develop cleanup levels for bioaccumulative chemicals.
- Develop a narrative standard for the protection of biota from bioaccumulative effects.
- Develop a narrative standard along with guidance for the protection of biota from bioaccumulative effects.
- Adopt numeric criteria for the protection of biota from bioaccumulative effects.
- Adopt biological criteria for the protection of biota from bioaccumulative effects.

Factors to Consider When Selecting an Option

The development of the amendments will involve the consideration and balancing of a number of issues and interests. The proposed options will also be developed to satisfy several, sometimes conflicting, regulatory goals, including the following:

- Whether the option provides for the selection of cleanup actions that protect human health and the environment.
- Whether the option provides for developing scientifically and legally defensible cleanup standards.
- Whether the option provides consistent standards and methodologies for assessing and managing risk.
- Whether the option provides flexibility to address site-specific factors.
- Whether the option promotes efficient and cost-effective cleanup of contaminated sites.
- Whether the option provides enhanced opportunities for public involvement.
- Whether the option improves the clarity and usability of the rule.
- Whether the option complies with key requirements of the Administrative Procedures Act.

Sediment Management Standards Issue Papers Glossary

Area background – means the concentration of hazardous substances that are consistently present in the environment in the vicinity of a site which are the result of human activities unrelated to releases from that site. *WAC 173-340-200*

Bioaccumulation - increase in concentration of a pollutant from the environment to the first organism in a food chain.

Biomagnification - increase in concentration of a pollutant from one link in a food chain to another.

Biological Criteria - SMS definition **–** means biological tests that are used to confirm if sediments have violated the sediment quality standards. These biological tests may override the results of chemical tests. For example, if chemical tests show violations but biological tests for the same sample pass the criteria, then the sediments are considered clean. *WAC 173-204-315.*

BSAF – Biota to Sediment Accumulation Factor – estimate of how a particular chemical will biomagnify in the food chain. BSAF is calculated as a ratio of contaminant concentration in the tissue of biota to the contaminant concentration in the sediment. Sediment locations should reflect the home range of the biota being measured.

Carcinogen – means any substance or agent that produces or tends to produce cancer in humans. For implantation of this chapter (MTCA), the term carcinogen applies to substances on the United States Environmental Protection Agency lists of A (known human) and B (probably human) carcinogens, and any substance that causes a significant increased incidence of benign or malignant tumors in a single, well conducted animal bioassay, consistent with the weight of evidence approach specified in the United States Environmental Protection Agency's Guidelines for Carcinogenic Risk Assessment as set forth in 51 FR 33992 et seq. *WAC 173-340-200*

Cleanup – means implementation of a cleanup action or interim action. *WAC 173-340-200*

Cleanup action – means any remedial action, except interim actions, taken at a site to eliminate, render less toxic, stabilize, contain, immobilize, isolate, treat, destroy, or remove a hazardous substance that complies with WAC 173-340-350 through 173-340-390. *WAC 173-340-200*

Cleanup level (MTCA rule definition) – means the concentration of a hazardous substance in soil, water, air, or sediment that is determined to be protective of human health and the environment under specified exposure conditions. *WAC 173-340-200*

Cleanup standards (MTCA rule definition) – means the standards adopted under RCW 70.105D.030 (2)(d). Establishing cleanup standards requires specification of the following:

- Hazardous substance concentrations that protect human health and the environment (cleanup levels).

- The location on the site where those cleanup levels must be attained (points of compliance); and
- Additional regulatory requirements that apply to a cleanup action because of the type of action and/or the location of the site. These requirements are specified in applicable state and federal laws and are generally established in conjunction with the selection of a specific cleanup action. *WAC 173-340-200*

CSL – Cleanup Screening Level – SMS definition – means the maximum level of sediment contamination (determined by either chemical or biological criteria) allowed and used to identify sediment cleanup sites or impaired sediments. This is the level above which minor adverse effects to the benthic community are expected. *WAC 173-204-520.*

Degradation by-products – means chemicals or conditions produced from the degradation of waste material in the aquatic environment. For example, the breakdown of wood waste in the aquatic environment can produce ammonia and sulfides. These chemicals can be toxic to aquatic life if produced in high enough concentrations.

Dermal contact – The exposure of skin to toxic chemicals.

Exposure – means subjection of an organism to the action, influence, or effect of a hazardous substance (chemical agent) or physical agent. *WAC 173-340-200*

Exposure pathway – means the path a hazardous substance takes or could take from a source to an exposed organism. An exposure pathway describes the mechanism by which an individual or population is exposed or has the potential to be exposed to hazardous substances at or originating from a site. Each exposure pathway includes an actual or potential source or release from a source, an exposure point, and an exposure route. If the exposure point differs from the source of the hazardous substance, the exposure pathway also includes a transport / exposure medium. *WAC 173-340-200*

Food ingestion exposure pathway – exposure to contaminants by ingestion of contaminated food or water. For example, eating fish with toxic contaminants.

HQ or Hazard quotient - means the ratio of the dose of a single hazardous substance over a specified time period to a reference dose for that hazardous substance derived for a similar exposure period**.** *WAC 173-340-200*

Incidental Ingestion –ingestion exposure by accidental ingestion and incidental residues of soil and sediment. For example, hand to mouth behavior of small children that result in accidental ingestion of soil.

Interim action – means a remedial action conducted under WAC 173-340-430.

MCUL – Minimum Cleanup Level - SMS definition – means the maximum allowed chemical concentration and biological effects level to be achieved at all cleanup sites. *WAC 173-204-570*

MDL – Method Detection Limit – means the minimum concentration of a compound that can be measured and reported with 99% confidence that the values is greater than zero.

MTCA act – Model Toxics Control Act – means chapter 70.105D RCW, first passed by the voters in the November 1988 general election as Initiative 97 and since adopted by the legislature.

Narrative Criteria – SMS definition – means criteria that is not defined numerically such as the SMS chemical or biological criteria.

Natural background - means the concentration of hazardous substance consistently present in the environment that has not been influenced by localized human activities. For example, several metals and radionulcides naturally occur in the bedrock, sediments, and soils of Washington state due solely to the geologic processes that formed these materials and the concentration of these hazardous substances would be considered natural background. Also, low concentrations of some particularly persistent organic compounds such as polychlorinated biphenyls PCBs) can be found in the surficial soils and sediment throughout much of the state due to global distribution of these hazardous substances. These low concentrations would be considered natural background. Similarly, concentrations of various radio nuclides that are present at low concentrations throughout the state due to global distribution of fallout from bomb testing and nuclear accidents would be considered natural background. 173-340-200.

Other Toxic, …, Deleterious Substances – SMS definition - means contaminants which are not identified in the sediment quality standards chemical criteria of WAC 173-204-320 through – 340. *WAC173-204-200, 173-204-310(3).*

Nonanthropogenic background –SMS definition –means that whenever "Nonanthropogenically affected" sediment quality is of lower quality (higher than the chemical or biological criteria) than the SMS criteria, the chemical and biological sediment quality is determined on an area-wide basis and used in place of the sediment quality standards. *WAC 173-204-330.*

Numeric criteria – The SMS has numeric chemical criteria that list maximum chemical concentrations allowed in sediment for marine waters of Puget Sound. Although thousands of chemicals exist, the SMS has numeric criteria for 47 chemicals. WAC 173-204-320, WAC 173-204-420, WAC 173-204-520.

PLP – Potentially liable parties – means any person who the department finds, based on credible evidence, to be liable under TCW 70.105D.040. *WAC 173-340-200*

Practicable – means capable of being designed, constructed and implemented in a reliable and effective manner including consideration of cost. When considering cost under this analysis, an alternative shall not be considered practicable if the incremental costs of the alternative are

disproportionate to the incremental degree of benefits provided by the alternative over other lower cost alternatives. *WAC 173-340-200* **OR** – means able to be completed in consideration of environmental effects, technical feasibility and cost. *WAC 173-204-200 (19).*

PQL - Practical quantitation limit – means the lowest concentration that can be reliably measured within specified limits of precisions, accuracy, representativeness, completeness, and comparability during routine laboratory operation conditions, using department approved methods. *WAC 173-340-200*

Reasonable maximum exposure – means the highest exposure that can be reasonably expected to occur for a human or other living organisms at a site under current and potential future use. *WAC 173-340-200*

Remedy selection – process for selecting cleanup actions – described in MTCA Rule WAC 173-340-360 and SMS Rule WAC 173-204-580.

Remedial action or remedy – means any action or expenditure consistent with the purposed of chapter 70.105D RCW to indentify, eliminate, or minimize any threat posed by hazardous substances to human health or the environment including any investigative and monitoring activities with respect to any release or threatened release of a hazardous substance and any health assessments or health effects studies conducted in order to determine the risk or potential risk to human health.

Risk - means the probability that a hazardous substance, when released into the environment will cause an adverse effect in exposed humans or other living organisms.

Sediment cleanup standard –SMS definition – The sediment cleanup standards are established on a site-specific basis within an allowable range of contamination. The lower end of the range is the sediment cleanup objective as defined in 173-204-570 (2). The upper end of the range is the minimum cleanup level as defined in 173-204-570 (3). The site specific cleanup standards shall be as close as practicable to the cleanup objective but in no case shall exceed the minimum cleanup level. For any given cleanup action, either a site-specific sediment cleanup standard shall be defined, or multiple site unit sediment cleanup standards shall be defined. In all cases, the cleanup standards shall be defined in consideration of the net environmental effects (including the potential for natural recovery of the sediment over time), cost and engineering feasibility of different cleanup alternatives, as determined through he cleanup study plan and report standards of WAC 173-204-560. *WAC 173-204-570 (4)*

Sediment Impact Zone – SIZ - SMS definition – means an area where the sediment quality standards of WAC 173-204-320 through – 340 are violated due to ongoing authorized wastewater, storm water, or nonpoint source discharges. These discharges are authorized by the department through a federal or state wastewater or storm water discharge permit. *WAC 173-204-400 through 420.*

Sediment Management Standards - SMS definition -– WAC 173-204 Regulations promulgated under the Model Toxics Control Act chapter 70.105D RCW, the Water Pollution Control Act chapter 90.48 RCW. The purpose of the Sediment Management Standards is to reduce and ultimately eliminate adverse effects on biological resources and significant health threats to humans from surface sediment contamination by: (a) Establishing standards for the quality of surface sediments; (b) applying these standards as the basis for management and reduction of pollutant discharges; and (c) providing a management and decision process for the cleanup of contaminated sediments. *WAC 173-204-100(2)*

Sediment Quality Standards - SQS – SMS definition - Sediment Quality Standard of the SMS provide chemical concentration criteria, biological effects criteria, human health criteria, and other toxic, radioactive, biological, or deleterious substances criteria which identify surface sediment that have **no adverse effects**, including no acute or chronic adverse effects on biological resources and no significant health risk to humans, as defined in this regulation. The sediment quality standards provide a regulatory and management goal for the quality of sediments throughout the state.

Water Pollution Control Act - WPCA – means the act that the Sediment Management Standards were promulgated under and provides the state with the regulatory authority to protect waters of the state. *RCW 90.48.*