DEPARTMENT OF
ECOLOGY
State of Washington

Draft Revisions
MTCA Method A Groundwater Cleanup Levels

Discussion Materials
Prepared for the MTCA/SMS Advisory Group
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1. Summary

Ecology developed the initial Model Toxics Control Act (MTCA) Method A ground water cleanup levels when the initial cleanup standards were published in 1991. Ecology reviewed the Method A cleanup levels during the 2001 rule revision process and made several revisions to incorporate new scientific and regulatory information.

Since the 2001 rule revisions, there have been numerous scientific and regulatory developments applicable to one or more of the hazardous substances in the Method A tables. Based on a review of that information, Ecology has reached several initial conclusions:

- Many of the current Method A cleanup levels do not need to be revised based on a review of new scientific and regulatory information.
- Several of the current Method A ground water cleanup levels need to be updated based a review of new scientific and regulatory information. Ecology is seeking feedback on several potential revisions. These include:
  - Ecology is considering whether to raise the Method A value for arsenic from 5 ug/L to 10 ug/L based on a review of background ground water concentrations.
  - Ecology believes the Method A value for benzo[a]pyrene should be lowered from 0.1 ug/L to 0.02 ug/L based on the application of EPA's methods and policies for early life stage adjustments and consideration of analytical feasibility.
  - Ecology believes that the Method A value for total chromium (50 ug/L) should be replaced by separate values for chromium III and chromium VI. Ecology believes that the Method A value for chromium III value should be 100 ug/L. This is the current state and federal drinking water standard for total chromium. The chromium VI value should be updated based on new scientific information. However, there are several scientific and implementation issues that need to be evaluated before deciding whether and how to revise the rule. It is also unclear how often chromium VI is an issue at Washington cleanup sites.
  - Ecology believes that the Method A value for ethylene dibromide (EDB) should be increased from 0.01 ug/L to 0.05 ug/L based on the updated oral cancer slope factor published in the IRIS database.
  - Ecology is still reviewing the MTCA/SMS Advisory Group comments on need for revisions to the Method A ground water value for lead. That review is being done concurrently with the evaluation of changes to the Method A soil cleanup level. The results of that review will be presented to the advisory group in separate materials.
  - Ecology believes that the Method A cleanup level for naphthalene should be updated based on new scientific information. However, Ecology understands rule revisions could have significant impacts on cleanup actions in Washington. Consequently, there are several scientific and implementation issues that need to be evaluated before deciding whether and how to revise the rule.
  - Ecology is considering what changes to make to the Method A ground water cleanup level for PAH mixtures. Specifically, Ecology is considering whether the 0.04 ug/L cleanup level for BaP should be applied to individual PAH compounds or to mixture of multiple carcinogenic PAH compounds.

Glossary of Acronyms Used in This Document

ATSDR	Agency for Toxics Substances and Disease Registry
CalEPA	California Environmental Protection Agency
BaP	Benzo[a]pyrene
BLL	Blood Lead Level
CLARC	Cleanup Levels and Risk Calculations
CPF	Cancer Potency Factor (Cancer Slope Factor)
CPAH	Carcinogenic Polycyclic Aromatic Hydrocarbons
DOH	Washington Department of Health
DWEL	Drinking Water Equivalent Level
EDB	Ethylene dibromide
EDC	1,2-Dichloroethane
EPA	U.S. Environmental Protection Agency
HEAST	Health Effects Assessment Summary Tables
IARC	International Agency for Research on Cancer
INH	Inhalation Correction Factor
IRIS	Integrated Risk Information System
IUR	Inhalation Unit Risk
LCR	Lead and Copper Rule
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MRL	Minimal Risk Level
MTCA	Model Toxics Control Act
NJDEP	New Jersey Department of Environmental Protection

NPDWR	National Primary Drinking Water Standard
NTP	National Toxicology Program
OEHHA	Office of Environmental Health Hazard Assessment
ORNL	Oak Ridge National Laboratory
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PCE	Perchloroethylene/Tetrachloroethylene
PHG	California Public Health Goal for Drinking Water
PPRTV	Provisional Peer-Reviewed Toxicity Values
PQL	Practical Quantitation Limit
RAGS	Risk Assessment Guidance for Superfund
RfC	Reference Concentration
RfDi	Reference Dose (inhalation pathway)
RME	Reasonable Maximum Exposure
RPF	Relative Potency Factor
RSC	Relative Source Contribution
SAB	Model Toxics Control Act Science Advisory Board
SDWA	Safe Drinking Water Act
SMS	Sediment Management Standards (Chapter 173-204 WAC)
TCE	Trichloroethylene
TSCA	Toxic Substances Control Act
VAF	Vapor Attenuation Factor
VF	Volatilization Factor
WHO	World Health Organization

2. Introduction

Purpose of the Discussion Materials

Ecology completed a preliminary review of the Method A ground water and soil cleanup levels in March 2010. Ecology provided the document to the MTCA/SMS Advisory Group for review. The advisory group provided verbal and written comments. Since the March advisory group meeting, Ecology has reviewed those comments and evaluated additional information. The purpose of this document is two-fold:

- Promote continued review and discussion of potential revisions to the current Method A ground water cleanup levels
- Identify implementation issues that Ecology should consider when preparing the Environmental Impact Statement and economic analyses for the rule revisions.

Regulatory Question

Ecology developed the MTCA Method A ground water and soil cleanup levels when the initial cleanup standards were published in 1991. Ecology reviewed the Method A values during the 2001 rule revision process and made several revisions based on new scientific and regulatory information.

Since the 2001 rule revisions, there have been numerous scientific and regulatory developments applicable to one or more of the substances included in the Method A tables. Ecology is now evaluating this information to help answer the following regulatory question:

What changes do we need to make to the MTCA cleanup standards, given:

- *New toxicological values published since the 2001 rule amendments*
- *New state and federal standards published since the 2001 rule amendments (e.g., new drinking water standards)*
- *New EPA guidance on risk assessment issues (e.g., March 2005 cancer guidelines)*
- *Updated information on analytical limits and/or background levels*
- *New information on cross-media transfer (e.g., vapor intrusion).*

Overview of MTCA Cleanup Standards

Under the current MTCA rules, there are three methods (Methods A, B and C) for establishing cleanup levels.

- *Method A* can be used to establish cleanup levels at relatively small sites that involve few contaminants. Ecology used the Method B policies and equations to develop the Method A levels.
- *Method B* can be used to establish cleanup levels at any site. Method B includes a series of policies and risk equations for establishing site cleanup levels.
- *Method C* can be used to establish cleanup levels in limited situations—typically for soil cleanup levels for industrial land uses. Method C includes a series of policies and risk equations for establishing site cleanup levels in limited situations.

3. Summary of Draft Revisions to Method A Ground Water Cleanup Levels

Key Requirements for MTCA Cleanup Levels (Potable Ground Water)

WAC 173-340-720 establishes the methods and policies for establishing ground water cleanup levels. Ecology has used these methods and policies to establish the Method A ground water cleanup levels in the current rule. Ground water cleanup levels for potable ground water must meet the following requirements:

- Applicable State and Federal Laws. Ground water cleanup levels must be at least as stringent as the Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs) for non-carcinogens included in the state and federal drinking water regulations. The MTCA rule requires downward adjustment of these concentrations if they correspond to a hazard quotient greater than one (1) or an excess cancer risk greater than one-in-one hundred thousand (1×10^{-5}).
- Human Health Protection. Ground water cleanup levels must generally[1] be at least as stringent as the risk-based concentrations calculated using the equations and parameters specified in the MTCA rule (Equations 720-1 and 720-2). For non-carcinogenic health risks, cleanup levels are based on a hazard quotient of 1. For known or suspected carcinogens, cleanup levels are based on an excess cancer risk of one in one million (1×10^{-6}).
- Protection of Other Environmental Media. Ground water cleanup levels must be established at concentrations that prevent violations of surface water, sediments, soil, or air cleanup standards.
- Analytical Considerations. The MTCA rule specifies that the ground water cleanup levels must not be set at concentrations below the practical quantitation limit (PQL).
- Natural Background Concentrations. The MTCA rule specifies that ground water cleanup levels must not be set at levels below natural background concentrations.

Under Method B and C, the MTCA rule also specifies that the total site risk for carcinogens cannot exceed one-in-one hundred thousand (10^{-5}). Non-cancer total site risk cannot exceed a hazard quotient of one. The MTCA rule requires that the cleanup levels established for individual substances be adjusted downward if the total site risk exceeds either of these limits. Total site risk includes consideration of multiple hazardous substances and multiple pathways of exposure. The total site risk provision does not apply to Method A.

[1] Cleanup levels are based on applicable state and federal laws when those requirements are sufficiently protective (i.e., hazard quotient less than one (1) or an excess cancer risk less than one-in-one hundred thousand (1×10^{-5}).

Review Process

1. Toxicological Information. Ecology reviewed the Integrated Risk Information System (IRIS) database and information compiled by the Oakridge National Laboratory and the Environmental Protection Agency. Ecology used these sources to identify cancer slope factors and reference doses that had been developed or updated since the 2001 rule revisions.

    - Regional Screening Levels for Chemical Contaminants at Superfund Sites. December 2009. http://www.epa.gov/reg3hscd/risk/human/rb-concentration_table/index.htm
    - Integrated Risk Information System. December 2009. http://www.epa.gov/iris/

2. Applicable State and Federal Laws. Ecology reviewed the current state (WAC 246-290-310) and federal (40 C.F.R. 141.61) drinking water standards. Ecology used this information to identify maximum contaminant levels (MCLs) or maximum contaminant levels goals (MCLGs) that have been developed since the 2001 rule revisions.

3. Vapor Intrusion Pathway. Ecology reviewed the ground water vapor intrusion screening levels included in the draft Ecology guidance for public review during 2009.[2] Ecology used this information to identify substances that may pose a vapor intrusion risk at ground water concentrations below the cleanup levels that are based on the drinking water pathway.

4. Analytical Limits. For purposes of this evaluation, Ecology considered analytical information compiled by EPA during their review of the federal drinking water standards,[3] information compiled by the New Jersey Department of Environmental Protection when they revised the state's ground water standards[4] and practical quantitation limits compiled when preparing the 2001 rule revisions.[5]

5. Initial Evaluation. Ecology used the information described above to recalculate the cleanup levels based on the drinking water exposure pathway. This provided the basis for making an initial determination on whether revisions to particular Method A levels might be necessary.

6. MTCA/SMS Advisory Group Review: Ecology provided the document to the MTCA/SMS Advisory Group for review and discussion. Advisory group members have provided verbal and written comments on many issues relevant to updating the Method A ground water cleanup levels. Ecology has reviewed and considered those

[2] Draft Guidance for Evaluating Vapor Intrusion at Washington Sites: Investigations and Remedial Actions. (October 2009) http://www.ecy.wa.gov/programs/tcp/policies/VaporIntrusion/vig.html

[3] Environmental Protection Agency. 2010. National Primary Drinking Water Regulations; Announcement of the Results of EPA's Review of Existing Drinking Water Standards and Request for Public Comment and/or Information on Related Issues. 75 FR 15500.

[4] New Jersey Department of Environmental Protection. 2009. Ground Water Quality Standards. NJAC 7:9C. Amended November 4, 2009. See Appendix Table 1 – Specific Ground Water Quality Criteria.

[5] Concise Explanatory Statement for 2001 Rule Amendments. Appendix D. Calculations for Method A Cleanup Levels. http://www.ecy.wa.gov/programs/tcp/regs/Appendix_D.pdf

comments when preparing this document. Ecology has included excerpts from some of those comments in this document.

7. Further Evaluation: Since the March advisory group meeting, Ecology reviewed advisory group comments and performed additional evaluations.

Summary of Evaluation Results

Table 720-1 includes Method A ground water cleanup levels for 27 substances and 5 petroleum mixtures. The results of the Ecology review are summarized in the Table below. The rationale for conclusions on cleanup levels for individual hazardous substances or mixtures are summarized in the following pages. Shaded boxes indicate potential changes.

Summary of Draft Revisions to Method A Ground Water Cleanup Levels (ug/L unless otherwise specified)

Substance	CAS #	Current Value	Draft Value	Comments
Arsenic	7440-38-2	5	**??**	Ongoing review of GW data.
Benzene	71-43-2	5	5	No change. Based on MCL.
Benzo[a]pyrene	50-32-8	0.1	**0.02**	Revision based on early life stage policy/PQL
Cadmium	7440-43-9	5	5	No change. Based on MCL.
Chromium (total)	7440-47-3	50	**Remove**	
Chromium III		50	**100**	Revision to clarify rule. Based on MCL.
Chromium VI		50	**??**	Revision based on cancer risks.
DDT	50-29-3	0.3	0.3	No change. Based on Equation 720-2.
1,2-Dichloroethane	107-06-2	5	5	No change. Based on MCL
Ethylbenzene	100-41-4	700	700	No change. Based on MCL.
Ethylene dibromide	106-93-4	0.01	**0.05**	Revision based on new toxicity information.
Gross Alpha Particle Activity		15 pCi/L	15 pCi/L	No change. Based on MCL.
Gross Beta Particle Activity		4 mrem/y	4 mrem/y	No change. Based on MCL.
Lead	7439-92-1	15	**??**	Reviewing Advisory Group comments.
Lindane	58-89-9	0.2	0.2	No change. Based on MCL.
Mercury	7439-97-6	2	2	No change. Based on MCL.
Methylene chloride	75-09-2	5	5	No change. Based on MCL.
MTBE	1634-04-4	20	20	No change. Based on federal advisory.
Naphthalenes	91-20-3	160	**??**	Evaluation in Progress.
PAHs (carcinogenic)		0.1 TEQ	**??**	Revision to PAH mixture policy?
PCB Mixtures		0.1	0.1	No change. Based on adjusted MCL.
Radium 226 & 228		5 pCi/L	5 pCi/L	No change. Based on MCL.
Radium 226		3 pCi/L	3 pCi/L	No change. Based on MCL.
Tetrachloroethylene	127-18-4	5	5	No change. Based on MCL.
Toluene	108-88-3	1000	1000	No change. Based on MCL.
TPH – Gasoline/Benzene		800	?	Evaluation in Progress.
TPH – Gasoline/No Benzene		1000	?	Evaluation in Progress.
TPH - Diesel		500	?	Evaluation in Progress.
TPH – Heavy Oils		500	?	Evaluation in Progress.
TPH – Mineral Oils		500	?	Evaluation in Progress.
1,1,1-Trichloroethane	71-55-6	200	200	No change. Based on MCL.
Trichloroethylene	79-01-6	5	5	No change. Based on MCL.
Vinyl chloride	75-01-4	0.2	0.2	No change. Based on adjusted MCL.
Xylenes	1330-20-7	1000	1000	No change. Based on TPH/aesthetics.

4. Arsenic

Background

Ecology developed the current MTCA Method A ground water cleanup level for arsenic (5 ug/L) when the initial cleanup standards were published in 1991. The Method A value was based on the background concentrations of arsenic that were reported in PTI (1989).

Ecology reviewed the Method A value during the 2001 rule revision process and elected not to revise it after reviewing more recent information on background concentrations of arsenic in ground water.

There have been several scientific and regulatory developments since the 2001 rule revisions. These include the following:

- State and Federal Drinking Water Standard for Arsenic. EPA published a new drinking water standard (10 ug/L) for arsenic in January 2001.[6] The Washington Department of Health (DOH) has also updated the state drinking water standards.
- Cancer Slope Factors Developed Prior to 2010. EPA has published an oral slope factor (1.5 mg/kg/day $^{-1}$) in the Integrated Risk Information System (IRIS) database. The value in the IRIS database is based on a study where increased rates of skin cancer were observed among residents in villages in southwestern Taiwan where drinking water wells had elevated levels of arsenic. Since the 2001 rule revisions, several agencies and scientific panels have developed a range of cancer slope factors or unit risk values based on other cancer endpoints (e.g. lung, bladder and liver).[7]
- EPA Six Year Review of Drinking Water Standards. EPA completed a review of the federal drinking water standards in March 2010. With respect to the federal standard for arsenic, EPA concluded "…[t]he Agency does not believe a revision to the NPDWR for arsenic is appropriate at this time because a reassessment of the health risks resulting from exposure to arsenic is ongoing (USEPA, 2009b). As noted previously, the arsenic MCL is based on the SDWA cost benefit provision (Section

[6] 66 FR 6976. In January 2001, EPA established a MCLG of zero based on a cancer classification of arsenic as a known human carcinogen. EPA established an MCL of 10 ug/L which was higher than the feasible analytical limit (3 ug/L). EPA concluded that 10 ug/L was the level that maximized health risk reductions at cost that is justified by the benefits.

[7] California Environmental Protection Agency. 2004. Public Health Goals for Arsenic in Drinking Water. Prepared by the Office of Environmental Health Hazard Assessment (April 2004). National Research Council. 2001. Arsenic in Drinking Water: 2001 Update. National Academy Press. Washington DC; National Research Council. 1999. Arsenic in Drinking Water. National Academy Press. Washington DC. Environmental Protection Agency. 2001a. National Primary Drinking Water Regulations; Arsenic and Clarifications to Compliance and New Source Contaminants Monitoring; Final Rule. Prepublication version signed by the EPA Administrator on January 16, 2001.; Environmental Protection Agency. 2003a. A Probabilistic Risk Assessment for Children Who Contact CCA-Treated Playsets and Decks. Draft Preliminary Report. (November 10, 2003).

1412(b)(6)) and the health effects assessment is important for reviewing the benefits associated with the basis of the MCL…"[8]

- EPA Toxicological Assessment. In March 2010, EPA distributed a draft toxicological review for inorganic arsenic.[9] The draft review includes updated oral cancer slope factors based on combined lung plus bladder cancer risks. EPA proposed cancer slope factors for combined cancer incidence for females (25.7 $(mg/kg/day)^{-1}$) and males (16.9 $(mg/kg/day)^{-1}$). EPA recommended that the cancer slope factor for women be used when deriving health criteria.[10] The draft report is currently undergoing external peer review.
- Ground Water Monitoring Results. More recent sampling data indicates natural background levels in Washington are generally higher than 5 ug/L (see discussion below).

MTCA Rulemaking Options

Ecology has reviewed the new scientific and regulatory information relevant to updating the MTCA cleanup level for arsenic. Based on that review, Ecology has considered two main options for revising the Method A ground water cleanup level for arsenic:

1. No Revision. Under this option, the Method A ground water cleanup level would remain 5 ug/L.
2. Revisions Based on Reanalysis of Statewide Ground Water Data. Under this option, Ecology would revise the Method A ground water cleanup level to 10 ug/L.

Draft Revisions and Rationale

Current ground water monitoring data indicate that natural background levels can be higher than 5 ug/L (the current Method A ground water cleanup level). Ecology believes that there is some justification for raising the Method A cleanup level to 10 ug/L. This revision could be justified based on three lines of reasoning:

- A revised Method A cleanup level of 10 ug/L would be equal to the state and federal drinking water standard for arsenic. EPA published a new drinking water standard (10 ug/L) for arsenic in January 2001. The Washington Department of Health (DOH) has also updated the state drinking water standards.
- A revised Method A cleanup level of 10 ug/L is consistent with Ecology's analysis of statewide ground water monitoring data in Washington. Ecology is evaluating

[8] EPA. 2010. National Primary Drinking Water Regulations; Announcement of the Results of EPA's Review of Existing Drinking Water Standards and Request for Public Comment and/or Information on Related Issues. 75 FR 15500 at 15526.

[9] EPA. 2010. Toxicological Review of Inorganic Arsenic (CAS No.) In Support of Summary Information on the Integrated Risk Information System (IRIS). National Center for Environmental Assessment, Office of Research and Development, U.S. Environmental Protection Agency. Washington DC.

[10] EPA (2010) concluded that "…insufficient data are available to adequately demonstrate a mutagenic mode of action for inorganic arsenic. Therefore, the application of age-dependent adjustment factors is not recommended…" (p. 149)

information on ambient (background) ground water arsenic here in the State of Washington to determine whether there is a technical basis for revising the current Method A ground water cleanup level. Arsenic sampling data were obtained from the Washington Department of Health (DOH) Drinking Water Program This included ground water data (18,238 sample results) from 6,776 drinking water wells (depths 10-2,200 ft.) that were collected over a ten year period (2000-10). Of the 18,238 data records, 7,491(41%) were above laboratory detection limits, which varied from 0.5 – 100 ppb (10,747 non-detects or 59%). Ecology's used the "MTCAStat" statistical software to estimate background arsenic concentrations using the procedures specified in WAC 173-340-709. Non-detect values were assigned a value of ½ the laboratory reporting limit. Key results include:

- On a statewide basis, Ecology estimated that 10.7 ug/L represents the 90th percentile of the sampling distribution (assuming that the data are lognormally distributed). See table below with for further details.
- On a statewide basis, arsenic concentrations ranged from 0.2 ug/L – 310 ug/L with an arithmetic mean of 6.1 ug/L (median = 3 ug/L).
- Overall, arsenic concentrations in western Washington (range = 0.3 ug/L to 310 ug/L with an arithmetic mean of 6.59 ug/L) were higher than eastern Washington (range = 0.2 ug/L – 100 ug/L with an arithmetic mean of 4.99 ug/L).
- High arsenic concentrations (> 25 ug/L) were detected in 12 western WA counties (Clark, Cowlitz, Island, Jefferson, King, Lewis, Mason, Skagit, Skamania, Snohomish, Thurston and Whatcom). High arsenic concentrations (> 25 ug/L) were also detected in 7 eastern WA counties (Chelan, Grant, Kittitas, Lincoln, Stevens, Walla Walla and Yakima).

- A revised Method A cleanup level of 10 ug/l would be consistent with ground water cleanup levels established by other states. The current Method A cleanup level falls within the range of standards and guidelines used by other states to support cleanup decisions (See Table 1). The majority of states surveyed by Ecology currently use the federal drinking water standard to establish ground water cleanup levels.

Background (MTCAStat) Calculation Statistical Results – Ground Water Arsenic (2000-2010)	
Variable	Result
Number of Samples	18,238
Number of Detects	7,491
Min Detect Value	0.2
Min Non-Detect Value	0.5
Max Detect Value	310
Max Non-Detect Value	100
Min Criteria Value	1
Max Detect Exceedance	310
Max Non-Detect Exceedance	100
Freq of Detection	0.41
Freq of Detect Exceedance	0.40
Freq of Non-Detect Exceedance	0.58
Potential HIS	Evaluate
Mean	9.1
Median	5.0
Mode	3.0
Std.Dev.	16.7
Variance	280
Coeff. of Var	185
Skewness	9.2
Kurtosis	106
NormalR2	0.4
LogNormalR2	0.9
Test	D'Agostino
Test Value LN	1,774
UCL Method	Lognormal
UCL Value	9,089
ANOVA P Value	0
90^{th} Percentile Value	**10.7**
50Percentile	2.5
4X50Percentile	9.9
CVBckGnd	1.6

The rationale for maintaining the current Method A value includes the following:

- Revising the Method A cleanup level would be inconsistent with the current scientific information that indicates that the risks associated with arsenic exposure are much than previous estimates. As noted above, EPA recently completed a draft toxicological review for inorganic arsenic. The draft review includes updated oral cancer slope factors that are much higher than the current IRIS cancer slope factor (1.5 $(mg/kg/day)^{-1}$). The proposed cancer slope factors for combined cancer incidence are 25.7 $(mg/kg/day)^{-1}$ for females and 16.9 $(mg/kg/day)^{-1}$) for males.
- The revised EPA health assessment could significantly alter the cost-benefit analysis that was used to justify the revised federal drinking water standard of 10 ug/L. In 2001, EPA established an MCL of 10 ug/L because EPA concluded that 10 ug/L was the level that maximized health risk reductions at a cost that is justified by the benefits. EPA has noted that the health effects assessment is important for reviewing the benefits associated with the current drinking water standard The implications of the health effects assessment can be illustrated by reviewing the cost-benefit analysis (CBA) results supporting EPA's 2001 conclusion.[11] The CBA results are summarized in the table below. The benefit estimates are primarily based on the number of cancer cases avoided which were estimated using a cancer slope factor of 3.7 $mg/kg/day)^{-1}$. This cancer slope factor is 5-7 times lower than EPA's proposed cancer slope factors. In the 2001 analysis, benefits were lower than costs at the 3 ug/L and 5 ug/L levels. This is shown in the columns titled "2001" below. However, benefits would be much higher using the proposed cancer slope factors included in the 2010 EPA health assessment. Using a benefit multiplier of 5, the benefits of arsenic reductions greatly exceed costs at both 3 ug/L and 5 ug/L. This is shown in the columns titled "2010" below. Consequently, it might be premature to raise the MTCA cleanup standard because future cost/benefit analyses could support a drinking water standard that is similar to the current Method A cleanup level.

Comparison of Costs and Benefits of Revised Arsenic Standard With 7% Discount Rate ($ millions)

(Adapted from Exhibit 7-2 in Arsenic in Drinking Water Rule Economic Analysis)

	Alternative Arsenic Drinking Water Standards							
	3 ug/L		5 ug/L		10 ug/L		20 ug/L	
	2001	2010	2001	2010	2001	2010	2001	2010
Costs	$792	$792	$472	$472	$206	$206	$76	$76
Benefits (upper)	$491	$2455	$356	$1780	$198	$990	$75	$375
Benefit/Cost	0.6	3.0	0.8	4	1	5	1	5
Benefits (lower)	$214	$1070	$191	$955	$140	$700	$66	$330
Benefit/Cost	0.3	1.5	0.4	2	0.7	3.5	0.9	4.5

[11] EPA. 2000. Arsenic in Drinking Water Rule Economic Analysis. Prepared by Abt Associates for the EPA Office of Ground Water and Drinking Water. EPA 815-R-00-026. December 2000.

5. Benzene

Background

Ecology developed the current MTCA Method A ground water cleanup level for benzene (5 ug/L) when the initial cleanup standards were published in 1991. The Method A cleanup level is based on applicable state and federal law (WAC 246-290-310 and 40 C.F.R. 141.61).[12]

Ecology reviewed the Method A value during the 2001 rule revision process, but elected not to revise it. Information available at that time indicated the Method A value was sufficiently protective.

There have been several scientific and regulatory developments since the 2001 rule revisions. These include the following:

- IRIS Cancer Slope Factor. EPA revised the cancer slope factor in the IRIS database in late 2000 after Ecology had published the proposed MTCA rule amendments.
- IRIS Reference Dose. EPA updated the IRIS oral reference dose for benzene in 2003. A Method B ground water cleanup of 32 ug/L can be calculated using the IRIS reference dose (0.004 mg/kg/day)[13] and Equation 720-1.
- ATSDR Chronic Minimum Risk Level (MRL). ATSDR published a new chronic MRL for benzene in 2007.[14] The revised MRL (0.0005 mg/kg/day) is lower than the current IRIS reference dose. A Method B ground water cleanup of 4 ug/L can be calculated using the ATSDR revised MRL and Equation 720-1.
- Draft Ecology Vapor Intrusion Guidance. Ecology published a draft vapor intrusion guidance document for public review and comment in late 2009.[15] The draft guidance document included ground water screening levels based on preventing the accumulation of hazardous substances in buildings located near contaminated groundwater.
- EPA Six Year Review of Drinking Water Standards. EPA completed a review of the federal drinking water standards in March 2010. With respect to the federal standard for benzene, EPA concluded "…[a]lthough there are new data that support

[12] EPA published the current drinking water standard for benzene in 1987 (52 FR 25690). EPA established a MCLG of zero based on benzene's classification as a known human carcinogen. The Maximum Contaminant Limit (MCL) of 5 ug/L based on analytical feasibility.

[13] EPA. 2002. Toxicological Review of Benzene (Noncancer Effects) (CAS No. 71-43-2) In Support of Summary Information on the Integrated Risk Information System (IRIS). National Center for Environmental Assessment, Office of Research and Development, U.S. Environmental Protection Agency. Washington DC.

[14] ATSDR. 2007. Toxicological Profile for Benzene. ATSDR, Public Health Service, U.S. Department of Health and Human Services. Atlanta, GA.

[15] Department of Ecology. 2009. Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action (Draft). Washington State Department of Ecology, Toxics Cleanup Program.

consideration of a possibly lower PQL (and therefore a possibly lower MCL), EPA does not believe a revision to the NPDWR for benzene is appropriate at this time…"[16]

MTCA Rulemaking Options

Ecology has reviewed the new scientific and regulatory information relevant to updating the MTCA cleanup level for benzene. Based on that review, Ecology has considered two main options for revising the Method A ground water cleanup level for benzene:

1. No Revision. Under this option, the Method A ground water cleanup level would remain 5 ug/L.
2. Revisions Based on New Toxicity and Analytical Information. Under this option, Ecology would revise the Method A ground water cleanup level to 1 ug/L.

Draft Revisions and Rationale

Ecology does not plan to revise the Method A value for benzene. Ecology's rationale for maintaining the current Method A value includes the following:

- The current Method A cleanup level remains sufficiently protective and consistent with current scientific information on health risks resulting from benzene exposure. EPA revised the cancer slope factor for benzene in 2000. The ground water cleanup level calculated using Equation 720-2 and the updated slope factor (0.8 ug/L) is lower than the cleanup level (1.5 ug/L) calculated using the previous cancer slope factor. However, the MTCA cleanup level will continue to be based on the state and federal drinking water standard (5 ug/L) since the risk-based value falls below a 10^{-5} risk level. The risk-based cleanup level calculations using Equation 720-2 are based on the use of an inhalation correction factor of 2. The Regional Screening Tables prepared by EPA and the Oak Ridge National Laboratory suggest that inhalation risks calculated using chemical-specific information would be somewhat higher than the risks calculated using an inhalation correction factor of 2. However, the cancer risks at the MCL still fall below a 10^{-5} risk level.
- The current Method A cleanup level is similar to the draft ground water VI screening levels developed by Ecology. Ecology published a draft vapor intrusion guidance document for public review and comment in late 2009. The draft ground water screening level for benzene is 2.4 ug/L. This screening value was calculated using a vapor attenuation factor (VAF) of 0.001. However, Ecology also concluded that a VAF of 0.0001 would generally be appropriate for benzene because it tends to biodegrade in the environment. Use of a VAF of 0.0001 results in a ground water screening level of 24 ug/L.
- The current cleanup level complies with current statutory and regulatory requirements for establishing cleanup standards. The current standard is based on the state and federal drinking water standard for benzene. Consequently, the current cleanup level

[16] EPA. 2010. National Primary Drinking Water Regulations; Announcement of the Results of EPA's Review of Existing Drinking Water Standards and Request for Public Comment and/or Information on Related Issues. 75 FR 15500 at 15525.

complies with the MTCA statute which states that cleanup standards must be "…at least as stringent as all applicable state and federal laws, including health-based standards under state and federal law…"

- The current cleanup level falls within the range of ground water standards and guidelines established by other states. The current standard falls within the range of standards and guidelines used by other states to support cleanup decisions (See Table 1). The majority of states surveyed by Ecology use the federal drinking water standard to establish ground water cleanup levels.

6. Benzo[a]pyrene (BaP)

Background

Ecology developed the current MTCA Method A ground water cleanup level for BaP (0.1 ug/L) when the rule was revised in February 2001. The Method A value was based on the drinking water standard specified in WAC 246-290-310 and 40 C.F.R. 141.61[17] with an adjustment to a 1 x 10^{-5} risk level.

There have been several scientific and regulatory developments since the 2001 rule revisions. These include the following:

- Guidance on Early Life Stage Considerations. EPA[18] and California[19] have adopted methods and policies for adjusting cancer slope factors and/or cancer risk estimates to take into account child susceptibility to carcinogenic substances. EPA's policies apply to carcinogens that act via a mutagenic mode of action (including BaP); the California EPA policies apply to all carcinogens.
- MTCA Mixtures Rule Amendment. Ecology reviewed the Method A value during the 2007 rule revision process, but elected not to revise it. Information available at that time indicated the Method A value was sufficiently protective. However, Ecology added clarifying language that specifies that when other carcinogenic PAHs are suspected of being present at the site, investigators should test for them and use this value as the total concentration that all carcinogenic PAHs must meet using the toxicity equivalency methodology in WAC 173-340-708(8).
- California Public Health Goal. In February 2010, the Office of Environmental Health Hazard Assessment (OEHHA) proposed a new public health goal (0.013 ug/L) for BaP in drinking water.[20] As part of that effort, OEHHA developed an oral cancer slope factor (1.7 $(mg/kg/day)^{-1}$) for BaP. This is approximately four times lower than the oral cancer slope factor (7.3 $(mg/kg/day)^{-1}$) published in the IRIS database.
- EPA Six Year Review of Drinking Water Standards. EPA completed a review of the federal drinking water standards in March 2010. With respect to the federal standard for BaP, EPA concluded "…[t]he Agency does not believe a revision to the NPDWR for benzo[a]pyrene is appropriate at this time because a reassessment of the health risks resulting from exposure to benzo[a]pyrene is in progress (USEPA, 2009b).

[17] EPA published the current drinking water standard for benzo[a]pyrene in July 1992 (57 FR 31776). EPA established a MCLG of zero based on a classification as a probable human carcinogen (B2). The Maximum Contaminant Limit (MCL) of 0.2 ug/L was based on analytical feasibility.

[18] EPA. 2005. Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens. U.S. Environmental Protection Agency, Risk Assessment Forum, March 2005. EPA/630/R-03/003F.

[19] OEHHA. 2008. Air Toxics Hot Spots Program Risk Assessment Guidelines, Part II, Technical Support Document for Cancer Potency Factors, June 2008, Public Review Draft, California Environmental Protection Agency, Office of Environmental Health Hazard Assessment.

[20] OEHHA. 2010. Public Health Goal for Benzo[a]pyrene in Drinking Water. Prepared by Pesticide and Environmental Toxicology Branch, OEHHA, California Environmental Protection Agency. February 2010.

Furthermore, a review of analytical feasibility did not identify a potential to revise the MCL, which is limited by feasibility…"[21]

- EPA Review of PAH Mixtures. In March 2010, EPA published a draft toxicological review of PAH mixtures.[22] The document reviews the scientific rationale for using a relative potency factor (RPF) approach to assess cancer risks from exposure to PAH mixtures. The RPF analysis provides a cancer risk estimate for PAH mixtures by summing doses of component PAHs after scaling the doses (with RPFs) relative to the potency of an index PAH (i.e., BaP). The cancer risk is then estimated using the dose-response curve for the index PAH. This approach builds on earlier EPA guidance.[23] However, it incorporates more recent scientific information, includes a broader range of PAH compounds (27 compounds vs. 7 compounds addressed in the 1993 EPA guidance) and focuses on the mixture (as opposed to individual PAH compounds).

MTCA Rulemaking Options

Ecology has reviewed the new scientific and regulatory information relevant to updating the MTCA cleanup level for benzo[a]pyrene. Based on that review, Ecology has considered two options for revising the Method A ground water cleanup level for benzo[a]pyrene:

1. No Revision. Under this option, the Method A ground water cleanup level would remain 0.1 ug/L.
2. Revisions Based on Early-Life Stage Susceptibility. Under this option, Ecology would revise the Method A ground water cleanup level to 0.02 ug/L. The revised cleanup level for BaP (0.02 ug/L) is based on adjusting the drinking water standard downward to a level that corresponds to an excess cancer risk of 1×10^{-5} with an additional adjustment for analytical feasibility.

Draft Revisions and Rationale

Ecology plans to lower the Method A ground water cleanup level for BaP from 0.1 ug/L to 0.02 ug/L (Option 2). Ecology's rationale for this revision includes the following:

- The revised cleanup level is consistent with current scientific information on health risks associated with BaP exposure. EPA has published early life stage guidance that is applicable to BaP. The Method B ground water cleanup level calculated using the EPA methods for adjusting the cancer slope factor based on early life stage considerations falls between 0.001 ug/L and 0.002 ug/L.
- The methods and policies used to develop the revised cleanup level are consistent with the policies underlying the MTCA rule. The current drinking water standard is higher

[21] EPA. 2010. National Primary Drinking Water Regulations; Announcement of the Results of EPA's Review of Existing Drinking Water Standards and Request for Public Comment and/or Information on Related Issues. 75 FR 15500 at 15526.

[22] EPA. 2010. Development of Relative Potency Factor (RPF) Approach for Polycyclic Aromatic Hydrocarbon (PAH) Mixtures In Support of Summary Information on the Integrated Risk Information System (IRIS). February 2010.

[23] EPA. 1993. Provisional Guidance for Quantitative Risk Assessment of PAHs (Provisional Guidance)

than the risk-based concentration calculated using Equation 720-2 and the EPA cancer slope factor for BaP with early-life stage adjustments. Ecology's proposal to lower the Method A cleanup level is consistent with the general policies and procedures in the current rule. Specifically, the MTCA rule requires downward adjustment of cleanup levels based on applicable requirements if those levels correspond to a hazard quotient greater than one (1) or an excess cancer risk greater than one-in-one hundred thousand (1×10^{-5}). As noted above, the revised cleanup level for BaP is based on adjusting the drinking water standard downward to a level that corresponds to an excess cancer risk of 1×10^{-5} with an additional adjustment for analytical feasibility.

- The revised cleanup level complies with MTCA statutory requirements. The revised cleanup level (0.02 ug/L) is lower than the state and federal drinking water standard for BaP (0.2 ug/L). Consequently, the revised cleanup level complies with the MTCA statute which states that cleanup standards must be "…at least as stringent as all applicable state and federal laws, including health-based standards under state and federal law…"

- Compliance with the revised cleanup level can be determined using current analytical methods. Ecology has determined that compliance with the revised cleanup level can be evaluated using Method SW 8270C (SIM). This is consistent with ground water monitoring results included in the Ecology Environmental Information Management (EIM) system which indicate that laboratories regularly achieve PQLs or reporting limits of 0.1 ug/L or better. However, Ecology is currently surveying analytical laboratories to gain a better understanding on analytical limits.

- The revised cleanup level falls within the range of cleanup levels and guidelines developed by other state environmental agencies. The revised cleanup levels falls within the range of standards and guidelines used by other states to support cleanup decisions (See Table 1). However, Ecology acknowledges that the majority of states surveyed currently use the federal drinking water standard to establish ground water cleanup levels.

In developing the draft revisions, Ecology also considered the range of comments on adjusting the cancer slope factor for benzo[a]pyrene based on the early life stage exposure considerations. Ecology believes the draft revisions is consistent with comments from several work group members who expressed support for applying early-life stage adjustments for benzo[a]pyrene during the March meeting. Several members also provided written comments on this issue.

> *Early life stage adjustment factors should be used by Ecology for all carcinogens. (Larry Dunn, April 27, 2010 Comments on the MTCA and SMS Issues Under Review)*

> *Consider applying age-dependent adjustments in the current rule making to carcinogens with a known mutagenic mode of action, consistent with current EPA guidance on early life exposures. (Patty Boyden and Mike Stoner, May 27, 2010 Comments on Proposed MTCA-SMS Rule Revisions)*

However, Ms. Boyden and Mr. Stoner also provided the following comment on revisions to Method A ground water cleanup level for BaP:

> *The anticipated changes to the CLARC cleanup level calculation methods may not justify changes to the Method A groundwater cleanup level for benzo(a)pyrene at this time, as the MCL has not changed and the current cleanup level would remain compliant under MTCA requirements*

Ecology acknowledges that other members expressed reservations about making these adjustments for benzo[a]pyrene and other chemicals. One member provided written comments on some of the technical underpinnings of the approach and questioned the need for incorporating an additional degree of protection to a cleanup level framework that already includes a "substantial number of health protective factors" (William Ernst, April 23, 2010 Comments on Early Life Exposure). Another member (Mr. Thomas Newlon) also provided written comments questioning the rationale for making early life stage adjustments for PAHs given the policy choices made during the 2007 rulemaking process (See Section 22 - PAH Mixtures).

7. Cadmium

Background

Ecology established the current MTCA Method A ground water cleanup level for cadmium when the initial cleanup standards were published in 1991. The Method A cleanup level is based on applicable state and federal law (WAC 246-290-310 and 40 C.F.R. 141.62).[24]

Ecology reviewed the Method A value during the 2001 rule revision process, but elected not to revise it. . Information available at that time indicated the Method A value was sufficiently protective.

There have been several scientific and regulatory developments since 2001. These include:

- California Public Health Goal Update. In 2006, the Office of Environmental Health Hazard Assessment (OEHHA) re-evaluated information on cadmium health risks and concluded that the public health goal should be lowered from 0.07 ug/L to 0.04 ug/L.[25] The revised public health goal was derived using a No Observed Adverse Effects Level (NOAEL) of 19 ug/day, an overall uncertainty factor of 50 and a relative source contribution of 20 percent. [26]
- ATSDR Toxicological Profile. The ATSDR published a draft update to the toxicological profile for cadmium that was distributed for public comment in September 2008.[27] The draft document includes a chronic oral Minimal Risk Level of 0.0001 mg/kg/day which is based preventing kidney damage. As of May 2010, ATSDR has not finalized this value. A Method B ground water cleanup of 1.6 ug/L could be calculated using the draft MRL and Equation 720-1.
- EPA Six Year Review of Drinking Water Standards. EPA completed a review of the federal drinking water standards in March 2010. With respect to the federal standard for cadmium, EPA concluded "…[s]ince the MCL for cadmium is set at its MCLG and a reassessment of the health risks from exposure to cadmium is in progress, the Agency does not believe a revision to the NPDWR is appropriate at this time…"[28]

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[24] EPA published the current drinking water standard for cadmium in January 1991 (56 FR 3526). EPA established an MCLG and MCL of 5 ug/L. EPA developed this value using an RfD of 0.0005 mg/kg/day. This is the current IRIS value. EPA classified cadmium as a Group D carcinogen by the oral route of exposure.

[25] Sedman, R. 2006. Update of the Public Health Goal for Cadmium. Memorandum to Dr. Joan Denton, Director of the Office of Environmental Health Hazard Assessment (December 19, 2006).

[26] Dr. Sedman noted that CalEPA, EPA and IARC have determined that there is sufficient evidence that cadmium is carcinogenic to humans. However, they concluded that there are no oral studies that are suitable for establishing an oral cancer slope factor. They also concluded that available information does not allow extrapolation of the inhalation potency to the oral route. To address cancer risks via the oral pathway, CalEPA used an additional 10-fold uncertainty factor when deriving the PHG.

[27] ATSDR. 2008. Toxicological Profile for Cadmium (Draft Update). September 2008. Available at: http://www.atsdr.cdc.gov/toxprofiles/index.asp

[28] EPA. 2010. National Primary Drinking Water Regulations; Announcement of the Results of EPA's Review of Existing Drinking Water Standards and Request for Public Comment and/or Information on Related Issues. 75 FR 15500 at 15526.

MTCA Rulemaking Options

Ecology does not plan to revise the Method A cleanup level for cadmium. EPA is currently reassessing the health risks from exposure to cadmium. However, EPA has not updated the IRIS toxicological parameters for cadmium or revised the federal drinking water standard. The Washington DOH has not revised the state drinking water standard for cadmium.

8. Total Chromium/Chromium III

Background

Ecology developed the current MTCA Method A ground water cleanup level for total chromium (50 ug/L) when the initial cleanup standards were established in 1991. The Method A value was based on the drinking water standard specified in WAC 246-290-310 and 40 C.F.R. 141.62.[29]

Ecology reviewed the Method A value during the 2001 rule revision process, but elected not to revise it. Information available at that time indicated the Method A value was sufficiently protective.[30]

There have been several scientific and policy developments since the 2001. These include:

- Research and Evaluation of Chromium VI Health Risks. In 2008, the NTP completed a study to evaluate the chronic toxicity and carcinogenicity of oral exposure to chromium VI.[31] The study results triggered a series of evaluations and reassessments of health risks posed by exposure to chromium VI. [See discussion in the next section.]
- EPA Six Year Review of Drinking Water Standards. EPA completed a review of the federal drinking water standards in March 2010. With respect to the federal standard for total chromium, EPA concluded "…[t]he Agency does not believe a revision to the NPDWR for total chromium is appropriate at this time. A reassessment of the health risks associated with chromium exposure is being initiated and Agency does not believe it is appropriate to revise the NPDWR while that effort is in process.[32]

MTCA Rulemaking Options

Ecology has reviewed the new scientific and regulatory information relevant to updating the MTCA cleanup level for total chromium. Based on that review, Ecology has considered two main options for revising the Method A ground water cleanup level for total chromium:

1. No Revision. Under this option, the Method A ground water cleanup level would remain 50 ug/L for total chromium.

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[29] EPA published the current drinking water standard for total chromium in January 1991 (56 FR 3526). EPA established an MCLG and MCL of 0.1 mg/L (100 ug/L). EPA based the standard on adverse health effects associated with chromium VI. The MCLG and MCL were developed this value using an RfD of 0.005 mg/kg/day and an assumed relative source contribution from water of 70%. EPA regulated chromium as a Group D carcinogen (not classifiable as to human carcinogenicity) by the oral route of exposure.

[30] Ecology added language that specifies that the Method A cleanup level was derived using Equation 720-1 for chromium VI. This is a total value for chromium III and chromium VI. If just chromium III is present at the site, a cleanup level of 100 ug/L may be used (based on WAC 246-290-310 and 40 C.F.R. 141.62).

[31] NTP. 2008. Technical report on the toxicology and carcinogenesis studies of sodium dichromate dehydrate (CAS # 7789-12-0) in F344 rats and B6C3F1 mice (drinking water studies). TR-546. July 2008.

[32] EPA. 2010. National Primary Drinking Water Regulations; Announcement of the Results of EPA's Review of Existing Drinking Water Standards and Request for Public Comment and/or Information on Related Issues. 75 FR 15500 at 15526.

2. Separate Cleanup Levels for Chromium III and VI. Under this option, Ecology would establish separate cleanup levels for chromium III and chromium VI. The Method A cleanup level for chromium III would be 100 ug/L. This is the current MCL for total chromium that is included in the state and federal drinking water standards.

Draft Revisions and Rationale

Ecology plans to revise the MTCA rule by creating separate Method A ground water cleanup levels for chromium III and VI (Option 2). Under this option, the Method A ground water cleanup level for chromium III is 100 ug/L.

Ecology's rationale for the revised ground water cleanup level for chromium III includes the following:

- The revised cleanup level is sufficiently protective and consistent with current scientific information on health risks. Chromium III is much less toxic than chromium VI. A risk-based ground water cleanup level for chromium III (24,000 ug/L) can be calculated using Equation 720-1 and the oral reference dose from the IRIS database.
- The revised cleanup level complies with MTCA statutory requirements. MTCA states that cleanup standards must be "…at least as stringent as the cleanup standards under section 121 of the federal cleanup law, 42 U.S.C. Sec. 9621, and at least as stringent as all applicable state and federal laws, including health-based standards under state and federal law…" The revised Method A value (100 ug/L) is equal to the current state and federal drinking water standard.
- The revised cleanup level is consistent with the current MTCA rule. The current MTCA rule includes several provisions that establish different requirements for chromium III and VI. For example, the explanatory note in Table 720-1 states that the Method A cleanup level for chromium is 100 ug/L if only trivalent chromium is present at a site. Similarly, the rule establishes separate Method A soil cleanup levels for chromium III and VI.
- Many states currently use the federal drinking water standard to establish ground water cleanup levels. This approach is consistent with approaches by Massachusetts, Maryland and Michigan who have established separate ground water cleanup levels for chromium III and VI. However, those states have established the same standard for the two forms of chromium.

9. Chromium VI

Background

Ecology developed the current MTCA Method A ground water cleanup level for total chromium (50 ug/L) when the initial cleanup standards were established in 1991. The Method A value was based on the drinking water standard specified in WAC 246-290-310 and 40 C.F.R. 141.62.[33]

Ecology reviewed the Method A value during the 2001 rule revision process, but elected not to revise it. Information available at that time indicated the Method A value was sufficiently protective.[34]

There have been several scientific and regulatory developments since the 2001 rule revisions. These include the following:

- Guidance on Early Life Stage Considerations. EPA[35] and California[36] have adopted methods and policies for adjusting cancer slope factors and/or cancer risk estimates to take into account child susceptibility to carcinogenic substances. EPA's policies apply to carcinogens that act via a mutagenic mode of action (including chromium VI); the California EPA policies apply to all carcinogens.
- National Toxicology Program (NTP) Cancer Study. In 2008, the NTP completed a study to evaluate the chronic toxicity and carcinogenicity of oral exposure to chromium VI.[37] The NTP found clear evidence of carcinogenicity in male and female rats (increased incidence of squamous cell neoplasms of the oral cavity) and male and female mice (increased incidence of neoplasms in the small intestine).
- ATSDR Toxicological Profile (Draft Update). The ATSDR distributed a draft update to the toxicological profile for chromium VI for public comment in September 2008.[38]

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[33] EPA published the current drinking water standard for total chromium in January 1991 (56 FR 3526). EPA established an MCLG and MCL of 0.1 mg/L (100 ug/L). EPA based the standard on adverse health effects associated with chromium VI. The MCLG and MCL were developed this value using an RfD of 0.005 mg/kg/day and an assumed relative source contribution from water of 70%. EPA regulated chromium as a Group D carcinogen (not classifiable as to human carcinogenicity) by the oral route of exposure.

[34] Ecology added clarifying language that specifies that the Method A cleanup level was derived using Equation 720-1 for chromium VI. This is a total value for chromium III and chromium VI. If just chromium III is present at the site, a cleanup level of 100 ug/L may be used (based on WAC 246-290-310 and 40 C.F.R. 141.62).

[35] EPA. 2005. Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens. U.S. Environmental Protection Agency, Risk Assessment Forum, March 2005. EPA/630/R-03/003F.

[36] OEHHA. 2008. Air Toxics Hot Spots Program Risk Assessment Guidelines, Part II, Technical Support Document for Cancer Potency Factors, June 2008, Public Review Draft, California Environmental Protection Agency, Office of Environmental Health Hazard Assessment.

[37] NTP. 2008. Technical report on the toxicology and carcinogenesis studies of sodium dichromate dehydrate (CAS # 7789-12-0) in F344 rats and B6C3F1 mice (drinking water studies). TR-546. July 2008.

[38] ATSDR. 2008. Toxicological Profile for Chromium (Draft Update). September 2008. Available at: http://www.atsdr.cdc.gov/toxprofiles/index.asp

The draft document includes a chronic oral Minimal Risk Level (MRL) of 0.001 mg/kg/day which is based on preventing adverse gastrointestinal effects. This is lower than the current IRIS reference dose. As of May 2010, ATSDR has not finalized this value. A Method B ground water cleanup of 16 ug/L can be calculated using the draft MRL and Equation 720-1.

- NJDEP Oral Cancer Slope Factor. The New Jersey Department of Environmental Protection (NJDEP) developed an oral cancer slope factor (0.5 $(mg/kg/day)^{-1}$) for chromium VI to support decisions on soil cleanup levels.[39] The NJDEP slope factor is based on the results from the NTP cancer bioassays. It was peer-reviewed by scientists with relevant expertise and has been finalized by NJDEP. EPA and Oakridge National Laboratory have used the NJDEP slope factor to establish soil and ground water screening levels in the most recent Regional Screening Tables posted in May 2010.
- California Public Health Goal. In August 2009, the Office of Environmental Health Hazard Assessment (OEHHA) proposed a PHG (0.06 ug/L) for chromium VI in drinking water.[40] To calculate the PHG, OEHHA derived an oral cancer slope factor of 0.6 ($(mg/kg/day)^{-1}$), based on the increased incidence of tumors of the small intestine in mice reported by the NTP. OEHHA acknowledged that chromium VI acts through a mutagenic mode of action. However, OEHHA did not apply an early life stage adjustment when preparing the oral slope factor. OEHHA also calculated an inhalation cancer slope factor 510 $(mg/kg/day)^{-1}$ based on occupational studies.
- EPA Six Year Review of Drinking Water Standards. EPA completed a review of the federal drinking water standards in March 2010. With respect to the federal standard for total chromium, EPA concluded "…[t]he Agency does not believe a revision to the NPDWR for total chromium is appropriate at this time. A reassessment of the health risks associated with chromium exposure is being initiated and Agency does not believe it is appropriate to revise the NPDWR while that effort is in process.[41]

[39] Stern, A.H. 2009. Derivation of Ingestion-Based Soil Remediation Criterion for Cr^{+6} Based on the NTP Chronic Bioassay Data for Sodium Dichromate Dihydrate. Available at: http://www.state.nj.us/dep/dsr/chromium/soil-cleanup-derivation.pdf.

[40] OEHHA. 2009. Draft Public Health Goal for Hexavalent Chromium in Drinking Water. Prepared by Pesticide and Environmental Toxicology Branch, Office of Environmental Health Hazard Assessment, California Environmental Protection Agency. August 2009.

[41] EPA. 2010. National Primary Drinking Water Regulations; Announcement of the Results of EPA's Review of Existing Drinking Water Standards and Request for Public Comment and/or Information on Related Issues. 75 FR 15500 at 15526.

MTCA Rulemaking Options

Ecology has reviewed the new scientific and regulatory information and believes it is appropriate to consider revisions to the MTCA cleanup level. Ecology has considered three main options for resolving this rulemaking issue:

1. No Revision. Under this option, the Method A ground water cleanup level would remain 50 ug/L.
2. No Method A Cleanup Level. Under this option, Ecology would not establish a Method A ground water cleanup level for chromium VI. Cleanup levels for individual sites would be established under Method B or C.
3. Chromium VI Cleanup Levels – Cancer Risk. Under this option, Ecology would establish a Method A ground water cleanup level for chromium VI based on cancer risks. For example, use of the NJDEP cancer slope factor would result in a revised cleanup level of 2 ug/L. This is based on adjusting the drinking water standard downward to a level that corresponds to an excess cancer risk of 1×10^{-5}.

Draft Revisions and Rationale

Ecology believes it is appropriate to develop a Method A ground water cleanup level for chromium VI based on recent scientific information on the carcinogenic risks associated the ingestion of this substance.

Ecology received several comments relevant to this issue. For example, two members provided the following comment:

> *…[t]he proposed changes to the cleanup levels for chromium VI, ethylbenzene, and naphthalene are not warranted at this time, as the toxicity values being considered by Ecology are not published in IRIS, HEAST or NCEA guidance, and Ecology has not demonstrated a clear and convincing need to use alternate values. Therefore, revisions to these Method A values should not be pursued during the current rule making. (Patty Boyden and Mike Stoner, May 27, 2010 Comments on Proposed MTCA-SMS Rule Revisions)*

Other members expressed the opinion that it is appropriate to consider other sources of toxicity information when updating the cleanup levels in the CLARC database (and by extension the MTCA rule which provides the basis for the CLARC values). For example:

> *On the hierarchy of toxicological information IRIS is indeed the gold standard but as noted is a lengthy process to complete. Regional screening tables are reasonable to use for a basis to update the CLARC data base. Annual updates should be sufficient unless an emerging issue is identified with a new chemical. (Larry Dunn, April 27, 2010 Comments on the MTCA and SMS Issues Under Review)*

Ecology is still evaluating the options identified above and has not reached a final decision on whether and how to proceed with rule revisions. In light of the above comments, Ecology will complete the following activities to support agency decision-making on this issue:

- MTCA/SMS Advisory Group Review: Ecology will be discussing cleanup level revisions at MTCA/SMS Advisory Group meetings held in the Summer/Fall of 2010.
- Quality of Information Analysis and Science Panel Review: Ecology recognizes that the decision to base chromium VI cleanup levels on carcinogenic risks represents a

major change from past procedures. Consequently, Ecology is currently evaluating this issue using the quality of information criteria in WAC 173-340-702(16). Ecology plans to present the results of this analysis to the MTCA Science Panel for review and comment at meetings held in the Fall of 2010.

- Implications for Cleanup Actions and Restoration Time Frames: Ecology will be evaluating available data to estimate how a revised cleanup level for chromium VI might impact cleanup investigations, cleanup actions and restoration timeframes.

10. DDT

Background

Ecology established the current MTCA Method A ground water cleanup level for DDT (0.1 ug/L) when the initial cleanup standards were published in 1991. The Method A cleanup level was calculated using Equation 720-2 and a cancer slope factor (0.34 $(mg/kg/day)^{-1}$). The cancer slope factor for DDT is published in the IRIS database. EPA published the cancer slope factor in the IRIS database in May 1991. Ecology reviewed the Method A value during the 2001 rule revision process, but elected not to revise it. Information available at that time indicated the Method A value was sufficiently protective.

MTCA Rulemaking Options

Ecology does not currently plan to revise the Method A value for DDT. EPA has not revised the toxicological parameters for DDT since the 2001 MTCA rule amendments. Neither EPA nor the Washington DOH has established a drinking water standard for DDT.

11. 1,2-Dichloroethane

Background

Ecology developed the current MTCA Method A ground water cleanup level for 1,2-dichloroethane (5 ug/L) when the initial cleanup standards were published in 1991. The Method A cleanup level is based on applicable state and federal law (WAC 246-290-310 and 40 C.F.R. 141.61).[42]

Ecology reviewed the Method A value during the 2001 rule revision process, but elected not to revise it. Information available at that time indicated the Method A value was sufficiently protective.

There have been several scientific and regulatory developments since 2001. These include:

- Review of California Public Health Goal (PHG). The Office of Environmental Health Hazard Assessment (OEHHA) established a PHG of 0.4 ug/L for 1,2-dichloroethane in 1999.[43] The 1999 PHG was developed using a cancer slope factor of 0.047 (mg/kg-day)$^{-1}$ that was developed using incidence data of hemangiosarcomas in male rats. In 2005, OEHHA completed a review of the PHG and confirmed that the earlier analysis remained consistent with available data. [44] They concluded that no revisions were needed since the current PHG (0.4 ug/L) was very close to the current California MCL (0.5 ug/L) established by the California Department of Health Services.
- IRIS Reference Dose. EPA updated the IRIS oral reference dose (0.02 mg/kg/day) for 1,2-dichloroethane in 2003. A Method B ground water cleanup of 160 ug/L can be calculated using the IRIS reference dose and Equation 720-1.
- EPA Six Year Review of Drinking Water Standards. EPA completed a review of the federal drinking water standards in March 2010. With respect to the federal standard for 1,2-dichloroethane, EPA concluded "…[t]he Agency does not believe a revision to the NPDWR for 1,2-dichloroethane is appropriate at this time because a reassessment of the health risks resulting from exposure to 1,2-dichloroethane is in progress (USEPA, 2009b). Furthermore, the occurrence and exposure analysis based on possible changes in analytical feasibility indicate that any revision to the MCL is unlikely to provide a meaningful opportunity to improve public health protection…"[45]

[42] EPA published the current drinking water standard for 1,2-dichloroethane in July 1987 (52 FR 25690). EPA established a MCLG of zero based on 1,2-dichloroethane's classification as a probable human carcinogen (B2). The Maximum Contaminant Limit (MCL) of 5 ug/L was based on analytical feasibility.

[43] OEHHA. 1999. Public Health Goal for 1,2-Dichloroethane in Drinking Water. Prepared by the Office of Environmental Health Hazard Assessment, California Environmental Protection Agency. February 1999.

[44] Jowa, L. 2005. Update of PHG for 1,2-Dichloroethane. Memorandum to Val F. Siebal, Chief Deputy Director of the Office of Environmental Health Hazard Assessment (September 16, 2005).

[45] EPA. 2010. National Primary Drinking Water Regulations; Announcement of the Results of EPA's Review of Existing Drinking Water Standards and Request for Public Comment and/or Information on Related Issues. 75 FR 15500 at 15526.

MTCA Rulemaking Options

Ecology does not plan to revise the Method A cleanup level for 1,2-dichloroethane which is currently based on the federal and state drinking water standards. Since the 2001 rule revisions, neither EPA nor the Washington DOH have revised the drinking water standard for 1,2-dichloroethane. In addition, EPA has not updated the IRIS oral cancer slope factor for 1,2-dichloroethane.

Ecology acknowledges that EPA has updated the oral reference dose in the IRIS database. The risk-based ground water cleanup level calculated using that value and Equation 720-1 is 160 ug/L. However, the Method A ground water cleanup level must still comply with applicable state and federal drinking water standards and ground water cleanup levels based on cancer risks.

12. Ethylbenzene

Background

Ecology established the initial MTCA Method A ground water cleanup level for ethylbenzene (30 ug/L) when the initial cleanup standards were established in 1991. The Method A value was based on applicable state and federal requirements (i.e, drinking water standards specified in WAC 246-290-310 and 40 C.F.R. 141.61) and prevention of adverse aesthetic characteristics.

Ecology reviewed the Method A value during the 2001 rule revision process. Based on that review, Ecology elected to publish a revised standard (700 ug/L) that was based on the current state and federal drinking water standards. Ecology concluded that this value met the statutory requirements under state law and is more stringent than the ground water cleanup level (800 ug/L) calculated using Equation 720-1 and an oral reference dose of 0.1 mg/kg/day.

There have been several scientific and regulatory developments since the 2001 rule revisions. These include the following:

- ATSDR Toxicological Profile (Draft Update). The ATSDR distributed a draft update to the toxicological profile for ethylbenzene for public comment in September 2007.[46] The draft document includes a chronic oral Minimal Risk Level of 0.5 mg/kg/day which is based on preventing kidney damage. As of May 2010, ATSDR has not finalized this value. A Method B ground water cleanup of 4 mg/L (4000 ug/L) can be calculated using the draft MRL and Equation 720-1.
- EPA/ORNL Regional Screening Levels. The California EPA established a public health goal (300 ug/L) for ethylbenzene in 1997. [47]
- Regional Screening Tables: The Regional Screening Tables published by EPA and the Oak Ridge National Laboratory include an oral cancer slope factor (0.11 $(mg/kg/day)^{-1}$) for ethylbenzene. This value was developed by Office of Environmental Health Hazard Assessment. EPA/ORNL used this value to calculate a risk-based screening level for tap water of 6 ug/L.
- EPA Six Year Review of Drinking Water Standards. EPA completed a review of the federal drinking water standards in March 2010. With respect to the federal standard for ethylbenzene, EPA concluded "…[s]ince the MCL for ethylbenzene is set at its MCLG and a reassessment of the health risks resulting from exposure to ethylbenzene is in

[46] ATSDR. 2008. Toxicological Profile for Ethylbenzene (Draft Update). September 2007. Available at: http://www.atsdr.cdc.gov/toxprofiles/index.asp

[47] OEHHA. 1997. Public Health Goal for Ethylbenzene in Drinking Water. Prepared by Pesticide and Environmental Toxicology Branch, Office of Environmental Health Hazard Assessment, California Environmental Protection Agency. December 1997.

progress, EPA does not believe a revision to the NPDWR for ethylbenzene is appropriate at this time…"[48]

MTCA Rulemaking Options

Ecology has reviewed the new scientific and regulatory information relevant to updating the MTCA cleanup level for arsenic. Based on that review, Ecology has considered two main options for revising the Method A ground water cleanup level for arsenic:

Ecology has reviewed the new scientific and regulatory information and believes it is appropriate to consider revisions to the MTCA cleanup level. Ecology has considered five options for resolving this rulemaking issue:

1. No Revision. Under this option, the Method A ground water cleanup level for ethylbenzene would remain 700 ug/L.
2. Cancer Risks. Under this option, the Method A ground water cleanup level for ethylbenzene would be lowered to 40 ug/L. This concentration was calculated using Equation 720-2, a target risk level of one-in-one hundred thousand and the oral cancer slope factor included in the EPA/ORNL Regional Screening Tables.

Draft Revisions and Rationale

Ecology does not plan to revise the Method A cleanup level for ethylbenzene. EPA is currently reassessing the health risks from exposure to ethylbenzene and has not updated the IRIS toxicological parameters. Similarly, neither EPA nor DOH has revised the drinking water standard for ethylbenzene.

Ecology acknowledges that the EPA Regional Screening Tables includes a cancer slope factor for ethylbenzene that was developed by the California Environmental Protection Agency. However, Ecology has decided not to base cleanup level revisions on that information since EPA is currently reassessing the health risks associated with ethylbenzene exposure. .

[48] EPA. 2010. National Primary Drinking Water Regulations; Announcement of the Results of EPA's Review of Existing Drinking Water Standards and Request for Public Comment and/or Information on Related Issues. 75 FR 15500 at 15543.

13. Ethylene Dibromide (EDB)

Background

Ecology developed the current MTCA Method A ground water cleanup level for EDB (0.01 ug/L) when the initial cleanup standards were established in 1991. The Method A value was calculated using the Method B ground water equation and a cancer slope factor of 85 $(mg/kg/day)^{-1}$ and then modified based on analytical considerations.[49]

Ecology reviewed the Method A value during the 2001 rule process, but elected not to revise it. Information available at that time indicated the Method A value was sufficiently protective.

There have been several scientific and policy developments since 2001. These include:

- California Public Health Goal. The Office of Environmental Health Hazard Assessment (OEHHA) published a public health goal (0.01 ug/L) for EDB in 2003. [50] The public health goal was calculated using a cancer slope factor of 3.6 $(mg/kg/day)^{-1}$.
- Oral Cancer Slope Factor. EPA updated the IRIS oral cancer slope factor for EDB in 2003.[51] EPA lowered the IRIS value from 85 to 2 $(mg/kg/day)^{-1}$.
- EPA Six Year Review of Drinking Water Standards. [52] EPA completed a review of the federal drinking water standards in March 2010. With respect to the federal standard for EDB, EPA concluded "…EPA did not identify new data that support consideration of a possibly lower PQL (and therefore a possibly lower MCL). Therefore, EPA does not believe a revision to the NPDWR for EDB is appropriate at this time…"[53]

MTCA Rulemaking Options

Ecology has reviewed the new scientific and regulatory information and believes it is appropriate to consider revisions to the MTCA cleanup level. Ecology has considered two options for revising the cleanup level:

1. No Revision. Under this option, the Method A ground water cleanup level would remain 0.01 ug/L.
2. Maximum Contaminant Limit: Under this option, the Method A ground water cleanup level for EDB would be increased to 0.05 ug/L. This is the current MCL included in state and federal drinking water standards.

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[49] Ecology based the Method A standard on a PQL of 0.01 ug/L based on the use of EPA Method 504.1.

[50] OEHHA. 2003. Public Health Goal for Ethylene Dibromide in Drinking Water. Prepared by Pesticide and Environmental Toxicology Branch, OEHHA, California Environmental Protection Agency.

[51] EPA. 2002. Toxicological Review of Ethylene Dibromide (CAS No. 106-93-4) In Support of Summary Information on the Integrated Risk Information System (IRIS). National Center for Environmental Assessment, Office of Research and Development, U.S. Environmental Protection Agency. Washington DC.

[52] EPA published a final drinking water standard for EDB (0.05 ug/L) in January 1991 (56 FR 3526).

[53] EPA. 2010. National Primary Drinking Water Regulations; Announcement of the Results of EPA's Review of Existing Drinking Water Standards and Request for Public Comment and/or Information on Related Issues. 75 FR 15500 at 15544.

Draft Revisions and Rationale

Ecology plans to revise the MTCA rule by raising the Method A ground water cleanup level from 0.01 ug/L to 0.05 ug/L (Option 2). Ecology's rationale for this revision includes the following:

- The revised cleanup level is consistent with current scientific information on health risks resulting from EDB exposure. EPA revised the cancer slope factor for EDB in 2003. Specifically, EPA lowered the cancer slope factor for EDB from 85 to 2 $(mg/kgday)^{-1}$. The lower EPA slope factor is similar to the value calculated by OEHHA when developing the California public health goal for EDB in drinking water.
- The revised cleanup level complies with current statutory and regulatory requirements for establishing cleanup standards. The revised cleanup level is based on the state and federal drinking water standard for EDB. Consequently, the current cleanup level complies with the MTCA statute which states that cleanup standards must be "…at least as stringent as all applicable state and federal laws, including health-based standards under state and federal law…"
- The revised cleanup level is consistent with the MTCA methods and policies for establishing ground water cleanup levels. The current drinking water standard is higher than the risk-based concentration calculated using Equation 720-2 and the current cancer slope factor for EDB. However, Ecology's proposal to base the Method A cleanup level on the current drinking water standard is consistent with the general policies and procedures in the MTCA rule. Specifically, the MTCA rule only requires downward adjustment of cleanup levels based on applicable requirements if those levels correspond to a hazard quotient greater than one (1) or an excess cancer risk greater than one-in-one hundred thousand (1×10^{-5}). The current drinking water standard corresponds to a cancer risk of 3×10^{-6}.
- The current cleanup level is consistent with ground water standards established by other states. The current standard falls within the range of standards and guidelines used by other states to support cleanup decisions (See Table 1).

Several MTCA/SMS Advisory Group members expressed support for the draft revision during the March 2010 meeting. Two members provided a written comment expressing their support (Patty Boyden/Mike Stoner). However, some members expressed concerns about increasing this level given the uncertainties in cancer risk assessment.

14. Gross Alpha Particle Activity

Background

Ecology established the current MTCA Method A ground water cleanup level (15 pCi/L) for gross alpha particle activity when the initial cleanup standards were published in 1991. The Method A cleanup level is based on applicable state and federal law (WAC 246-290-310 and 40 C.F.R. 141.62).[54]

Ecology reviewed the Method A value during the 2001 rule revision process, but elected not to revise it. Information available at that time indicated the Method A value was sufficiently protective.

EPA completed a review of the federal drinking water standards in March 2010. With respect to the federal standard for alpha particle emitters, EPA concluded "…[t]he Agency does not believe a revision to the NPDWR for gross alpha particle emitters is appropriate at this time because a reassessment of the health risks resulting from exposure to alpha particles is in progress (USEPA, 2009b). Furthermore, there is no new information regarding analytical or treatment feasibility that would warrant reconsideration of the MCL…" [55]

MTCA Rulemaking Options

Ecology does not plan to revise the Method A cleanup level for gross alpha particle activity. EPA is currently reassessing the health risks from exposure to alpha particle emitters. However, EPA has not updated the IRIS toxicological parameters or revised the federal drinking water standard. The Washington DOH has not revised the state drinking water standard.

[54] EPA published an interim drinking water standard and set an MCL of 15 pCi/L for gross alpha particle activity in July 1976 (41 FR 28402). The MCL was based on analytical feasibility. In December 2000, EPA established an MCLG of zero for gross alpha particle activity based on a cancer classification of A (known human carcinogen) and finalized the MCL of 15 pCi/L.

[55] EPA. 2010. National Primary Drinking Water Regulations; Announcement of the Results of EPA's Review of Existing Drinking Water Standards and Request for Public Comment and/or Information on Related Issues. 75 FR 15500 at 15522.

15. Gross Beta Particle Activity

Background

Ecology established the current MTCA Method A ground water cleanup level (4 mrem/yr) for gross alpha particle activity when the initial cleanup standards were published in 1991. The Method A cleanup level is based on applicable state and federal law (WAC 246-290-310 and 40 C.F.R. 141.62).[56]

Ecology reviewed the Method A value during the 2001 rule revision process, but elected not to revise it. Information available at that time indicated the Method A value was sufficiently protective.

EPA completed a review of the federal drinking water standards in March 2010. With respect to the federal standard for beta particle and photon emitters, EPA concluded "…[t]he Agency does not believe a revision to the NPDWR for beta particles is appropriate at this time because a reassessment of the health risks resulting from exposure to beta particles is in progress (USEPA, 2009b). Furthermore, there is no new information regarding analytical or treatment feasibility that would warrant reconsideration of the MCL…" [57]

MTCA Rulemaking Options

Ecology does not plan to revise the Method A cleanup level for gross beta particle activity. EPA is currently reassessing the health risks from exposure to beta particle and photon emitters. However, EPA has not updated the IRIS toxicological parameters or revised the federal drinking water standard. The Washington DOH has not revised the state drinking water standard.

[56] EPA published an interim drinking water standard and set an MCL of 4 mrem/yr for beta particle and photon emitters in July 1976 (41 FR 28402). The MCL was based on analytical feasibility. In December 2000, EPA established an MCLG of zero for beta particle and photon emitters based on a cancer classification of A (known human carcinogen) and finalized the MCL of 15 pCi/L.

[57] EPA. 2010. National Primary Drinking Water Regulations; Announcement of the Results of EPA's Review of Existing Drinking Water Standards and Request for Public Comment and/or Information on Related Issues. 75 FR 15500 at 15526.

16. Lead

Background

Ecology established the initial MTCA Method A ground water cleanup level for lead (5 ug/L) when the initial cleanup standards were established in 1991. The Method A value was based on applicable state and federal law and prevention of unacceptable blood lead levels.[58]

Ecology reviewed the Method A value during the 2001 rule revision process. Based on that review, Ecology elected to publish a revised standard (15 ug/L) that was based on the state and federal drinking water standard for lead (40 C.F.R. 141.80).

There have been numerous scientific and policy developments since the 2001. These developments were summarized in the March 2010 discussion materials provided to the MTCA/SMS Advisory Group. They include:

- Scientific Information on Health Risks. Over the past 10 years, researchers have completed studies identifying adverse health effects at blood lead levels below10 ug/dL Several expert scientific committees have reviewed these studies. A general consensus has emerged that exposure below a blood lead level of 10 ug/dL can be harmful to human health and that scientists are unable to identify a safe level of exposure.
- California Public Health Goal. The Office of Environmental Health Hazard Assessment (OEHHA) published a Public Health Goal (PHG) for lead in drinking water in April 2009. [59] The revised PHG (0.2 ug/L) takes into account current scientific information on lead health risks.
- Regulatory Policies. EPA has adopted a new National Ambient Air Quality Standard (NAAQS) that takes into account current information on lead health risks. The Centers for Disease Control and Prevention (CDCP) has established policies that emphasize measures for preventing elevated lead exposure. Ecology and the Washington DOH have prioritized actions to reduce lead exposure and developed a comprehensive action plan that includes updating the MTCA cleanup levels.
- EPA Six Year Review of Drinking Water Standards. EPA completed a review of the federal drinking water standards in March 2010. With respect to the federal standard for lead, EPA stated that the agency was considering both short term revisions to the Lead and Copper Rule (LCR) and long-term revisions to the requirements for lead.[60]

[58] The Method A ground water cleanup level was based on the proposed MCLG published by EPA.

[59] OEHHA. 2009. Public Health Goal for Lead in Drinking Water. Prepared by Pesticide and Environmental Toxicology Branch, Office of Environmental Health Hazard Assessment, California Environmental Protection Agency. April 2009.

[60] EPA. 2010. National Primary Drinking Water Regulations; Announcement of the Results of EPA's Review of Existing Drinking Water Standards and Request for Public Comment and/or Information on Related Issues. 75 FR 15500 at 15506.

MTCA Rulemaking Options

Ecology has reviewed the new scientific and regulatory information and believes it is appropriate to consider revisions to the MTCA cleanup level. Ecology has considered four main options for resolving this rulemaking issue:

1. No Revision. Under this option, the Method A ground water cleanup level would remain 15 ug/L.
2. Revision Based on Target Blood Lead Level of 5 ug/dL. Under this option, Ecology would update the general risk policies relevant to ground water and soil cleanup levels and establish a new Method A ground water cleanup level for lead of 10 ug/L.
3. Revision Based on Target Blood Lead Level of 2 ug/dL. Under this option, Ecology would establish a new Method A ground water cleanup level of 6 ug/L.
4. Revision Based on Target Blood Lead Level of 1 ug/dL. Under this option, Ecology would establish a new Method A ground water cleanup level that is 3 ug/L or ground water background levels, whichever is higher.

Draft Revisions and Rationale

Ecology has received several comments from members of the MTCA/SMS Advisory Group on options for revising the Method A ground water and soil cleanup levels for lead. Most of those comments have focused on the Method A soil cleanup levels. Ecology wants to finish reviewing those comments before proposing revision to Method A values.

17. Lindane

Background

Ecology established the current MTCA Method A ground water cleanup level for lindane (0.2 ug/L) when the initial cleanup levels were published in 1991. The Method A cleanup level is based on applicable state and federal law (WAC 246-290-310 and 40 C.F.R. 141.62).[61]

Ecology reviewed the Method A value during the 2001 rule revision process, but elected not to revise it. Available information indicated the Method A value was sufficiently protective.

There have been several scientific and regulatory developments since the 2001 rule revisions. These include the following:

- EPA Six Year Review of Drinking Water Standards (2003). EPA completed a review of the federal drinking water standards in 2003. With respect to the federal standard for lindane, EPA revised the RfD from 0.0003 mg/kg/day to 0.0047 mg/kg/day. However, EPA could not determine whether a revision to the federal standard would provide a meaningful opportunity for cost savings to public water systems or their customers.
- Review of California Public Health Goal (PHG). The Office of Environmental Health Hazard Assessment (OEHHA) established a PHG of 0.032 ug/L for lindane in 1999.[62] The 1999 PHG was developed using a cancer slope factor of 1.1 $(mg/kg\text{-}day)^{-1}$ that was developed using incidence data of hemangiosarcomas in male rats. In 2005, OEHHA completed a review of the PHG and confirmed that the earlier analysis remained consistent with available data. [63] They concluded that no revisions were needed. However, they noted that if the PHG document were revised, it would be appropriate to revise the cancer slope factor using a cross-species scaling factor of three fourths (3/4) instead of the two thirds (2/3) scaling factor used in 1999. This modification would result in a revised PHG of 0.06 ug/L.
- EPA Six Year Review of Drinking Water Standards (2010). EPA completed a review of the federal drinking water standards in March 2010. With respect to the federal standard for lindane, EPA noted that new toxicological assessments could support a revised MCLG/MCL in a range between 1 and 30 ug/L (depending on the choice of uncertainty factors). However, EPA concluded "…[a]lthough there are new data that support consideration of whether to revise the MCLG/MCL for lindane, EPA does not believe a revision to the NPDWR for lindane is appropriate at this time…"[64]

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[61] EPA published the current drinking water standard for lindane in January 1991 (56 FR 3526). EPA established an MCLG and MCL of 0.2 ug/L. EPA developed this value using an RfD of 0.0003 mg/kg/day. This is the current IRIS value. EPA classified lindane as a Group C carcinogen (Possible human carcinogen).

[62] OEHHA. 1999. Public Health Goal for Lindane in Drinking Water. Prepared by the Office of Environmental Health Hazard Assessment, California Environmental Protection Agency.

[63] Avalos, J. 2005. Update of PHG - Lindane. Memorandum to Val F. Siebal, Chief Deputy Director of the Office of Environmental Health Hazard Assessment (June 2, 2005).

[64] EPA. 2010. National Primary Drinking Water Regulations; Announcement of the Results of EPA's Review of Existing Drinking Water Standards and Request for Public Comment and/or Information on Related Issues. 75 FR 15500 at 15559.

MTCA Rulemaking Options

Ecology does not plan to revise the Method A cleanup level for lindane. EPA has not updated the IRIS toxicological parameters for lindane. Ecology acknowledges that the results from more recent EPA toxicological assessments were discussed in EPA's review of the federal drinking water standards. The more recent toxicological assessments might provide support for calculating a higher ground water cleanup level using Equation 720-1.

However, the Method A ground water cleanup level must also comply with applicable state and federal drinking water standards. Neither EPA nor the Washington DOH has revised the drinking water standard for lindane. Consequently, raising the Method A cleanup level for lindane would be inconsistent with the statutory requirement that cleanup standards must be "…at least as stringent as all applicable state and federal laws, including health-based standards under state and federal law…"

18. Mercury

Background

Ecology established the current MTCA Method A ground water cleanup level for mercury when the initial cleanup standards were published in 1991. The Method A cleanup level is based on applicable state and federal law (WAC 246-290-310 and 40 C.F.R. 141.62).[65]

Ecology reviewed the Method A value during the 2001 rule revision process, but elected not to revise it. Information available at that time indicated the Method A value was sufficiently protective.

There have been several scientific and regulatory developments since the 2001 rule revisions. These include the following:

- California Public Health Goal Update. The California EPA re-evaluated information on mercury health risks and concluded that the public health goal for inorganic mercury should be remain at 1.2 ug/L.[66]
- EPA Six Year Review of Drinking Water Standards. EPA completed a review of the federal drinking water standards in March 2010. With respect to the federal standard for inorganic mercury, EPA concluded "…EPA's review shows that there are no data supporting a change to the inorganic mercury NPDWR. As a result, a revision to the NPDWR would not be appropriate at this time…" [67]

MTCA Rulemaking Options

Ecology does not plan to revise the Method A cleanup level for inorganic mercury. EPA has not updated the IRIS toxicological parameters for mercury or revised the federal drinking water standard since the 2001 rule revisions. The Washington DOH has not revised the state drinking water standard for mercury during that time period.

[65] EPA published the current drinking water standard for inorganic mercury in January 1991 (56 FR 3526). EPA established an MCLG and MCL of 2 ug/L. EPA developed this MCLG/MCL using a drinking water equivalent level (DWEL) of 10 ug/L. This is equivalent to a RfD of 0.0003 mg/kg/day. This is the current IRIS value. EPA classified mercury as a Group D carcinogen (not classifiable as to human carcinogenicity) by the oral route of exposure.

[66] Jowa, L. 2005. Update of PHG for Inorganic Mercury. Memorandum to Val F. Siebal, Chief Deputy Director of the Office of Environmental Health Hazard Assessment (May 13, 2005).

[67] EPA. 2010. National Primary Drinking Water Regulations; Announcement of the Results of EPA's Review of Existing Drinking Water Standards and Request for Public Comment and/or Information on Related Issues. 75 FR 15500 at 15526.

19. Methylene Chloride

Background

Ecology established the current MTCA Method A ground water cleanup level for methylene chloride when the initial cleanup standards were published in 1991. The Method A cleanup level was calculated using the ground water cleanup equations.

Ecology reviewed the Method A value during the 2001 rule revision process, but elected not to revise it.[68] Information available at that time indicated the Method A value was sufficiently protective. However, Ecology revised the explanatory notes to state that the Method A value is based on applicable state and federal law (WAC 246-290-310 and 40 C.F.R. 141.62).[69]

There have been several scientific and regulatory developments since the 2001 rule revisions. These include the following:

- EPA Six Year Review of Drinking Water Standards (2003). EPA completed a review of the federal drinking water standards in 2003. With respect to the federal standard for methylene chloride, EPA revised the RfD from 0.0003 mg/kg/day to 0.0047 mg/kg/day. However, EPA could not determine whether a revision to the federal standard would provide a meaningful opportunity for cost savings to public water systems or their customers.
- EPA Six Year Review of Drinking Water Standards (2010). EPA completed a review of the federal drinking water standards in March 2010. With respect to the federal standard for methylene chloride (dichloromethane), EPA concluded "…[t]he Agency does not believe a revision to the NPDWR for dichloromethane is appropriate at this time because a reassessment of the health risks resulting from exposure to dichloromethane is in progress (USEPA, 2009b). In view of the fact that dichloromethane is a common laboratory contaminant, there is uncertainty regarding the extent to which a PQL revision is feasible or whether the Six Year Review ICR data are reliable at concentrations well below the current PQL. Furthermore, the occurrence and exposure analysis based on possible changes in analytical feasibility indicates that any revision to the MCL is unlikely to provide a meaningful opportunity for public health protection…" [70]

[68] The ground water cleanup level calculated using Equation 720-2 and the IRIS cancer slope factor available in 2001 (0.0075 $(mg/kg/day)^{-1}$) is 6 ug/L. Cleanup levels also have to comply with applicable state and federal requirements.

[69] EPA published the current drinking water standard for methylene chloride in July 1992 (57 FR 31776). EPA established an MCLG of zero based on a cancer classification of B2 (probable human carcinogen). The drinking water standard also established an MCL of 5 ug/L based on analytical feasibility.

[70] EPA. 2010. National Primary Drinking Water Regulations; Announcement of the Results of EPA's Review of Existing Drinking Water Standards and Request for Public Comment and/or Information on Related Issues. 75 FR 15500 at 15536.

- EPA Toxicological Assessment. In March 2010, EPA distributed a draft toxicological review for dichloromethane (methylene chloride). [71] The draft review includes an updated oral cancer slope factor of 0.002 $(mg/kg/day)^{-1}$) that is based on increased incidence of liver tumors in mice exposed to methylene chloride in drinking water. The draft review also includes an inhalation unit risk (IUR) of 1 x 10^{-8} $(ug/m^3)^{-1}$ that is based on development of liver and lung tumors in mice exposed to airborne methylene chloride. The draft report is currently undergoing external peer review. A Method B ground water cleanup level of 22 ug/L can be calculated using the draft oral cancer slope factor and Equation 720-2.

MTCA Rulemaking Options

Ecology does not plan to revise the Method A cleanup level for methylene chloride. EPA has not updated the IRIS toxicological parameters for methylene chloride. However, EPA has published a draft oral cancer slope factor (0.002 $(mg/kg/day)^{-1}$) for external review. Ecology acknowledges that the results from the draft EPA toxicological assessment might provide support for a higher cleanup level. However, neither EPA nor Washington DOH has updated the drinking water standard for methylene chloride. Consequently, raising the Method A cleanup level for methylene chloride would be inconsistent with the statutory requirement that cleanup standards must be "…at least as stringent as all applicable state and federal laws, including health-based standards under state and federal law…"

[71] EPA. 2010. Toxicological Review of Dichloromethane (Methylene Chloride) (CAS No. 75-09-2) In Support of Summary Information on the Integrated Risk Information System (IRIS). U.S. Environmental Protection Agency. Washington DC. March 2010.

20. MTBE

Background

Ecology developed the current MTCA Method A ground water cleanup level for methyl tert butyl ether (MTBE) (20 ug/L) when the rule was revised in February 2001. The Method A value was based on drinking water standard advisory published by the Environmental Protection Agency.[72]

There have been several scientific and regulatory developments since the 2001 rule revisions. These include the following:

- Oral Cancer Slope Factor. The Office of Environmental Health Hazard Assessment (OEHHA) has developed a cancer slope factor for MTBE (0.0018 $(mg/kg/day)^{-1}$).[73] This value is included in the Regional Screening Tables published by the USEPA and the Oak Ridge National Laboratory in May 2010. Ecology has calculated MTCA ground water cleanup levels using the Equation 720-2 and the OEHHA cancer slope factor and equation 720-2. The calculated values vary from 16 to 24 ug/L with the difference due to the assumptions used to estimate inhalation risks.[74] The Regional Screening Tables include a MTBE screening level for tap water (13 ug/L).

MTCA Rulemaking Options

Ecology does not plan to revise the Method A cleanup level for MTBE. EPA has not revised the drinking water advisory for MTBE. Neither EPA nor Washington DOH has established a drinking water standard for MTBE. Ground water cleanup levels based on cancer risks are similar to the current Method A value.

[72] EPA-822-F-97-009, December 1997.

[73] The Office of Environmental Health Hazard Assessment (OEHHA) developed the cancer slope factor for MTBE when preparing the public health goal for MTBE in drinking water. The PHG for MTBE (13 ug/L) was published in March 1999. OEHHA calculated a range of cancer slope factors using the Linearized Multi-Stage (LMS) model and the results from several cancer bioassays. The cancer slope factor established by OEHHA represents the geometric mean of the cancer slope factors derived from three studies.

[74] The Regional Screening Tables indicates that inhalation exposure is about 2 times higher than ingestion exposure. This is consistent with an inhalation correction factor of 3. The Method B ground water cleanup level calculated using equation 720-1 and an inhalation correction factor of 3 is 16 ug/L.

21. Naphthalene

Background

Ecology developed the current MTCA Method A ground water cleanup level for naphthalenes (160 ug/L) when the rule was revised in February 2001. This is a total value for naphthalene, 1-methyl naphthalene and 2-methyl naphthalene. The Method A ground water cleanup level was calculated using Equation 720-1 and the oral reference dose (RfD published in the Integrated Risk Information System (IRIS) database. The oral RfD for naphthalene (0.02 mg/kg/day) was established in 1998.

There have been several scientific and regulatory developments since the 2001 rule revisions. These include the following:

- EPA Inhalation Risk Assessment Guidance. EPA published revisions to the Superfund procedures for evaluating health risks resulting from inhalation exposure in early 2009. The updated guidance (*Risk Assessment Guidance for Superfund: Volume I: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment)*[75]*).* Part F is designed to promote consistent implementation of EPA's procedures for assessing inhalation risks[76]. Key differences between the MTCA rule and the updated EPA guidance include the following:
    - EPA recommends that risk assessors use the air concentration of a chemical as the exposure metric (e.g., ug/m^3) when evaluating inhalation risks. This differs from RAGS Part A and MTCA equations that use intake (mg/kg-d) as the exposure metric.
    - EPA recommends that risk assessors not use inhalation toxicity values generated using simple route-to-route extrapolation.
- Cancer Slope Factors/Inhalation Unit Risk Factors. In 2002, the National Toxicology Program completed a review of current toxicity information and concluded that naphthalene is *reasonably anticipated to be a human carcinogen*.[77] The International Agency for Research on Cancer has also concluded there is sufficient evidence for the carcinogenicity of naphthalene in experimental animals.[78] Since the 2001 rule revisions, EPA has evaluated the information on the carcinogenicity of 1-methylnaphthalene and 2-methylnaphthalene. With respect to 1-methylnaphthalene, EPA concluded it is *likely to be carcinogenic in humans* and developed an oral cancer slope factor (0.029 $(mg/kg/day)^{-1}$) that was published as a Provisional Peer Reviewed Toxicity Value

[75] EPA. 2009. Risk Assessment Guidance for Superfund. Volume I: Part F, Supplemental Guidance for Inhalation Risk Assessment. Office of Superfund Remediation & Tech. Innovation. Washington D.C. EPA-540-R-070-002.

[76] EPA.1994. Methods for Derivation of Inhalation Reference Concentrations and Application of Inhalation Dosimetry

[77] National Toxicology Program. 2002. Report on Carcinogens Background Document for Naphthalene. NTP.

[78] IARC. 2002. Traditional Herbal Medicines, Some Mycotoxins, Naphthalene and Styrene. IARC Monographs on the evaluation of Carcinogenic Risks to Humans. Volume 82. Lyon, France.

(PPRTV).[79] With respect to 2-methylnaphthalene, EPA concluded that available data were *inadequate to assess human carcinogenic potential*.[80] In 2005, the Office of Environmental Health Hazard Assessment (OEHHA) published an inhalation unit risk factor for naphthalene (0.000034 $(ug/m^3)^{-1}$).

MTCA Rulemaking Options

Ecology has reviewed the new scientific and regulatory information and believes it is appropriate to consider revisions to the MTCA cleanup level. Ecology has considered five main options for resolving this rulemaking issue:

1. No Revision. Under this option, the Method A ground water cleanup level would remain 160 ug/L.
2. Revisions based on IRIS Reference Dose and Reference Concentration for Naphthalene. Under this option, Ecology would lower the Method A ground water cleanup level to 10 ug/L. The draft value was calculated using the EPA Regional Screening Equation (tap water – carcinogenic risks) and the oral reference dose and reference concentration for naphthalene that are published in the IRIS database.
3. Revisions based on EPA Cancer Slope Factor for 1-Methylnaphthalene. Under this option, Ecology would lower the Method A ground water cleanup level for naphthalene to 10 ug/L. The draft value for this option was calculated in the following manner:
   - A Method B ground water cleanup level was calculated for 1-methylnaphthalene of 3 ug/L is calculated using MTCA equation 720-2 and the cancer slope factor (0.029 $(mg/kg/day)^{-1}$) developed by National Center for Environmental Assessment. For purposes of this calculation, Ecology used an inhalation correction factor of 1 (in other words, the oral cancer slope factor would not be used to estimate cancer risks via the inhalation pathway).
   - The cleanup level 1-methylnaphthalene was used to develop a cleanup level for naphthalene based on the assumption that 1-methylnaphthalene represents 30% of total naphthalene mixture.
4. Revisions based on OEHHA Inhalation Unit Risk Factor for Naphthalene. Under this option, Ecology would lower the Method A ground water cleanup level to 1 ug/L. The revised value was calculated using the EPA Regional Screening Equation (tap water – carcinogenic risks) and the OEHHA inhalation unit risk factor (0.000034 $(ug/m^3)^{-1}$). The calculated value is based on inhalation exposure only (in other words, the IUR value would not be used to estimate cancer risks via the ingestion pathway).
5. Revisions based on the vapor intrusion pathway. Under this option, Ecology would lower the Method A ground water cleanup level to a value somewhere between 9 ug/L

[79] EPA. Regional Screening Levels for Chemical Contaminants at Superfund Sites. December 2009. http://www.epa.gov/reg3hscd/risk/human/rb-concentration_table/index.htm [EPA/ORNL updated the Regional Screening Tables on May 17, 2010. No changes were made to the toxicity values for naphthalene compounds].

[80] EPA. 2003. Toxicological Review of 2-Methylnaphthalene (CAS No. 91-57-6) in Support of Summary Information for the Integrated Risk Information System (IRIS). EPA, Washington DC. December 2003.

and 90 ug/L. The revised value is calculated using the inhalation unit risk factor (0.000034 $(ug/m^3)^{-1}$) developed by OEHHA and the methods described in the draft vapor intrusion guidance document distributed for public review in October 2009. The range of draft cleanup levels was calculated using a range of vapor attenuation factors (0.001 to 0.0001).

Summary of Options for Revising the Method A Ground Water Cleanup Level for Naphthalene				
Option	Oral Reference Dose/ Reference Concentration	Cancer Slope Factor/ Inhalation Unit Risk	Cleanup Level Equation	Cleanup Level
1	RfD_o = 0.02 mg/kg/day	NA	MTCA Equation 720-1	160 ug/L
2	RfD_o = 0.02 mg/kg/day RfD_i = 8.6E-04 mg/kg/day[81]	NA	EPA Regional Screening Equations (tap water)	10 ug/L
3	NA	CSF_o = 0.029 $(mg/kg/day)^{-1}$	MTCA Equation 720-2	10 ug/L
4	NA	IUR = 0.000034 $(ug/m^3)^{-1}$	EPA Regional Screening Equations (tap water)	1 ug/L
5	NA	IUR = 0.000034 $(ug/m^3)^{-1}$	MTCA Equation 750-2 and Method for GW Screening Levels in Ecology Guidance (VAF = 0.001 to 0.0001)	9- 90 ug/L

Draft Revisions and Rationale

Ecology is considering revisions to the Method A ground water cleanup level for naphthalene based on recent scientific information on the carcinogenic risks associated with naphthalene exposure.

Ecology received several comments relevant to this issue. For example, two members provided the following comment:

> *…[t]he proposed changes to the cleanup levels for chromium VI, ethylbenzene, and naphthalene are not warranted at this time, as the toxicity values being considered by Ecology are not published in IRIS, HEAST or NCEA guidance, and Ecology has not demonstrated a clear and convincing need to use alternate values. Therefore, revisions to these Method A values should not be pursued during the current rule making. (Patty Boyden and Mike Stoner, May 27, 2010 Comments on Proposed MTCA-SMS Rule Revisions)*

Other members expressed the opinion that it is appropriate to consider other sources of toxicity information when updating the cleanup levels in the CLARC database (and by extension the MTCA rule which provides the basis for the CLARC values). For example:

[81] This corresponds to a reference concentration (RfC) of 3.0E-03 mg/m^3.

On the hierarchy of toxicological information IRIS is indeed the gold standard but as noted is a lengthy process to complete. Regional screening tables are reasonable to use for a basis to update the CLARC data base. Annual updates should be sufficient unless an emerging issue is identified with a new chemical. (Larry Dunn, April 27, 2010 Comments on the MTCA and SMS Issues Under Review)

Ecology is still evaluating the options identified above and has not reached a final decision on whether and how to proceed with rule revisions. In light of the above comments, Ecology will complete the following activities to support agency decision-making on this issue:

- MTCA/SMS Advisory Group Review: Ecology will be discussing cleanup level revisions at MTCA/SMS Advisory Group meetings held in the Summer/Fall of 2010.
- Vapor Work Group Review: Ecology will be discussing several issues relevant to the naphthalene cleanup level at Vapor Work Group meetings.
- Quality of Information Analysis and Science Panel Review: Ecology recognizes that the decision to base naphthalene cleanup levels on carcinogenic risks represents a major change from past procedures. Consequently, Ecology is currently evaluating this issue using the quality of information criteria in WAC 173-340-702(16). Ecology plans to present the results of this analysis to the MTCA Science Panel for review and comment at meetings held in the Fall of 2010.
- Implications for Cleanup Actions and Restoration Time Frames: Ecology will be evaluating available data to estimate how a revised cleanup level for naphthalene might impact cleanup investigations, cleanup actions and restoration timeframes.
- Action Levels/Implementation Guidance: Ecology will consider other rule or guidance changes (e.g., action levels and/or model remedies for common cleanup situations) needed to implement a revised cleanup level.

22. Polycyclic Aromatic Hydrocarbon (PAH) Mixtures

Background

Ecology developed the current MTCA Method A ground water cleanup level for carcinogenic PAHs (0.1 ug/L) when the initial cleanup standards were established in 1991. The Method A cleanup level was calculated using Equation 720-2 and a cancer slope factor of 7.3 $(mg/kg/day)^{-1}$. Ecology reviewed the Method A value during the 2001 rule revision process, but elected not to revise it. Information available at that time indicated the Method A value was sufficiently protective.

There have been several scientific and regulatory developments since the 2001 rule revisions. These include the following:

- Guidance on Early Life Stage Considerations. EPA[82] and California[83] have adopted methods and policies for adjusting cancer slope factors and/or cancer risk estimates to take into account child susceptibility to carcinogenic substances. EPA's policies apply to carcinogens that act via a mutagenic mode of action (including several PAH compounds); the California EPA policies apply to all carcinogens.
- MTCA Mixtures Rule Amendment. Ecology reviewed the Method A value during the 2007 rule revision process but elected not to revise it. However, Ecology added clarifying language that specifies that when other carcinogenic PAHs are suspected of being present at the site, investigators should test for them and use this value as the total concentration that all carcinogenic PAHs must meet using the toxicity equivalency methodology in WAC 173-340-708(8).
- California Public Health Goal. The California EPA has proposed a new public health goal (0.013 ug/L) for BaP in February 2010. [84] As part of that effort, the California EPA developed an oral cancer slope factor $(1.7\ (mg/kg/day)^{-1})$ for BaP. BaP is the index chemical used to assess PAH mixtures.
- EPA Six Year Review of Drinking Water Standards. EPA completed a review of the federal drinking water standards in March 2010. With respect to the federal standard for BaP, EPA concluded "…[t]he Agency does not believe a revision to the NPDWR for benzo[a]pyrene is appropriate at this time because a reassessment of the health risks resulting from exposure to benzo[a]pyrene is in progress (USEPA, 2009b).

[82] USEPA. 2005. Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens. U.S. Environmental Protection Agency, Risk Assessment Forum, March 2005. EPA/630/R-03/003F.

[83] OEHHA. 2008. Air Toxics Hot Spots Program Risk Assessment Guidelines, Part II, Technical Support Document for Cancer Potency Factors, June 2008, Public Review Draft, California Environmental Protection Agency, Office of Environmental Health Hazard Assessment.

[84] OEHHA. 2010. Public Health Goal for Benzo[a]pyrene in Drinking Water. Prepared by Pesticide and Environmental Toxicology Branch, OEHHA, California Environmental Protection Agency. February 2010.

Furthermore, a review of analytical feasibility did not identify a potential to revise the MCL, which is limited by feasibility…"[85]

- EPA Review of PAH Mixtures. In March 2010, EPA published a draft toxicological review of PAH mixtures.[86] The document reviews the scientific rationale for using a relative potency factor (RPF) approach to assess cancer risks from exposure to PAH mixtures. The RPF analysis provides a cancer risk estimate for PAH mixtures by summing doses of component PAHs after scaling the doses (with RPFs) relative to the potency of an index PAH (i.e., BaP). The cancer risk is then estimated using the dose-response curve for the index PAH. This approach builds on earlier EPA guidance.[87] However, it incorporates more recent scientific information, includes a broader range of PAH compounds (27 compounds vs. 7 compounds addressed in the 1993 guidance) and provides a level of confidence (high, medium, low) for each RPF value. EPA did not propose revisions to the cancer slope factor for the index chemical (BaP).

MTCA Rulemaking Options

Ecology received comments from several members of the MTCA/SMS Advisory Group on the application of the early-life stage adjustments to PAH mixtures. One member recommended that Ecology consider this issue in light of the 2007 rule revisions.

> *I would like to briefly provide input on the issue of taking early life history exposures into account in MTCA rule revisions. Ecology has taken steps in this direction before, with this issue being one of the drivers for the 2007 rule revision clarifying that the 10^{-6} risk level applies for cPAHs, dioxins, and similar families of chemicals (rather than the 10^{-5} risk level that arguably otherwise would be applicable for mixtures). The Concise Explanatory Statement for that rulemaking justified what amounts to a 10-fold decrease in cleanup levels for these families of chemicals as follows:*
>
> > *"Ecology believes that the proposed approach provides a margin of safety that minimizes the potential health risks resulting from early-life exposures to carcinogenic PAHs." (CES Issue 4-3, page 92)*
>
> *Now that we have the 10^{-6} risk level in place, Ecology seems to have forgotten about the "margin of safety" that was only recently included in the regulations to account for more susceptible populations. I am not arguing that early life history exposures should be ignored, I am only pointing out that we seem to have accepted the 10^{-6} risk level as the new baseline from which we are operating, and are now factoring in additional reasons for conservatism that will push the cleanup levels even lower (and in many instances to levels that may be below background concentrations in urban and other areas).*

[85] EPA. 2010. National Primary Drinking Water Regulations; Announcement of the Results of EPA's Review of Existing Drinking Water Standards and Request for Public Comment and/or Information on Related Issues. 75 FR 15500 at 15526.

[86] EPA. 2010. Development of a Relative Potency Factor (RPF) Approach for Polycyclic Aromatic Hydrocarbon (PAH) Mixtures In Support of Summary Information on the Integrated Risk Information System (IRIS) *February 2010*.

[87] EPA. 1993. Provisional Guidance for Quantitative Risk Assessment of PAHs (Provisional Guidance).

Before Ecology pushes the rules further in the direction of creating the same kind of problems we currently have with sediment cleanup levels (risk based levels that are an order of magnitude or more below even natural background levels for some contaminants), the agency should take fully into account its earlier efforts to make sure there is a "margin of safety" in the rules as they already exist. (Tom Newlon, June 2, 2010 e-mail to Martha Hankins)

The risk posed by early-life stage exposure was one of several factors considered by Ecology when deciding how to establish Method B cleanup levels for carcinogenic PAH mixtures. However, Ecology believes that Mr. Newlon has raised a legitimate policy issue and would like to get feedback from the MTCA/SMS Advisory Group on the following question:

Should Ecology reconsider the MTCA policy for establishing Method B cleanup levels for carcinogenic PAH mixtures when adjusting the cancer slope factor to account for early-life stage exposure? Specifically, should Ecology establish Method B cleanup levels for PAH mixtures using a target cancer risk of 10^{-5} (instead of 10^{-6})?

23. Polychlorinated Biphenyl (PCB) Mixtures

Background

Ecology established the current MTCA Method A ground water cleanup level for PCB mixtures (0.1 ug/L) when the initial cleanup standards were published in 1991. The Method A value was based on drinking water standards specified in WAC 246-290-310 and 40 C.F.R. 141.61 with an adjustment based on analytical considerations.

Ecology reviewed the Method A value during the 2001 and 2007 rule revision processes, but elected not to revise it. Information available at that time indicated the Method A value was sufficiently protective.

There have been several scientific and regulatory developments since the 2001 rule revisions. These include the following:

- MTCA Mixtures Rule Amendment. Ecology reviewed the Method A value during the 2007 rule revision process, but elected not to revise it. However, Ecology added rule language to clarify that when using congener analyses, compliance with cleanup standards is based on the whole mixture using the toxicity equivalency methodology in WAC 173-340-708(8).
- California Public Health Goal. In October 2007, the Office of Environmental Health Hazard Assessment (OEHHA) proposed a new public health goal (0.09 ug/L) for water soluble polychlorinated biphenyls expected to be found in drinking water.[88] OEHHA followed EPA's guidance on PCB mixtures and used the mid-range oral cancer slope factor (0.4 $(mg/kg/day)^{-1}$) to calculate the proposed PHG. As of May 2010, the California EPA had not finalized the revised PHG for PCB mixtures.
- EPA Six Year Review of Drinking Water Standards. EPA completed a review of the federal drinking water standards in March 2010. With respect to the federal standard for PCBs, EPA concluded "…[t]he Agency does not believe a revision to the NPDWR for polychlorinated biphenyls is appropriate at this time because a reassessment of the health risks resulting from exposure to PCBs is in progress (USEPA, 2009b). Furthermore, a review of analytical feasibility did not identify a potential to revise the MCL, which is limited by feasibility…" [89]
- Dioxin Reassessment. In May 2010, EPA completed a re-analysis of key issues related to the toxicity of dioxin-like compounds that were raised by the National Research Council and other interested parties.[90] EPA's review of issues surrounding

[88] OEHHA. 2007. Public Health Goal for Water Soluble Polychlorinated Biphenyls Expected to be Found in Drinking Water. Prepared by Pesticide and Environmental Toxicology Branch, OEHHA, California Environmental Protection Agency. October 2007.

[89] EPA. 2010. National Primary Drinking Water Regulations; Announcement of the Results of EPA's Review of Existing Drinking Water Standards and Request for Public Comment and/or Information on Related Issues. 75 FR 15500 at 15526.

[90] EPA. 2010. EPA's Reanalysis of Key Issues Related to Dioxin Toxicity and Response to NAS Comments. National Center for Environmental Assessment, Office of Research and Development, U.S. Environmental Protection Agency. May 2010.

the oral cancer slope factor is particularly relevant to the MTCA rulemaking process. EPA calculated cancer slope factors for 2,3,7,8 tetrachlorodibenzo[p]dioxin (TCDD)[91] at specific risk target levels ranging from 1.1×10^{5} to 1.3×10^{6} $(mg/kg/day)^{-1}$. EPA recommended that an oral cancer slope factor of 1×10^{6} $(mg/kg/day)^{-1}$ be used when the target cancer risk range is 10^{-5} to 10^{-7}.

MTCA Rulemaking Options

Ecology does not plan to revise the Method A cleanup level for PCB mixtures. Ecology acknowledges that the results from EPA toxicological assessments of dioxins, furans and dioxin-like PCBs might ultimately provide support for a revised value. However, EPA has not updated the IRIS toxicological parameters for PCB mixtures or revised the federal drinking water standard since the 2007 rule revisions. The Washington DOH has not revised the state drinking water standard.

[91] TCDD is the index chemical when applying the TEQ approach to dioxin-like PCBs.

24. Radium 226 & 228 (Combined Radiums) and Radium 226

Background

Ecology established the current MTCA Method A ground water cleanup level for radium 226 and 228 (5 pCi/L) and radium 226 (3 pCi/L) when the initial cleanup standards were published in 1991. The Method A cleanup levels are based on applicable state and federal law (WAC 246-290-310 and 40 C.F.R. 141.62).[92]

Ecology reviewed the Method A values during the 2001 rule revision process, but elected not to revise them. Information available at that time indicated the Method A value was sufficiently protective.

EPA completed a review of the federal drinking water standards in March 2010. With respect to the federal standard for radium 226 and 228, EPA concluded "…[t]he Agency does not believe a revision to the NPDWR for combined radiums is appropriate at this time because a reassessment of the health risks resulting from exposure to radium is in progress (USEPA, 2009b). Furthermore, there is no new information regarding analytical or treatment feasibility that would warrant reconsideration of the MCL…" [93]

MTCA Rulemaking Options

Ecology does not plan to revise the Method A cleanup level for radium 226 and 228. EPA is currently reassessing the health risks from exposure to radium. However, EPA has not updated the IRIS toxicological parameters or revised the federal drinking water standard since the 2001 rule revisions. The Washington DOH has not revised the state drinking water standard.

[92] EPA published an interim drinking water standard and set an MCL of 5 pCi/L for radium 226 and 228 in July 1976 (41 FR 28402). The MCL was based on analytical feasibility. In December 2000, EPA established an MCLG of zero for radium 226 and 228 based on a cancer classification of A (known human carcinogen) and finalized the MCL of 15 pCi/L.

[93] EPA. 2010. National Primary Drinking Water Regulations; Announcement of the Results of EPA's Review of Existing Drinking Water Standards and Request for Public Comment and/or Information on Related Issues. 75 FR 15500 at 15556.

25. Tetrachloroethylene

Background

Ecology developed the current MTCA Method A ground water cleanup level for tetrachloroethylene (5 ug/L) when the initial cleanup standards were published in 1991. The Method A cleanup level is based on applicable state and federal law (WAC 246-290-310 and 40 C.F.R. 141.61).[94]

Ecology reviewed the Method A value during the 2001 rule revision process, but elected not to revise it. Information available at that time indicated the Method A value was sufficiently protective.

There have been several scientific and regulatory developments since the 2001 rule revisions. These include the following:

- California Public Health Goal. In August 2001, the Office of Environmental Health Hazard Assessment (OEHHA) published a new public health goal (0.06 ug/L) for tetrachloroethylene.[95] As part of that effort, OEHHA developed an oral cancer slope factor (0.54 $(mg/kg/day)^{-1}$) for tetrachloroethylene.
- EPA Reassessment of Toxicological Information. In June 2008, EPA distributed a draft toxicological review for tetrachloroethylene.[96] The draft review includes an updated oral reference dose (RfD = 0.004 mg/kg/day), reference concentration (RfC = 0.016 mg/m3) and inhalation unit risk factor (IUR = 2 x 10-5 $(ug/m^3)^{-1}$. The National Research Council completed a review of the draft document in early 2010 and recommended that EPA reassess several issues.
- CLARC Revisions. In November 2008, Ecology updated the toxicological parameters for tetrachloroethylene included in the CLARC database.[97] Ecology replaced the CLARC Version 3.1 value ($(0.051 (mg/kg/day)^{-1}$) with the value developed by the OEHHA (see above). Ecology also revised the CLARC entries for the inhalation cancer slope factor. The updated inhalation slope factor ($(0.021 mg/kg/day)^{-1}$) was also based on work by the OEHHA.[98]

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[94] EPA published the current drinking water standard for tetrachloroethylene in January 1991 (56 FR 3526). EPA established a MCLG of zero based on tetrachloroethylene classification as a probable human carcinogen (B2). The Maximum Contaminant Limit (MCL) of 5 ug/L was based on analytical feasibility.

[95] OEHHA. 2001. Public Health Goal for Tetrachloroethylene in Drinking Water. Prepared by the Office of Environmental Health Hazard Assessment, California Environmental Protection Agency. August 2001.

[96] EPA. 2008. Toxicological Review of Tetrachloroethylene (Perchloroethylene) (CAS No. 127-18-4) In Support of Summary Information on the Integrated Risk Information System (IRIS). External Review Draft. U.S. Environmental Protection Agency. Washington DC. June 2008.

[97] Department of Ecology. 2008. Tetrachloroethylene Toxicity Information (Perc, PCE, Perchloroethylene) CAS # 127-18-4. Available at: https://fortress.wa.gov/ecy/clarc/FocusSheets/TCE%20PCE%20Oct%202004%20Final.pdf

[98] OEHHA has published a unit risk factor for tetrachloroethylene (5.96E-06 per ug/m^3)

- Draft Ecology Vapor Intrusion Guidance. Ecology published a draft vapor intrusion guidance document for public review and comment in late 2009.[99] The draft guidance document included ground water screening levels based on preventing the accumulation of hazardous substance in building located near contaminated groundwater. The draft ground water screening level for tetrachloroethylene is 1 ug/L. This screening value was calculated using a vapor attenuation factor (VAF) of 0.001.
- EPA Six Year Review of Drinking Water Standards. EPA completed a review of the federal drinking water standards in March 2010. With respect to the federal standard for tetrachloroethylene, EPA concluded "…[t]he Agency believes it is appropriate to revise the NPDWR for tetrachloroethylene although a health effects assessment is currently in progress. The existing MCLG is zero (based on current B2 cancer classification) and the current MCL is based on a PQL (i.e., analytical feasibility) of 0.005 mg/L. The Agency's review indicates that analytical feasibility could be as much as 10 times lower (0.0005 mg/L) and occurrence at this level appears to be relatively widespread. Hence, revisions to the NPDWR may provide a meaningful opportunity for health risk reduction. Furthermore, the occurrence and exposure analysis based on possible changes in analytical feasibility indicate that any revision to the MCL is unlikely to provide a meaningful opportunity to improve public health protection…"[100]

MTCA Rulemaking Options

Ecology does not plan to revise the Method A cleanup level for tetrachloroethylene. EPA has not revised the toxicological parameters for DDT since the 2001 MTCA rule amendments. EPA and Washington DOH have not established a drinking water standard for tetrachloroethylene.

[99] Department of Ecology. 2009. Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action (Draft). Washington State Department of Ecology, Toxics Cleanup Program.

[100] EPA. 2010. National Primary Drinking Water Regulations; Announcement of the Results of EPA's Review of Existing Drinking Water Standards and Request for Public Comment and/or Information on Related Issues. 75 FR 15500 at 15558.

26. Toluene

Background

Ecology established the initial MTCA Method A ground water cleanup level for toluene (40 ug/L) when the initial cleanup standards were established in 1991. The Method A value was based on applicable state and federal requirements (i.e., drinking water standards specified in WAC 246-290-310 and 40 C.F.R. 141.61)[101] and prevention of adverse aesthetic characteristics.

Ecology reviewed the Method A value during the 2001 rule revision process. Based on that review, Ecology elected to publish a revised standard (1000 ug/L) that was based on the current state and federal drinking water standards. Ecology concluded that this value met the statutory requirements under state law and was more stringent than the ground water cleanup level (1600 ug/L) calculated using Equation 720-1 and an oral reference dose of 0.2 mg/kg/day.

There have been several scientific and regulatory developments since the 2001 rule revisions. These include the following:

- IRIS Reference Dose. EPA updated the IRIS oral reference dose (0.08 mg/kg/day)[102] for toluene in 2005. The cleanup level calculated using Equation 720-1 and the updated reference dose is 640 ug/L.
- Draft Ecology Vapor Intrusion Guidance. Ecology published a draft vapor intrusion guidance document for public review and comment in late 2009.[103] The draft guidance document included ground water screening levels based on preventing the accumulation of hazardous substances in buildings located near contaminated groundwater.
- EPA Six Year Review of Drinking Water Standards. EPA completed a review of the federal drinking water standards in March 2010. With respect to the federal standard for toluene, EPA concluded "…[a]lthough there are new data that support consideration of whether to revise the MCLG/MCL for toluene, EPA does not believe a revision to the NPDWR for toluene is appropriate at this time…"[104]

[101] EPA published the current drinking water standard for toluene in January 1991 (56 FR 3526). EPA established a MCLG and MCL of 1 mg/L (1000 ug/L) using a reference dose of 0.2 mg/kg/day.

[102] EPA. 2005. Toxicological Review of Toluene (CAS No. 108-88-3) In Support of Summary Information on the Integrated Risk Information System (IRIS). National Center for Environmental Assessment, Office of Research and Development, U.S. Environmental Protection Agency. Washington DC.

[103] Department of Ecology. 2009. Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action (Draft). Washington State Department of Ecology, Toxics Cleanup Program.

[104] EPA. 2010. National Primary Drinking Water Regulations; Announcement of the Results of EPA's Review of Existing Drinking Water Standards and Request for Public Comment and/or Information on Related Issues. 75 FR 15500 at 15559.

MTCA Rulemaking Options

Ecology has reviewed the new scientific and regulatory information and believes it is appropriate to consider revisions to the MTCA cleanup level. Ecology has considered two main options for resolving this rulemaking issue:

1. No Revision. Under this option, the Method A ground water cleanup level would remain 1000 ug/L.
2. Updated Cleanup Level Based on Current EPA Oral Reference Dose. Under this option, the Method A ground water cleanup level for toluene would be lowered to 640 ug/L.

Draft Revisions and Rationale

Ecology does not currently plan to revise the Method A value for toluene. Ecology's rationale for maintaining the current Method A value includes the following:

- The current Method A cleanup level remains protective and consistent with current scientific information on health risks resulting from toluene exposure. EPA revised the RfD for toluene in 2005. The ground water cleanup level calculated using Equation 720-1 and the updated RfD is 640 ug/L. However, this value is based on the use of an inhalation correction factor of 2. The Regional Screening Tables prepared by EPA and the Oak Ridge National Laboratory suggest that inhalation risks calculated using chemical-specific information are lower than the risks calculated using an inhalation correction factor of 2. The current MTCA rule provides the flexibility to consider chemical-specific information relevant to the choice of an inhalation correction factor. Using the current toxicological information for both the oral and inhalation exposure pathways results in a Method B ground water cleanup level that is slightly below 1000 ug/L. This approach is also consistent with current EPA inhalation risk assessment guidance.
- The current Method A cleanup level is below the draft ground water vapor intrusion screening level for toluene. Ecology published a draft vapor intrusion guidance document for public review and comment in late 2009. The draft ground water screening level for toluene is 15 mg/L (15,000 ug/L). This screening value was calculated using a vapor attenuation factor (VAF) of 0.001. However, Ecology also concluded that a VAF of 0.0001 would generally be appropriate for toluene because it tends to biodegrade in the environment.
- The revised cleanup level complies with current statutory and regulatory requirements for establishing cleanup standards. The revised cleanup level is based on the state and federal drinking water standard for toluene. Consequently, the current cleanup level complies with the MTCA statute which states that cleanup standards must be "…at least as stringent as all applicable state and federal laws, including health-based standards under state and federal law…"
- The current cleanup level is consistent with ground water standards and guidelines established by EPA and other states. The current standard falls within the range of standards and guidelines used by EPA and other states to support cleanup decisions (See Table 1).

27. 1,1,1-Trichlorethane

Background

Ecology developed the current MTCA Method A ground water cleanup level for 1,1,1-trichloroethane (200 ug/L) when the initial cleanup standards were published in 1991. The Method A cleanup level is based on applicable state and federal law (WAC 246-290-310 and 40 C.F.R. 141.61).[105]

Ecology reviewed the Method A value during the 2001 rule revision process, but elected not to revise it. Information available at that time indicated the Method A value was sufficiently protective.

There have been several scientific and regulatory developments since the 2001 rule revisions. These include the following:

- IRIS Reference Dose. EPA updated the IRIS oral reference dose for 1,1,1-trichloroethane in 2007.[106] With this update, EPA changed the oral reference to 2 mg/kg/day (previous RfD was 0.9 mg/kg/day).
- Draft Ecology Vapor Intrusion Guidance. Ecology published a draft vapor intrusion guidance document for public review and comment in late 2009.[107] The draft guidance document included ground water screening levels based on preventing the accumulation of hazardous substance in buildings located near contaminated groundwater. The draft ground water screening level for 1,1,1-trichloroethane is 5,300 ug/L[108]. This screening value was calculated using a vapor attenuation factor (VAF) of 0.001.
- EPA Six Year Review of Drinking Water Standards. EPA completed a review of the federal drinking water standards in March 2010. With respect to the federal standard for 1,1,1-trichloroethane, EPA noted that new toxicological assessments could support a revised MCLG/MCL as high as 14 mg/L (14,000 ug/L). However, EPA concluded "…[a]lthough there are new data that support consideration of whether to revise the MCLG/MCL for 1,1,1-trichloroethane, EPA does not believe a revision to the NPDWR for 1,1,1-trichloroethane is appropriate at this time…" [109]

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[105] EPA published the current drinking water standard for 1,1,1-trichloroethane in July 1987 (52 FR 25690). EPA established a MCLG and MCL of 200 ug/L. EPA based the MCLG on a reference dose of 0.035 mg/kg/day and carcinogen classification of D (not classifiable as to human carcinogenicity).

[106] EPA. 2007. IRIS, 1,1,1-Trichloroethane. Available at: http://www.epa.gov/ncea/iris/subst/0197/htm..

[107] Department of Ecology. 2009. Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action (Draft). Washington State Department of Ecology, Toxics Cleanup Program.

[108] The draft document listed a ground water screening level of 11,000 ug/L. However, that value was not based on the most current toxicological information. Ecology has recalculated the ground water screening level using the reference concentration currently included in the IRIS database (5 mg/m^3). The revised ground water screening level calculated using the current IRIS value is 5,300 ug/L which is well above the current state and federal drinking water standards.

[109] EPA. 2010. National Primary Drinking Water Regulations; Announcement of the Results of EPA's Review of Existing Drinking Water Standards and Request for Public Comment and/or Information on Related Issues. 75 FR 15500 at 15562.

MTCA Rulemaking Options

Ecology does not plan to revise the Method A cleanup level for 1,1,1-trichloroethane. Ecology acknowledges that the results from EPA toxicological assessments would support a much higher cleanup level (5-10 mg/L depending on how the vapor intrusion pathway is addressed). However, neither EPA nor the Washington Department of Health has revised the drinking water standard for 1,1,1-trichloroethane. Consequently, raising the Method A cleanup level would be inconsistent with the statutory requirement that cleanup standards must be "…at least as stringent as all applicable state and federal laws, including health-based standards under state and federal law…"

28. Trichloroethylene

Background

Ecology developed the current MTCA Method A ground water cleanup level for trichloroethylene (5 ug/L) when the initial cleanup standards were published in 1991. The Method A cleanup level is based on applicable state and federal law (WAC 246-290-310 and 40 C.F.R. 141.61).[110]

Ecology reviewed the Method A value during the 2001 rule revision process, but elected not to revise it. Information available at that time indicated the Method A value was sufficiently protective.

There have been several scientific and regulatory developments since the 2001 rule revisions. These include the following:

- California Public Health Goal. The Office of Environmental Health Hazard Assessment (OEHHA) published a new public health goal (1.7 ug/L) for TCE. As part of that effort, OEHHA developed an oral cancer slope factor (0.0059 $(mg/kg/day)^{-1}$) for TCE based on the increased incidence of liver tumors in animal bioassays.
- CLARC Revisions. In November 2008, Ecology updated the toxicological parameters for TCE included in the CLARC database.[111] Ecology replaced the CLARC Version 3.1 value (0.02 - 0.4 $(mg/kg/day)^{-1}$) with a value recommended by the USEPA (0.089 $(mg/kg/day)^{-1}$).[112] Ecology also revised the CLARC entries for the inhalation cancer slope factor. The updated inhalation slope factor (0.089 $(mg/kg/day)^{-1}$) reflected recommendations by EPA Region X.
- Draft Ecology Vapor Intrusion Guidance. Ecology published a draft vapor intrusion guidance document for public review and comment in late 2009.[113] The draft guidance document included ground water screening levels based on preventing the accumulation of hazardous substances in buildings located near contaminated groundwater. The updated draft ground water screening level for TCE is 5 ug/L.[114] The screening value was calculated using a vapor attenuation factor (VAF) of 0.001.

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[110] EPA published the current drinking water standard for trichloroethylene in July 1987 (52 FR 25690). EPA established a MCLG of zero based on trichloroethylene classification as a probable human carcinogen (B2). The Maximum Contaminant Limit (MCL) of 5 ug/L was based on analytical feasibility PQL = 5 ug/L).

[111] Department of Ecology. Recommended Trichloroethylene (TCE) Toxicity Values and MTCA Cleanup Levels CAS # 79-01-6. Available at https://fortress.wa.gov/ecy/clarc/FocusSheets/TCE%20PCE%20Oct%202004%20Final.pdf

[112] EPA, Region 10 letter from Michael W. Cox, Unit Manager, Risk Evaluation Unit, Office of Environmental Assessment (OEA-095) to Martha Hankins, Acting Unit Supervisor, Policy and Technical Support Unit, Toxics Cleanup Program, Department of Ecology, Re: Office of Environmental Assessment recommendations for evaluating trichloroethylene in human health risk assessment, October 22, 2008.

[113] Department of Ecology. 2009. Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action (Draft). Washington State Department of Ecology, Toxics Cleanup Program.

[114] The October 2009 draft document listed a ground water screening levels of 0.4 ug/L. However, this value was not based on the most current toxicological information. Ecology has recalculated the ground water screening level using the cancer slope factor currently included in the EPA Regional Screening Tables..

- EPA Toxicological Assessment. In October 2009, EPA distributed a draft toxicological review for TCE. [115] The draft review includes a recommended inhalation unit risk (IUR) of 4 x 10^{-6} $(ug/m^3)^{-1}$ that is based on risks associated with kidney and liver cancers and lymphomas. The draft review also includes an updated oral cancer slope factor of 0.05 $(mg/kg/day)^{-1}$) that is derived from route-to-route extrapolation using PBPK modeling. The draft report is currently undergoing external peer review. A Method B ground water cleanup level of 1 ug/L can be calculated using the draft oral cancer slope factor and Equation 720-2.
- EPA Six Year Review of Drinking Water Standards. EPA completed a review of the federal drinking water standards in March 2010. With respect to the federal standard for TCE, EPA concluded "…[t]he Agency believes it is appropriate to revise the NPDWR for trichloroethylene although a health effects assessment is currently in progress. The existing MCLG is zero (based on current B2 cancer classification) and the current MCL is based on a PQL (i.e., analytical feasibility) of 0.005 mg/L. The Agency's review indicates that analytical feasibility could be as much as 10 times lower (approximately 0.0005 mg/L) and occurrence at this level appears to be relatively widespread. Hence, revisions to the NPDWR may provide a meaningful opportunity for health risk reduction. Furthermore, the occurrence and exposure analysis based on possible changes in analytical feasibility indicate that any revision to the MCL is unlikely to provide a meaningful opportunity to improve public health protection…" [116]

MTCA Rulemaking Options

Ecology does not plan to make a final decision on whether to revise the Method A cleanup level for TCE until EPA has decided whether to revise federal drinking water standard.

EPA has not revised the toxicological parameters for TCE since the 2001 MTCA rule amendments. However, the current toxicological information does not indicate that the ground water cleanup level for TCE needs to be revised:

- The most recent ORNL/EPA tables include an oral cancer slope factor of (0.0059 $mg/kg/day)^{-1}$. Using that cancer slope factor, the risk-based ground water cleanup level calculated using Equation 720-2 is 7 ug/L. Based on that calculation, the current Method A cleanup level appears to be sufficiently protective and would not require revision.
- EPA proposed a new IRIS cancer slope factor (0.05 $(mg/kg/day)^{-1}$) in November 2009. EPA is currently reviewing public and peer review comments on the proposed value. Using that cancer slope factor, the risk-based ground water cleanup level calculated using Equation 720-2 is 0.9 ug/dL. Based on that calculation, the current Method A cleanup level appears to be sufficiently protective and would not require revision.

[115] . EPA. 2009. Toxicological Review of Trichloroethylene (CAS No. 79-01-6) In Support of Summary Information on the Integrated Risk Information System (IRIS). U.S. Environmental Protection Agency. Washington DC. October 2009.

[116] EPA. 2010. National Primary Drinking Water Regulations; Announcement of the Results of EPA's Review of Existing Drinking Water Standards and Request for Public Comment and/or Information on Related Issues. 75 FR 15500 at 15564.

29. Vinyl chloride

Background

Ecology developed the current MTCA Method A ground water cleanup level for vinyl chloride (0.2 ug/L) when the initial cleanup standards were published in 1991. The Method A cleanup level was calculated using the MTCA cleanup level equations and modified based on analytical considerations.

Ecology reviewed the Method A value during the 2001 rule revision process, but elected not to revise it. Information available at that time indicated the Method A value was sufficiently protective. However, Ecology did update the justification for the current Method A value. The explanatory note in the current rule states that the Method A value is based on applicable state and federal law (WAC 246-290-310 and 40 C.F.R. 141.61)[117] adjusted to a 10^{-5} risk limit.

There have been several scientific and regulatory developments since the 2001 rule revisions. These include the following:

- Guidance on Early Life Stage Considerations. EPA[118] and California[119] have adopted methods and policies for adjusting cancer slope factors and/or cancer risk estimates to take into account child susceptibility to carcinogenic substances. EPA's policies apply to carcinogens that act via a mutagenic mode of action (including vinyl chloride); the California EPA policies apply to all carcinogens.
- CLARC Revisions. In 2006, Ecology updated the toxicological parameters for vinyl chloride included in the CLARC database.[120] Specifically, Ecology included oral cancer slope factors and air unit risks that incorporated EPA policies on early life stage susceptibility. The new values reflected changes in the IRIS database. The updated CLARC database includes two oral cancer slope factors. Ecology recommended that the first value (0.75 $(mg/kg/day)^{-1}$) be used when establishing cleanup levels based on continuous exposure during adulthood. Ecology recommended that the second value (1.5 $(mg/kg/day^{-1})$ be used when establishing cleanup levels based on continuous lifetime exposure from birth. Similar recommendations were provided for air unit risks (4.4×10^{-3} per mg/m^3 for adult exposure and 8.8×10^{-3} per mg/m^3 for lifetime exposure from birth). The Method B ground water cleanup level calculated using Equation 720-2 and the cancer slope factor with early life stage adjustment is 0.03 ug/L.

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[117] EPA published the current drinking water standard for trichloroethylene in July 1987 (52 FR 25690). EPA established a MCLG of zero based on a classification as a known human carcinogen (A). The Maximum Contaminant Limit (MCL) of 2 ug/L was based on analytical feasibility.

[118] EPA. 2005. Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens. U.S. Environmental Protection Agency, Risk Assessment Forum, March 2005. EPA/630/R-03/003F.

[119] OEHHA. 2008. Air Toxics Hot Spots Program Risk Assessment Guidelines, Part II, Technical Support Document for Cancer Potency Factors, June 2008, Public Review Draft, California Environmental Protection Agency, Office of Environmental Health Hazard Assessment.

[120] Department of Ecology. Toxicological Information for Vinyl Chloride. Available at: https://fortress.wa.gov/ecy/clarc/FocusSheets/VinylChloride.pdf

- Draft Ecology Vapor Intrusion Guidance. Ecology published a draft vapor intrusion guidance document for public review and comment in late 2009.[121] The draft guidance document included ground water screening levels based on preventing the accumulation of hazardous substances in buildings located near contaminated ground water. The draft ground water screening level for vinyl chloride is 0.35 ug/L. This screening value was calculated using a vapor attenuation factor (VAF) of 0.001.
- EPA Six Year Review of Drinking Water Standards. EPA completed a review of the federal drinking water standards in March 2010. With respect to the federal standard for vinyl chloride, EPA concluded "…[a]lthough there are new data that support consideration of a possibly lower PQL (and therefore a possibly lower MCL), EPA does not believe a revision to the NPDWR for vinyl chloride is appropriate at this time…"[122]

MTCA Rulemaking Options

Ecology has reviewed the new scientific and regulatory information and believes it is appropriate to consider revisions to the MTCA cleanup level. Ecology has considered two main options for resolving this rulemaking issue:

1. No Revision. Under this option, the Method A ground water cleanup level would remain 0.2 ug/L.
2. Updated Cleanup Level Based on Early Life Stage Considerations: Under this option, the Method A ground water cleanup level for vinyl chloride would be lowered to 0.02 ug/L. This value was calculated using Equation 720-1 (10^{-6} cancer risk) and with adjustments to the cancer slope factor made in accordance with the EPA 2005 guidance document.

Draft Revisions and Rationale

Ecology does not plan to revise the current Method A ground water cleanup level for vinyl chloride (Option 1). Ecology's rationale for this revision includes the following:

- The current cleanup level is consistent with current scientific information on health risks associated with vinyl chloride exposure. EPA has published early life stage guidance that is applicable to vinyl chloride. The risk-based ground water cleanup level calculated using Equation 720-2 is 0.01 ug/L to 0.02 ug/L (target cancer risk = 10^{-6}) when the cancer slope factor is adjusted in accordance with the CalEPA and U.S. EPA guidance, respectively.
- The methods and policies used to develop the revised cleanup level are consistent with the policies underlying the MTCA rule. The CLARC database includes guidance applicable to vinyl chloride that describes how to make adjustments for early life stage exposure. The CLARC guidance is based on an earlier version of the EPA early life

[121] Department of Ecology. 2009. Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action (Draft). Washington State Department of Ecology, Toxics Cleanup Program.

[122] EPA. 2010. National Primary Drinking Water Regulations; Announcement of the Results of EPA's Review of Existing Drinking Water Standards and Request for Public Comment and/or Information on Related Issues. 75 FR 15500 at 15566.

stage exposure guidance. The Method B ground water cleanup level (10^{-6} risk level) based on the CLARC database procedures is 0.03 ug/L.

- The current cleanup level complies with MTCA statutory requirements. MTCA states that cleanup standards must be "…at least as stringent as the cleanup standards under section 121 of the federal cleanup law, 42 U.S.C. Sec. 9621, and at least as stringent as all applicable state and federal laws, including health-based standards under state and federal law…" The current Method A value (0.2 ug/L) is less than the current state and federal drinking water standard (2 ug/L).
- The current cleanup level is consistent with the MTCA methods and policies for establishing ground water cleanup levels. MTCA ground water cleanup levels must be at least as stringent as state and federal drinking water standards. However, the MTCA rule requires downward adjustment of cleanup levels based on a maximum contaminant limit (MCL) if the MCL corresponds to a hazard quotient greater than one (1) or an excess cancer risk greater than one-in-one hundred thousand (1×10^{-5}). The current Method A ground water cleanup level for vinyl chloride corresponds to an excess cancer risk of 1×10^{-5} using the EPA 2005 guidance.
- The current Method A cleanup level is lower than the draft ground water VI screening levels developed by Ecology. Ecology published a draft vapor intrusion guidance document for public review and comment in late 2009. The draft guidance document included ground water screening levels based on preventing the accumulation of hazardous substances in buildings located near contaminated ground water. The draft ground water screening level for vinyl chloride is 0.35 ug/L. This screening value was calculated using a vapor attenuation factor (VAF) of 0.001.
- The current cleanup level is consistent with ground water standards established by other states. The current standard falls within the range of standards and guidelines used by other states to support cleanup decisions (See Table 1).

In developing the draft revisions, Ecology also considered the range of comments on making early life stage adjustments to the cancer slope factors for carcinogens that act via a mutagenic mode of action. Ecology believes the draft revision is consistent with comments from several work group members who expressed support for applying early-life stage adjustments to vinyl chloride. Two members also provided specific comments on the Method A ground water cleanup level for vinyl chloride.

> *Ecology is considering potential changes to the Method A groundwater cleanup level for vinyl chloride (currently 0.2 ug/L). Method A cleanup levels appropriately consider multiple factors, including MCLs, PQLs, CLARC database outputs and other factors. Currently, the controlling factor for the vinyl chloride cleanup level is the drinking water MCL. The MCLs are specified under 40 CFR 141.61 and WAC 246-290 and their use under MTCA is performed consistent with the requirements of WAC 173-340-720(3)(b), incorporating the adjustment to a 1-in-100,000 risk level as required under WAC 173-340-720(7)(b). Given that the MCL for vinyl chloride has not changed, it is unnecessary to update the Method A groundwater cleanup level at this time, even if there are changes to the Method B CLARC database procedures for this compound. The current Method A cleanup level would remain compliant with MTCA requirements even with those other changes. The current groundwater cleanup level is also more protective than the current Ecology groundwater screening level for vapor intrusion, and complies with the published SW 846 vinyl*

chloride PQL (currently 0.2 ug/L for EPA Method 8260)…. (Patty Boyden and Mike Stoner, May 27, 2010 Comments on Proposed MTCA-SMS Rule Revisions)

30. Xylenes

Background

Ecology established the initial MTCA Method A ground water cleanup level for xylenes (20 ug/L) when the initial cleanup standards were established in 1991. The Method A value was based on applicable state and federal requirements (i.e., drinking water standards specified in WAC 246-290-310 and 40 C.F.R. 141.61)[123] and prevention of adverse aesthetic characteristics.

Ecology reviewed the Method A value during the 2001 rule revision process. Based on that review, Ecology elected to publish a revised standard (1000 ug/L) that was based on preventing exceedances of the cleanup level for total petroleum hydrocarbons and on prevention of adverse aesthetic characteristics. This is a total value for all xylenes.

There have been several scientific and regulatory developments since the 2001 rule revisions.

- IRIS Reference Dose. EPA updated the IRIS oral reference dose for xylenes in 2003.[124] With this update, EPA changed the oral reference to 0.2 mg/kg/day (previous RfD was 2 mg/kg/day). The Method B ground water cleanup level based on the updated value is 1600 ug/L.
- Draft Ecology Vapor Intrusion Guidance. Ecology published a draft vapor intrusion guidance document for public review and comment in late 2009.[125] The draft guidance document included ground water screening levels based on preventing the accumulation of hazardous substances in buildings located near contaminated groundwater. The draft ground water screening levels for meta- and ortho-xylene are 2,200 ug/L and 3,100 ug/L, respectively.[126] These screening values were calculated using a vapor attenuation factor (VAF) of 0.001. However, Ecology also concluded that a VAF of 0.0001 would generally be appropriate for xylenes because they tend to biodegrade in the environment. Use of a VAF of 0.0001 results in ground water screening levels greater than 10 mg/L (the current state and federal drinking water standard).
- EPA Six Year Review of Drinking Water Standards. EPA completed a review of the federal drinking water standards in March 2010. With respect to the federal standard for total xylenes, EPA noted that new toxicological assessments could possibly

[123] EPA published the current drinking water standard for total xylenes in January 1991 (56 FR 3526). EPA established a MCLG and MCL of 10 mg/L (10,000 ug/L). EPA based the MCLG on a reference dose of 2 mg/kg/day and cancer classification of D (not classifiable as to human carcinogenicity).

[124] EPA. 2003. IRIS, Xylenes. Available at: http://www.epa.gov/ncea/iris/subst/0270/htm..

[125] Department of Ecology. 2009. Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action (Draft). Washington State Department of Ecology, Toxics Cleanup Program.

[126] The draft document listed a ground water screening levels of 320 ug/L for both meta- and ortho-xylene.. However, these value were not based on the most current toxicological information. Ecology has recalculated the ground water screening level using the reference concentration currently included in the EPA Regional Screening Tables (0.7 mg/m3).

support a revised MCLG/MCL as low as 1 mg/L (1,000 ug/L). However, EPA concluded "…[a]lthough there are new data that support consideration of whether to revise the MCLG/MCL for total xylenes, EPA does not believe a revision to the NPDWR for total xylenes is appropriate at this time…" [127]

MTCA Rulemaking Options

Ecology does not currently plan to revise the Method A value for xylenes. EPA has published an oral reference dose (0.2 mg/kg/day) that is applicable to xylene mixtures and m-, o- and p-xylene isomers.

However, the ORNL/EPA tables include a risk-based screening level for total xylenes of 200 ug/L. This is driven by the inhalation pathway which is derived from the reference concentration (0.1 mg/m^3) published in the IRIS database. However, the ORNL/EPA table also includes risk-based screening levels (1200 ug/L) for the three xylene isomers that are based on reference concentrations developed by OEHHA.

[127] EPA. 2010. National Primary Drinking Water Regulations; Announcement of the Results of EPA's Review of Existing Drinking Water Standards and Request for Public Comment and/or Information on Related Issues. 75 FR 15500 at 15567.

Table 1: Comparison of Ground Water Cleanup Levels Established by Other State Environmental Agencies for Selected Hazardous Substances															
Chemical	CAS	Current Method A	**MCL**	**RST 2010 (cancer)**	**RST 2010 (NC)**	**CA 2010 (PHG)**	**CA 2010 (MCL)**	**FL 2005**	**MA 2005?**	**MD 2008**	**ME 2008**	**MI 2002**	**NJ 2009**	**OR**	**WI 2003**
Arsenic	7440-38-2	5	10	0.045		0.004	10	10	10	10	10	10	3 (PQL)		10
Benzene	71-43-2	5	5	0.41		0.15	1	1	5	5	6	5	1 (PQL)		5
Benzo[a]pyrene	50-32-2	0.1	0.2	0.0029		0.004	0.2	0.2	0.2	0.2	0.05	5	0.1 (PQL)		0.2
Cadmium	7440-43-9	5	5		18	0.04	5	5	5	5	3.5	5	4		5
Chromium III	16065-83-1	50/100	100		55000		100 (t)	100(tot)	100	100	40 (tot)	100	70 (tot)		
Chromium VI	18540-29-9	50	100	0.04	110				100	100		100			
DDT	50-29-3	0.3	none	0.2				0.1	0.3	0.2	1	9.1	0.1		
1,2-Dichloroethane (EDC)	107-06-2	5	5	0.15		0.4	0.5	3	5	5	4	5	2 (PQL)		5
Ethylbenzene	100-41-4	700	700	1.5	1300	300	300	30	700	700	70	74	700		700
Ethylene dibromide (EDB)	107-06-2	0.01	0.05	0.0065		0.01	0.05	0.02	0.02	0.05	0.2	1	0.03		0.05
Gross Alpha Particle Act.		15 pCi/y	15 pCi/y				15								
Gross Beta Particle Activity		4 mrem/y	4 mrem/y				4								
Lead	7439-92-1	15	15			0.2	15	15	15	15	10	4	5	15	15
Lindane	58-89-9	0.2	0.2	0.06	11	0.032	0.2	0.2	0.2	0.2	0.2	0.2			0.2
Mercury	7439-97-6	2	2		11	1.2	2	2	2	2	2	2	2		2
Methylene chloride	75-09-2	5	5	4.8		4	5	5	5	5		5	3		5
MTBE	1634-04-4	20	none	12		13		20	70	20	35	40	70		60
Naphthalenes	91-20-3	160	none	0.14	6.2			14	140	0.65	14	520	300		100

PAHs Mixtures															
PCB mixtures		0.1	0.5	0.03		0.09	0.5	0.5	0.5	0.5	0.5	0.5	0.5 (PQL)		0.03
Radium 226 and 228		5 pCi/L	5				5								
Radium 226		3 pCi/L	none			0.05									
Tetrachloroethylene	127-18-4	5	5	0.11	220	0.06	5	3	5	5	7	5	1 (PQL)		5
Toluene	108-88-3	1000	1000		2300	150	150	40	1000	1000	1400	790	1000		1000
1,1,1-Trichloroethane	71-55-6	200	200		9100	1000	200	200	200	200	200	200	70		200
Trichloroethylene	79-01-6	5	5	2		1.7	5	3	5	5	32	5	1 (PQL)		5
Vinyl chloride	75-01-4	0.2	2	0.016	72	0.05	0.5	1	2	2	0.2	2	1 (PQL)		0.2
Xylenes	1330-20-7	1000	10000		200	1800	1750	20	10000	10000	1400	280	1000		10000