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ECOLOGY
State of Washington

Model Remedies for Sites with Petroleum Contaminated Soils

Toxics Cleanup Program

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Acronyms & Abbreviations

Acronym or Abbreviation	Definition
CAP	Cleanup Action Plan
CLARC	Cleanup Level and Risk Calculations
CSM	Conceptual Site Model
CSWGP	Construction Stormwater General Permit (CSWGP)
CUL	cleanup level
EC	equivalent carbon
EPA	Environmental Protection Agency
EPH/VPH	extractable petroleum hydrocarbons / volatile petroleum hydrocarbons
HQ	Hazard Quotient
ISIS	Integrated Site Information System
L&I	Washington State Department of Labor & Industries
MTCA	Model Toxics Control Act
NFA	no further action
NWTPH	Northwest Total Petroleum Hydrocarbon Method
PCBs	polychlorinated biphenyls
PLP	potentially liable person
RCW	Revised Code of Washington
SEPA	State Environmental Policy Act
TCLP	Toxicity Characteristic Leaching Procedure
TCP	Toxics Cleanup Program
TPH	total petroleum hydrocarbons
TPH-Dx	total petroleum hydrocarbons – Diesel Range Organics
TPH-Gx	total petroleum hydrocarbons – Gasoline Range Organics
UST	underground storage tank
VCP	Voluntary Cleanup Program
VI	vapor intrusion
VOCs	halogenated volatile organic compounds
WAC	Washington Administrative Code

Summary: Model Remedies for Sites with Petroleum Contaminated Soils

To help streamline and accelerate the pace of cleanups, the Washington State Department of Ecology (Ecology) is developing standardized cleanup methods called “model remedies.” If a site meets the eligibility criteria and individual provisions for a particular model remedy, that cleanup method can be selected and implemented. Once the requirements for using a model remedy are met, it will not be necessary to conduct a Feasibility Study or Disproportionate Cost Analysis, or to submit Ecology review fees with a no further action request. Any requests for Ecology oversight or feedback prior to submitting an application for a no further action determination must include the appropriate review fees.

Seven model remedies have been developed for sites that have only petroleum contaminated soil. They are discussed in Chapter 6 of this document. This guidance is a companion to Ecology’s [Model Remedies for Sites with Petroleum Impacts to Groundwater](#) (Ecology 2017).

Introduction: Determine If Using a Model Remedy Is Appropriate

Information must be gathered and analyzed prior to selecting and implementing a model remedy for a site. The following chapters provide detailed information to assist in this effort. Chapters 3 and 6 are critical for assessing if it is appropriate to use a model remedy:

- Chapter 1:** What changes to the Model Toxics Control Act (MTCA) cleanup regulations affect model remedy development.
- Chapter 2:** What is the purpose of Model Remedies.
- Chapter 3:** What eligibility criteria must each project meet.
- Chapter 4:** How the model remedies meet the model remedy selection and the compliance monitoring requirements of MTCA.
- Chapter 5:** Additional provisions for addressing the direct contact and vapor intrusion pathways.
- Chapter 6:** What are the seven model remedies, and which provisions apply to each one.

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Chapter 1: Changes to MTCA Affect Model Remedy Development

In 2013, the Washington Legislature made significant changes to the Model Toxics Control Act (MTCA). One of the provisions gave additional direction to Ecology regarding the establishment of model remedies. In response to the 2013 legislative amendments, Ecology has assembled information in this document to establish model remedies for sites with petroleum contaminated soil. This guidance is a companion to Ecology's [Model Remedies for Sites with Petroleum Impacts to Groundwater](#) (Ecology 2017). During 2018, Ecology will evaluate whether developing model remedies for other types of contamination would be beneficial.

MTCA regulations ([WAC 173-340-390](#)) specify that Ecology must identify the circumstances under which application of a model remedy meets the requirements for selection of cleanup actions established under [WAC 173-340-360](#). If a site meets the requirements for use of a model remedy, it is not necessary to conduct a Feasibility Study ([WAC 173-340-350\(8\)](#)) or a Disproportionate Cost Analysis ([WAC 173-340-360\(3\)](#)).

A Feasibility Study evaluates and screens potential remedial technologies that may be appropriate for addressing contamination at a particular site. A Disproportionate Cost Analysis compares more costly remedial actions against the most practicable permanent remedy to determine whether the increased costs are warranted. If the cost to implement the more aggressive remedy is significantly higher than the incremental increase in benefits achieved, then selection of the more costly remedy is not required.

The 2013 legislative changes also provided Ecology the option to waive fees for the time spent reviewing no further action (NFA) requests at cleanups that qualify for and appropriately use a model remedy. As a matter of policy, Ecology will not require a fee to review no further action requests for sites in the Voluntary Cleanup Program (VCP) if the selected remedy meets the specified criteria and implementation follows the provisions set forth in this document.

The 2013 legislative changes require that development of model remedies include the following elements:

- Requirements for characterizing a site;
- A description of how the model remedy meets the cleanup standards and remedy selection provisions in MTCA;
- Monitoring requirements; and
- Public notice and the opportunity to comment on the proposed model remedy and the conditions under which it may be used.

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Chapter 2: Purpose of Model Remedies

The purpose of model remedies is to streamline and accelerate the selection of cleanup actions that protect human health and the environment, with a preference for permanent solutions to the maximum extent practicable. This document provides information to establish model remedies for cleanup at sites with petroleum contaminated soil, including: a) the eligibility criteria each project must meet, and b) a discussion of how the model remedies comply with the requirements of MTCA. Specific data from sites that received an NFA determination between January 2012 and June 2014 were used to identify remedies that have successfully met the requirements in MTCA. The data formed the basis for establishing seven model remedies, as well as the criteria that apply to each individual remedy. Appendix A identifies the provisions that must be evaluated and implemented for all selected model remedies.

Before considering a model remedy, the following steps in the remedial process must have already been completed:

1. A release to the environment has been confirmed;
2. Ecology has been notified of the release;
3. Emergency/Interim Actions have been implemented (if appropriate); and
4. An adequate site characterization has been completed.

Ecology previously developed guidance to address these steps in the cleanup process, so details for completing them are not included here. The model remedies in this document do not apply to sites with petroleum impacts to groundwater, surface water or sediments. Therefore, it is strongly recommended that the applicable provisions found in Chapters 4 through 7 of Ecology's [*Guidance for Remediation of Petroleum Contaminated Sites*](#) (Ecology 2016) be followed when conducting the site characterization so that sufficient data are collected to confirm that none of these pathways have been impacted.

Model remedies are most appropriate for routine cleanup projects at lower risk sites, and are generally more applicable to independent cleanups. This includes those seeking a No Further Action (NFA) letter under the Voluntary Cleanup Program (VCP) or situations where the potentially liable person (PLP) is implementing the cleanup with no Ecology oversight. However, these model remedies can also apply to Ecology-supervised cleanups.

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Chapter 3: Eligibility Criteria for Model Remedies

The following criteria apply to all model remedies identified in this document unless otherwise noted.

Geographic Area. The model remedies in this document are applicable throughout Washington State.

Release Confirmation and Ecology Notification. A release of petroleum has been confirmed and Ecology notification of the release has been completed.

Affected Media. An adequate characterization of the site is necessary to confirm that groundwater, surface water or sediments have not been impacted by petroleum. Soil cleanup levels must address direct contact, the soil to groundwater pathway, terrestrial ecological receptors, and vapor intrusion. These model remedies do not apply to sites with contaminated soil below the water table or sites with petroleum contamination detected above the practical quantitation limits in groundwater (see Table 7.3 in Ecology’s [Guidance for Remediation of Petroleum Contaminated Sites](#) (Ecology 2016)).

After the selected remedy is implemented and adequate compliance monitoring is completed, the Method A soil cleanup levels cannot be exceeded beyond the source property. This will help ensure that the potential for future impacts to other pathways is minimized. Given the importance of conducting an adequate site characterization, Ecology strongly recommends selecting a consultant who has significant experience performing this type of work, and is very familiar with the information in Chapter 6, “Conducting an Effective Site Characterization,” in Ecology’s [Guidance for Remediation of Petroleum Contaminated Sites](#).

Note about meeting the Method A cleanup levels beyond the source property:

Washington state’s statute specifies that model remedies are: “...for use in routine types of clean-up projects at facilities that have common features and lower risk to human health and the environment” ([RCW 70.105D.020\(20\)](#)). It has been Ecology’s experience that establishing mutually agreeable, off-property cleanup levels often requires a significant amount of time and effort to resolve. As a result, the model remedy process does not apply to situations where contamination will remain off the source property above the Method A levels for unrestricted use.

Note about Vapor Intrusion: While the focus of this guidance is on sites that have petroleum impacts to soil, these model remedies can also be used to address situations where vapors from contaminated soil may be impacting air quality. In many situations, sufficiently remediating the source will also address the vapor intrusion pathway. The vapor intrusion pathway is discussed in more detail in Chapter 5.

Contaminant Types. The site investigation must document that petroleum hydrocarbons consisting of gasoline, middle distillates/oils, or heavy fuels/oils and their constituents are the only contaminants present in soil, soil vapor, or indoor air (see Table 7.1 in *Guidance for the Remediation of Petroleum Contaminated Sites*). The testing requirements for petroleum releases are found in Table 830-1 of [WAC 173-340-900](#). Additional testing information is available in Table 7.2 in *Guidance for Remediation of Petroleum Contaminated Sites*.

If any contaminants other than those typically found in petroleum products are discovered above the Method A cleanup levels for unrestricted use during the site characterization, the site is not eligible to use any of the model remedies included in this document. The compounds identified in Table 830-1, except Polychlorinated Biphenyls (PCBs), Halogenated Volatile Organic Compounds (VOCs) and other site-specific compounds, are considered “those typically found in petroleum products.” The only exceptions are for situations where:

- a) The hazardous constituent(s) present meet the definition of natural background;
- b) Metals are present but at the time cleanup is completed, the remaining concentrations do not exceed the applicable cleanup standards; and
- c) Non-petroleum contaminants are present but have not co-mingled with the petroleum impacts. Upon successful completion of the remedial action, the petroleum release would be eligible for an NFA determination. This determination would not apply to the non-petroleum exceedances and the property would continue to be identified as contaminated.

Emergency/Interim Actions. Emergency or interim actions are not required due to the lower risk nature of the site, or if the necessary emergency/interim actions required by [WAC 173-340-450](#), have already been implemented. Additionally, at sites where free product is present, the UST owner/operator must follow the provisions in [WAC 173-340-450\(4\)](#), which includes conducting free product removal to the maximum extent practicable and in a manner that minimizes the spread of hazardous substances.

Terrestrial Ecological Evaluation. The site must: a) meet the criteria in [WAC 173-340-7491](#) and therefore be excluded from a terrestrial ecological evaluation, or b) the simplified terrestrial ecological evaluation can be ended under WAC 173-340-7492. There may be situations where a simplified terrestrial ecological evaluation results in adjusting the cleanup standards for certain compounds to meet the provisions in Table 749-2 of [WAC 173-340-900](#).

Remedy Selection. The remedial action that will be used for site cleanup is source removal, including free product and contaminated soil removal to the greatest degree practicable.

Chapter 4: How Model Remedies Meet the Remedy Selection and the Compliance Monitoring Requirements of MTCA

All the model remedies in this document provide for removing the contaminant source as well as the impacted soil, so that:

- a) The remaining soil meets the cleanup levels established in accordance with MTCA;
or
- b) If structural impediments such as buildings, utility lines, or public roads prevent complete removal of the contaminated soil, the remaining residual contamination will not impact other media including groundwater or indoor air quality.

In cases with structural impediments, contaminated soil must be removed to the greatest degree practicable. This generally means that the contamination is not accessible due to the presence of structures (e.g. buildings or roadways) or due to safety concerns related to working in close proximity to utility lines/product piping systems or the geotechnical conditions at the site. In these situations, institutional controls (typically environmental covenants) that meet the provisions in WAC 173-340-450 must be implemented to ensure the remedy remains protective.

It is recommended that cleanup standards, including points of compliance, be developed as early as possible in the cleanup process, but no later than immediately following completion of the site characterization. When developing the standards, use the provisions in:

- [WAC 173-340-740](#) (unrestricted land use soil cleanup standards) or
- [WAC 173-340-745](#) (soil cleanup standards for industrial properties);
- [WAC 173-340-750](#) (cleanup standards to protect air quality); and
- The applicable provisions in Chapters 8 and 9 of [Guidance for Remediation of Petroleum Contaminated Sites](#) (Ecology 2016).

The following discussion documents how the model remedies meet the minimum requirements found in [WAC 173-340-360](#) and [WAC 173-340-390](#).

A. Threshold Requirements

- (i) *Protect human health and the environment.* Model remedies must comply with the appropriate cleanups standards as well as all applicable state and federal laws. Cleanups complying with these two threshold requirements are presumed to be protective of human health and the environment (WAC 173-340-702).

- (ii) *Comply with cleanup standards contained in WAC 173-340-700 to 760.* All of the model remedies identified in this document require compliance with the soil and air quality standards set forth in MTCA. Adequate characterization must be completed to document that the site has not impacted groundwater, surface water, or sediments. In addition:
- a) The contaminated soil must be removed so that soil cleanup standards are met at the point of compliance, or
 - b) If the presence of structural impediments such as buildings, utilities lines or public roads prevents complete removal of contaminated soil, then institutional controls must be put in-place to ensure the remedy remains protective over time.

When considering which soil and air quality cleanup standards to use most of the options found in [WAC 173-340-704](#), [705](#) or [706](#) are available. Table 1 in Chapter 6 of this guidance provides more information on which options are specifically allowed. Ecology guidance, in conjunction with rule requirements, forms the basis for evaluating and selecting the appropriate standards. Finally, the site characteristics must qualify the site for an exclusion from a terrestrial ecological evaluation, or the simplified terrestrial ecological evaluation can be ended under [WAC 173-340-7492](#).

- (iii) *Comply with applicable state and federal laws.* Due to the lower risk nature of sites eligible to use these model remedies, many state or federal laws will not be applicable. For example, releases from the site cannot have impacted sediments, and therefore requirements found in the Sediment Management Standards ([Chapter 173-204 WAC](#)) will not be applicable. Although implementing any of these model remedies is unlikely to trigger compliance with an excessive number of state or federal laws, there will be several laws that will apply (e.g., transporting and managing contaminated soil in accordance with the state's solid waste management rules). Conduct an evaluation to determine compliance with applicable state and federal laws.
- (iv) *Provisions for compliance monitoring.* There are three types of compliance monitoring: 1) protection, 2) performance, and 3) confirmational monitoring. Protection monitoring includes the preparation of a health and safety plan, which should be completed before implementing any of the model remedies. Due to the simplified nature of these types of cleanups, it is anticipated the discussion will

typically be short and less detailed than for other sites. Performance and confirmational monitoring can likely be combined and are necessary to: a) document that applicable cleanup standards have been met, or b) to estimate the amount of contaminant mass that remains. Specific information about the number of samples and type of confirmation testing needed after soil removal is found in Appendix A.

B. Other Requirements

- (i) *Use a preference for permanent solutions to the maximum extent practicable.* A Disproportionate Cost Analysis determines whether the selected remedy used permanent solutions to the maximum extent practicable. If the incremental increase in costs for an alternative remedy is disproportionate to the benefits achieved, then selection of the more costly remedy is not warranted. Model remedies are, by definition, exempt from the requirement to evaluate cleanup action alternatives by preparing a Feasibility Study and a Disproportionate Cost Analysis.

In order to establish model remedies that meet the criteria of having “a preference for permanent solutions to the maximum extent practicable,” a review of information in Ecology’s Integrated Site Information System (ISIS) database was conducted. This evaluation revealed that between January 2012 and June 2014, more than 600 sites with only petroleum contamination in soil received an NFA determination. Approximately 125 of these letters were evaluated and in all but two cases, soil removal was used to address the contamination present. In the other two situations, initial sampling revealed soil impacts were below Method A levels.

This evaluation also confirms that focusing on removal of the source material can eliminate the direct contact threat and significantly reduce the potential for contaminants to leach to groundwater or impact indoor air quality. Source removal also enhances the natural degradation process and can often be implemented quickly thus minimizing short-term risks.

If a structural impediment precludes complete removal of all contaminated soil an environmental covenant must be used in conjunction with the remedy to reduce the overall risk and help ensure that the site remains protective over the long-term. As provided under WAC 173-340-420, Ecology will perform periodic reviews of sites where environmental covenants are required.

- (ii) *Provide for a reasonable restoration time frame.* All of the model remedies are based on soil being the only media impacted by the release. Implementation of a soil removal remedy will limit the time frame needed to achieve compliance to the greatest degree practicable.

- (iii) *Consideration of public concerns.* This guidance document was modified in response to feedback received during the public comment period.

Chapter 5: Additional Provisions for Addressing the Direct Contact and Vapor Intrusion Pathways

Establishing Method B Direct Contact TPH Cleanup Levels

Several of the model remedies identified later in this document rely on the use of Method B or Method C soil cleanup levels. Until recently, the only way to establish a Method B or Method C direct contact TPH (total petroleum hydrocarbons) cleanup level was to perform fractionation testing using the EPH/VPH methods (extractable petroleum hydrocarbons / volatile petroleum hydrocarbons methods). For many sites, especially older ones, available TPH data are from sample analysis using the NWTPH method (Northwest total petroleum hydrocarbon method) and often these results exceed the Method A TPH-Gx values of 30 or 100 mg/kg (The higher value can only be used if the soil is tested and found to not contain benzene).

To determine whether these existing data can be utilized, Ecology evaluated options for deriving a generic TPH direct contact cleanup level. Initially, this resulted in reviewing the process for calculating a direct contact TPH level using fractionated data. EPH/VPH testing provides concentrations for a series of equivalent carbon fractions. The toxicity of each carbon fraction is determined using a specific compound or assigned reference dose and represents all petroleum compounds present within that carbon range. This allows for a hazard quotient (HQ) to be calculated for each fraction. The HQs are summed to determine if the total (i.e. the hazard index) is less than or equal to 1 as required by MTCA.

The toxicity of the individual fractions vary depending on the specified compound or reference dose and therefore certain fractions will have a more significant influence on the calculated TPH level. To establish a conservative level, Ecology only used the equivalent carbon fraction with the highest toxicity (aromatic fraction EC 10-12¹) to calculate the hazard quotient and ultimately the TPH cleanup level. This approach results in a TPH cleanup level of 1500 mg/kg. The evaluation was supplemented by reviewing more than 100 MTCA TPH spreadsheets representing various petroleum compositions and site-specific conditions. This analysis found that approximately 85% of the results exceeded 2500 mg/kg with the lowest value being 1923 mg/kg.

The remaining question was how well the NWTPH method matches sample results using the EPH/VPH methods. If the NWTPH method yields similar or higher levels, then the approach described above will always be conservative. To address this question, Ecology reviewed a series of split samples that were analyzed using both test methods. Of the 29 sample results evaluated, only three (10%) had higher EPH/VPH results. These three samples were further

¹ For a more detailed explanation of how fractionation testing is used to determine TPH cleanup levels, see Section 8.5 in Ecology's *Guidance for Remediation of Petroleum Contaminated Sites*.

evaluated by entering the fractionated concentrations into the MTCA TPH spreadsheet. The calculated TPH cleanup levels for these three samples were well above the 1500 mg/kg level (4088 mg/kg to 5780 mg/kg). Given the development and evaluation process used, Ecology believes the 1500 mg/kg direct contact TPH cleanup level will be protective of human health and the environment.

When selecting and implementing a model remedy set forth in this guidance, there are two options for establishing a Method B or Method C direct contact TPH level:

Option 1: Analyze samples using the EPH/VPH methods then follow the procedures specified in Figure 8.1 of Ecology’s [Guidance for Remediation of Petroleum Contaminated Sites](#) (Ecology 2016) to determine a direct contact TPH cleanup level using the fractionated data.

Option 2: Apply the generic TPH cleanup level of 1500 mg/kg discussed above. The 1500 mg/kg level applies to situations where only TPH-Gx is present or for mixtures that include TPH-Gx. This level does not affect the Method A cleanup level of 2000 mg/kg for diesel range organics/heavy oils, or the 4000 mg/kg level for mineral oil if TPH-Gx is not present or is a limited portion of the mixture.

For example, if the measured TPH-Gx concentration is less than 30 mg/kg (when benzene is present) and TPH-Dx is 1750, then both the Method A cleanup levels are met. If the measured TPH-Gx concentration is 250 mg/kg and TPH-Dx is 300 mg/kg, then the combined total is less than the generic value of 1500 and the direct contact pathway has been addressed.

Use of the 1500 mg/kg direct contact TPH cleanup level is limited to sites that do not use Method A for establishing soil cleanup standards (i.e. options 4 – 7 as specified in Table 1 on page 18. The other limitation that applies when using the 1500 mg/kg cleanup level relates to determining compliance with the measured concentrations. Several options are provided in Chapter 10, “Determining Compliance with Cleanup Standards” (pp. 151-155 in [Guidance for Remediation of Petroleum Contaminated Sites](#)). However, given the methodology used to develop the 1500 mg/kg cleanup level, only the direct comparison method can be used at this time. Ecology intends to review the other options (e.g. statistical evaluation) to determine if they could be used in the future. Regardless of which option is used, the direct contact levels for compound-specific substances (e.g. benzene) also need to be met.

Vapor Intrusion (VI) Pathway

Assessment of the vapor intrusion pathway may be necessary for some of the model remedies identified. Most sites that meet the Method A levels will have adequately addressed the vapor intrusion pathway. However, WAC 173-340-740(3)(b)(iii)(C) and WAC 173-340-745(5)(b)(iii)(C) specify that whenever the TPH concentrations or other petroleum VOC concentrations are significantly higher than a concentration derived for protection of groundwater, the soil to vapor pathway must be evaluated.

When implementation of a model remedy requires an assessment of the vapor pathway, Ecology recommends following the provisions in Sections 3 through 5 of EPA's [*Technical Guide for Addressing Petroleum Vapor Intrusion at Leaking Underground Storage Tank Sites*](#) (USEPA June 2015) for initially assessing the vapor intrusion pathway. Ecology's Implementation Memo No. 14, [*Updated Process for Initially Assessing the Potential for Vapor Intrusion*](#) (Ecology 2016) provides additional guidance on how to complete this evaluation.

If circumstances are such that the site cannot be screened out during the initial assessment, then further investigation and mitigation (if necessary) would need to follow the provisions outlined in Ecology's [*Draft Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action*](#) (Ecology 2016)

Ecology has updated the Method B and Method C cleanup and screening levels for the vapor intrusion pathway. This information can be found at <https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Vapor-intrusion-overview/Vapor-intrusion-2015-changes-to-the-2009-toxicit>

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Chapter 6: Seven Model Remedies for Petroleum Contaminated Soil

General Information

This chapter discusses the scope of each model remedy. Before any of these model remedies can be used, a cleanup action plan must be completed that identifies the specific work to be done. Appendix A contains information that must be considered when developing the cleanup action plan. The level of detail in the cleanup action plan can be based on the site's complexity and the specific model remedy selected. Upon completion of the removal action, confirmation samples must be taken to determine compliance with the selected soil cleanup standards. The recommended number of samples and locations are outlined in Appendix A.

If confirmation sampling documents that the removal action was not sufficient to fully comply with the applicable soil cleanup standards due to the presence of a structural impediment, the source property owner must record an environmental covenant with the Register of Deeds in the County in which the site is located. The environmental covenant must meet all applicable requirements in WAC 173-340-440, but can be tailored to address site-specific situations. A copy of the draft restriction must be included as part of the final remedial action report. Within 90 days from completion of the remedial action, a final remedial action report documenting the results of all work must be submitted to Ecology.

All of the model remedies require source removal, including free product and contaminated soil to the maximum extent practicable. Table 1 summarizes the criteria that apply to each model remedy, and is followed by a more detailed discussion. The model remedies provide multiple options for addressing soil contamination on the source property. If off-source soil contamination also exists, the selected model remedy can be expanded to address these impacts, provided that the eligibility criteria in Chapter 3 have been satisfied and the soil cleanup levels in Table 740-1 are met for all adjacent properties².

² None of the model remedies set forth in Chapter 6 allow for off-property soil contamination above the Method A cleanup levels, once the selected remedy has been implemented and adequate compliance monitoring has been completed. This requirement includes any road right-of-way where the land is not owned by the source property owner.

Table 1. Summary of model remedies for sites with petroleum contaminated soils.

Option	Soil Cleanup Method Selected	Is the 1,500 mg/kg generic TPH CUL appropriate?	Meets selected CUL throughout property?	Empirical Demonstration Used?	IC required on property?
1	Method A - Unrestricted	No	Yes	No	No
2	Method A - Industrial	No	Yes	No	Yes
3	Method A – Either Unrestricted or Industrial	No	No	No	Yes
4	Method B	Yes	Yes	Yes	Maybe ³
5	Method B	Yes	No	Yes	Yes
6	Method C	Yes	Yes	Yes	Yes
7	Method C	Yes	No	Yes	Yes

Model Remedy 1. This model remedy is for situations where complete removal of the contaminated soil will take place and Method A Soil Cleanup Levels for Unrestricted Property Use have been selected. Following excavation, confirmation testing must be performed to document that the applicable Method A cleanup levels found in Table 740-1 of WAC 173-340-900 have been met at the point of compliance, such that no environmental covenants are necessary.

³ Depending on the amount of contamination remaining and the site-specific conditions, an institutional control (IC) may be necessary to address the vapor intrusion or terrestrial ecological pathways.

Model Remedy 2. This is similar to Model Remedy 1, in that soil will be completely removed. The major differences are:

- a) The site meets the definition of an industrial property as specified in WAC 173-340-745 and therefore can use the Method A cleanup levels for industrial properties contained in Table 745-1 of WAC 173-340-900; and
- b) Use of Table 745-1 is limited to the source property.

Following excavation of the contaminated soil, confirmation testing must be performed to document that the applicable Method A cleanup levels have been met. Use of the industrial Method A levels requires that an environmental covenant must be filed to help ensure the remedy remains protective and that the zoning designation does not change. Ecology has model language to use when preparing an environmental covenant. Visit TCP's Policies and Procedures website at <https://www.ecology.wa.gov/Regulations-Permits/Plans-policies/Toxics-cleanup-policies> and search "environmental covenant" under TCP Procedures.

Model Remedy 3. This model remedy applies to situations where Method A levels (either for unrestricted use, or for sites that meet the definition of industrial land use) are selected but the soil removal action is not sufficient to fully comply with the specified concentrations at all locations on the source property or within the portion of the right-of-way that is owned by the source property owner, due to the presence of one or more structural impediments (e.g., buildings, utility lines, or roadways). Information must be provided to document that:

- a) The soil removal action was implemented to the greatest degree practicable;
- b) The site characterization confirms that no other pathway has or can reasonably be expected to be impacted; and
- c) An environmental covenant is filed (or an institutional control is utilized for certain public right-of-ways) to ensure the remedy remains protective. (For more information, visit TCP's Policies and Procedures website at: <https://www.ecology.wa.gov/Regulations-Permits/Plans-policies/Toxics-cleanup-policies> and search "environmental covenant" under TCP Procedures.)

Model Remedy 4. This model remedy is for situations where Method B has been selected to establish the cleanup levels and removal of the contaminated soil is sufficient to meet the calculated Method B levels. The Method B soil cleanup levels (with the exception of the generic TPH level) must be determined using the provisions contained in WAC 173-340-740(3). Ecology's Cleanup Level and Risk Calculations (CLARC) website houses the CLARC spreadsheet that provides compound-specific Method B direct contact levels for unrestricted use:

- CLARC website: <https://fortress.wa.gov/ecy/clarc/>
- CLARC spreadsheet: <https://fortress.wa.gov/ecy/clarc/FocusSheets/Soil%20Methods%20B%20and%20A%20unrestricted.pdf>.

The options for determining Method B direct contact TPH cleanup levels are set forth in Chapter 5 of this document.

After contaminated soil is excavated, confirmation testing must be performed to document that the Method B direct contact cleanup levels have been met at the point of compliance and the vapor intrusion pathway has been evaluated and adequately addressed. At that point an NFA letter could be issued and no environmental covenant would be necessary.

Model Remedy 5. This model remedy is similar to Model Remedy 4. The major difference is that the soil removal action is not sufficient to fully comply with the calculated Method B levels at all locations on the property or within the portion of the right-of-way that is owned by the source property owner, due to the presence of one or more structural impediments (e.g. buildings, utility lines or roadways). Ecology’s CLARC spreadsheet provides compound-specific Method B direct contact levels for unrestricted use:

- CLARC spreadsheet:
<https://fortress.wa.gov/ecy/clarc/FocusSheets/Soil%20Methods%20B%20and%20A%20unrestricted.pdf>.

The options for determining Method B direct contact TPH cleanup levels are set forth in Chapter 5 of this document.

Documentation must be provided that the soil removal action was implemented to the greatest degree practicable and an environmental covenant has been filed (or an institutional control has been used for certain public right-of-ways) to ensure the remedy remains protective. (For more information, visit TCP’s Policies and Procedures website at <https://www.ecy.wa.gov/Regulations-Permits/Plans-policies/Toxics-cleanup-policies> and search “environmental covenant” under TCP Procedures.)

Model Remedy 6. This model remedy is for those situations where:

- a) The site meets the definition of an industrial property per WAC 173-340-745,
- b) Method C has been selected to establish the cleanup levels,
- c) Removal of the contaminated soil is sufficient to meet the calculated Method C levels.

The Method C soil cleanup levels must be determined using the provisions contained in WAC 173-340-745(5)(b). Ecology’s CLARC spreadsheet provides compound-specific Method C direct contact levels:

- CLARC spreadsheet:
<https://fortress.wa.gov/ecy/clarc/FocusSheets/Soil%20Methods%20C%20and%20A%20industrial.pdf>.

The options for determining Method C direct contact TPH cleanup levels are set forth in Chapter 5 of this document.

Following excavation of the contaminated soil, confirmation testing must be performed to document that the Method C levels have been met at the point of compliance and that the vapor pathway has been adequately addressed such that the only environmental covenant necessary is to limit the property to industrial land use. (For more information, visit TCP’s Policies and Procedures website at <https://www.ecy.wa.gov/Regulations-Permits/Plans-policies/Toxics-cleanup-policies> and search “environmental covenant” under TCP Procedures.)

Model Remedy 7. This model remedy is similar to Model Remedy 6. The major difference is that the soil removal action is not sufficient to fully comply with the Method C levels at all locations on the property, due to the presence of one or more structural impediments (e.g. buildings, utility lines or roadways). Ecology’s CLARC spreadsheet provides compound-specific Method C direct contact levels:

- CLARC spreadsheet:
<https://fortress.wa.gov/ecy/clarc/FocusSheets/Soil%20Methods%20C%20and%20A%20industrial.pdf>.

The options for determining Method C direct contact TPH cleanup levels are set forth in Chapter 5 of this document.

Documentation must be provided to show that the soil removal action was implemented to the greatest degree practicable and an environmental covenant must be filed to ensure the remedy remains protective and the property remains industrial. (For more information, visit TCP’s Policies and Procedures website at <https://www.ecy.wa.gov/Regulations-Permits/Plans-policies/Toxics-cleanup-policies> and search “environmental covenant” under TCP Procedures.)

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**Appendix A:
Model Remedy Provisions for Developing a
Cleanup Action Plan (CAP)**

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Appendix A: Model Remedy Provisions for Developing a Cleanup Action Plan (CAP)

Appendix A contains information that needs to be considered when developing the cleanup action plan. Applicants whose sites meet the criteria in Chapter 6 may select and implement that particular model remedy. Implementation needs to address all of the applicable provisions contained in Appendix A, including preparation and submittal of the final remedial action report to Ecology.

Select a Remediation Contractor/Consultant

Although not required, Ecology encourages owners and operators to hire an environmental consultant to act as their representative during the entire cleanup process to help ensure that all applicable regulatory requirements are met. Based on the results of a site characterization, an environmental consultant can determine whether any of the model remedies identified would apply, then prepare the necessary plans and specifications to implement the selected remedy. The consultant is also available to help solicit and evaluate bids from interested parties so that a qualified and experienced contractor can be selected to conduct the work.

Obtain Necessary Permits and Approvals

Model remedies are not exempt from local, state or federal laws and therefore implementation must comply with all applicable procedural and substantive requirements, including the need to obtain any necessary permits. Since all of the model remedies identified in this document rely on excavation and off-site management, several laws and permits may be applicable. See Chapter 11 of [Guidance for Remediation of Petroleum Contaminated Sites](#) (Ecology 2016) for a general discussion of permits. The information in this chapter is intended to supplement that guidance.

The information below is provided for example purposes only. Some provisions may not apply to the specific cleanup action being implemented, while additional requirements to those below may apply. Therefore, anyone considering using one of the model remedies outlined in this document should consult Ecology and other government entities (e.g., city or county authorities) to ensure compliance with all required permits, notifications, and other requirements.

- **State Environmental Policy Act (SEPA)**

SEPA (RCW 43.21C, Chapter 197-11 WAC, and the SEPA procedures found in Chapter 173-802 WAC) are intended to ensure that state and local government officials consider environmental values when making decisions. The SEPA process is triggered whenever

a local or state permit is required to conduct the cleanup. It begins by completing a SEPA Environmental Checklist and submitting it to the “lead agency” (usually the county or city where the site is located). The lead agency will use the checklist to decide whether the cleanup action is likely to cause a significant adverse impact to the environment. The SEPA Environmental Checklist form can be found in WAC 197-11-960. Information on how to use the checklist can be found in WAC 197-11-315 and 330.

Grade and Fill Permit

Most local governments require a grade and fill permit for larger excavations. Prior to conducting a cleanup, contact the city or county development permitting department with jurisdiction for the area to determine if a permit is required.

Demolition Permit

If the cleanup requires the demolition of a building or other structure, a permit will likely be needed from the local government. Contact the city or county development permitting department for additional information.

Electrical Permit

If the cleanup involves changes to electrical systems, an electrical permit will often be necessary. Many smaller jurisdictions rely on the Washington State Department of Labor & Industries (L&I) for electrical permitting and inspections. Contact the city or county development permitting department for additional information.

Construction Stormwater General Permit (CSWGP)

Construction site operators are required to obtain a Construction Stormwater General Permit (also known as a General Permit) if:

- a) They are engaged in clearing, grading, and excavating activities that disturb one or more acres; and
- b) Stormwater will or may be discharged to surface waters of the state.

Construction activity that Ecology has determined to be a significant contributor of pollutants to waters of the state, and construction activity that has a reasonable expectation to cause a violation of any water quality standard, also require a CSWGP. General Permits typically apply only to situations where runoff does not come in contact with contaminated soil or groundwater. Further information on the CSWGP can be found on Ecology’s website at

<http://www.ecology.wa.gov/programs/wq/stormwater/construction/>

Contaminated sites may not be eligible for a General Permit if the stormwater and/or dewatering discharge from the construction site have the potential to violate water quality standards. In these situations, Ecology's Water Quality Program should be contacted for direction on the applicable permit submittal requirements and permitting options. Permitting options include Individual Permits and/or site-specific companion orders to a General Permit.

Air Emissions

Excavation of petroleum contaminated soils may trigger regulatory requirements related to volatile emissions, diesel equipment emissions, and dust. Although using local construction equipment and dust controls (such as wetting or covering exposed soils during construction) should limit diesel emissions and airborne particulates, the local authority should be contacted to determine if any additional requirements apply.

Noise Ordinance Requirements

Construction activities must be carried out in a manner consistent with the local and state environmental noise standards (Chapter 173-60 WAC). Contact the city or county development permitting department for additional information.

Minimum Standards for Construction and Maintenance of Wells

Groundwater monitoring wells that will be installed or removed as part of excavation activities must be constructed or decommissioned in accordance with the requirements of Chapter 173-160 WAC.

Access Agreements

If soil contamination extends to neighboring properties, an access agreement is required before initiating any soil excavation work on property owned by others. These access agreements should be negotiated and obtained as early in the cleanup process as possible. When a model remedy is being used to address off-property contamination, the site characterization must address the full extent of contamination from the release without regard to property boundaries.

Local Health Jurisdiction Permits

Some local health departments/districts require that a permit be obtained prior to UST decommissioning. In addition, implementation of remedial actions such as treatment or disposal of petroleum contaminated soil may also require a local health department/district permit.

Complete Pre-Soil Removal Activities

Before initiating soil removal activities, the following important actions must be completed:

Utility Locating

Excavation locations should be marked with white paint and notification must be provided to underground utility service providers by calling 811 or 800-424-5555. Notification to the utility locate service must be made not less than two business days and not more than ten business days before the scheduled date of excavation. Failure to provide notification can result in significant penalties. Owners and operators may also want to contract a private utility locating service to mark areas within their facilities that will not be addressed by the one-call service.

UST Removal

If the model remedy is being applied at a site where the source of the contamination is determined to be a leak from or in the vicinity of an underground storage tank (UST), the UST must be removed and the margins of the excavation tested for compliance as part of remedy implementation. Notify applicable local authorities and Ecology UST officials prior to UST removal and conduct UST decommissioning according to the requirements of Chapter 173-360 WAC. UST decommissioning requires the person conducting the work to be certified under Chapter 173-360 WAC.

Conduct Remediation Activities

Soil Excavation Approach and Methods

All of the model remedies set forth in this document require that contaminated soil be removed to the greatest degree possible. As a result, excavation activities must extend laterally and vertically until soil concentrations are below the established cleanup levels or the presence of structural impediments precludes complete removal of the contaminated soil. The soil conditions, depth of excavation, and the proximity to buildings are all situations that may require shoring systems or other safety precautions. Shoring systems must be designed by a professional engineer and excavation slopes must comply with Washington State construction safety standards for excavation, trenching, and shoring (Chapter 296-155 WAC, Part N).

Field Screening and Confirmation Soil Sampling

Field-screening (headspace organic vapor screening, water sheen screening, and visual observation) should be used as excavation proceeds to help determine the extent of soil removal. Field-screening techniques are discussed in Chapter 5 of [Guidance for](#)

[Remediation of Petroleum Contaminated Sites](#) (Ecology 2016). Once it appears that the appropriate limits are reached or further excavation is not practicable, collect confirmation soil samples from the excavation sidewalls and base, and submit the samples for laboratory analysis. If an UST has been removed from the site, specific samples must be collected to comply with Chapter 173-360 WAC, which may be required in addition to those specified below.

Confirmation samples should be collected from locations where field screening/visual observations indicate contamination may be present, or at locations where a professional geologist or engineer has determined is the most appropriate based on site-specific factors. Follow the sampling criteria contained in [Guidance on Sampling and Data Analysis Methods](#). (Ecology 1995). Confirmation soil samples must be submitted to an Ecology-certified laboratory and analyzed for those constituents that are most likely to be present based on site characterization data (see Table 7.2 in *Guidance for Remediation of Petroleum Contaminated Sites* for the appropriate chemicals of concern to submit for analysis).

□ **Sampling and Analysis of Excavated Soil**

Excavated soil must be sampled and analyzed in order to properly classify the material. Sampling should be performed as specified in Table 5-3 of [Guidance for Site Checks and Site Assessments for Underground Storage Tanks](#) (Ecology 2003).

Soil contaminated by releases from federally regulated USTs is exempt from many of the dangerous waste regulations under WAC 173-303-071(3)(t). However, the Toxicity Characteristic Leaching Procedure (TCLP) values set forth in WAC 173-303-090(8) for waste codes D004 to D017 (which includes lead) must be met. In addition, petroleum contaminated soil from other releases (e.g., non-federally regulated USTs and spills) are not exempt. It is the responsibility of the waste generator to determine if the dangerous waste rules apply and if so, to manage the material properly. The remainder of this discussion focuses on those situations where the soil is not defined as a dangerous waste.

Collect soil samples from locations that are representative of the soil and where field-screening indicates contamination may be present. Samples that will be analyzed for VOCs must be collected using EPA Method 5035. Submit soil samples for chemical analysis and test for gasoline, diesel, and oil-range petroleum hydrocarbon-related compounds listed in the WAC 173-340-900, Table 830-1. Additional testing information is also available in Table 7.2 of [Guidance for Remediation of Petroleum Contaminated Sites](#) (Ecology 2016).

□ **Soil Segregation and Storage**

Contaminated material that will be temporarily stored on-site must be managed such that releases to the environment (e.g. groundwater, surface water, and air) are minimized. The contaminated soil must also be secured and covered as appropriate when not actively in use. Chapter 11.3.2 of the *Guidance for Remediation of Petroleum Contaminated Sites* provides specific information on options for appropriately storing petroleum contaminated soil. In some cases it may be advantageous to separate excavated soil based on visual observations or preliminary testing, since additional management options will often be available for soils with more limited impacts.

□ **Management of Contaminated Soil**

Excavated contaminated soil must be managed in accordance with state and local requirements. Table 12.2 of *Guidance for Remediation of Petroleum Contaminated Sites* provides a number of options, depending on the level of petroleum impacts. Anyone transporting contaminated material must be properly trained, licensed, and in compliance with applicable DOT regulations. Owners and operators must obtain the necessary approvals prior to transportation and maintain records of how the material was ultimately managed. This can include weight tickets provided by the disposal facility, manifests, or completed dangerous waste manifests as applicable to document disposal. The appropriate documentation must be submitted to Ecology as part of the remedial action report.

□ **Compliance with MTCA Cleanup Levels and Site Restoration**

If laboratory analytical results indicate all confirmation samples are less than the soil cleanup levels established for the site, or if removal of additional contaminated soil is no longer practical due to the presence of structural impediments, the excavation can be backfilled and site restoration activities completed. Backfill must be placed and compacted in a manner consistent with the planned use of the site and in accordance with all applicable local building, zoning, and grading requirements to prevent settling.

Prepare and Submit a Remedial Action Report to Ecology

The results of all site characterization activities, as well as a description of the cleanup work completed, shall be compiled and submitted to Ecology in a remedial action report. This report must provide adequate information to document that the selected model remedy meets the applicable cleanup standards, or that the presence of structural impediments precluded complete removal of the contaminated soil.

For those sites that are in the Voluntary Cleanup Program (VCP) process, the remedial action report submittal needs to follow the format and requirements set out in Chapter 5 of [Guidelines for Property Cleanups under the Voluntary Cleanup Program](#) (Ecology 2015). The cover letter should indicate that an Ecology-approved model remedy is being used so it is clear that a Feasibility Study, Disproportionate Cost Analysis, and a review fee are not required.

Based on the selected model remedy, it may be necessary to use environmental covenants or (for certain public rights-of-way) other institutional controls to help ensure that the remedy remains protective of human health and the environment over the long-term. If an environmental covenant is used, it must be filed with the Register of Deeds in the county where the site is located. The environmental covenant must meet all applicable requirements in WAC 173-340-440 and a copy of the draft restriction must be included as part of the final remedial action report. (For more information, visit TCP’s Policies and Procedures website at <https://www.ecy.wa.gov/Regulations-Permits/Plans-policies/Toxics-cleanup-policies> and search “environmental covenant” under TCP Procedures.) Documentation on the impediments encountered and an estimate of the amount of contaminated soil remaining needs to be provided in the final remedial action report.

Pursue a No Further Action (NFA) Determination

Sites in the independent cleanup process that are interested in pursuing a no further action determination must apply to enter the VCP Program including completing the Application Form and the Agreement. Part 1 of the Application Form should indicate a no further action determination is being requested.

While it is not required to submit a no further action request for sites under independent cleanup, the fees for such reviews are waived when a model remedy is selected as the remedial option. Therefore, Ecology encourages persons to pursue an NFA determination after work is completed, so that a final determination of the adequacy of the cleanup can be provided. The procedures for submitting a no further action request are found in Chapter 5 of *Guidelines for Property Cleanups under the Voluntary Cleanup Program*. Ecology has developed checklists to help identify the information that needs to be provided when requesting an opinion from Ecology. These documents are available at: <https://ecology.wa.gov/Spills-Cleanup/Contamination-cleanup/Cleanup-process/Cleanup-options/Voluntary-cleanup-program/Reporting-requirements> For sites where Ecology oversight is being provided under either an Agreed Order or Consent Decree, the method for documenting the cleanup actions must follow the specific requirements contained in those documents.

**Appendix B:
Response to Comments for
Model Remedies for Sites with Petroleum Contaminated Soils
(August 2017 Review Draft)**

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Appendix B: Response to Comments for Model Remedies for Sites with Petroleum Contaminated Soils (August 2017 Review Draft)

A public comment period was held from mid-August through September 22, 2017, for the August 2017 draft of this document. The following comments were received during that time and helped inform updates to this December 2017 revision.

Comment No. 1 – Chapter 6, paragraph 2 and Appendix A, page 7 contain references to an “executed” environmental covenant. This language should be revised to specify a “draft” covenant be provided as part of the remedial action report since Ecology’s review comments need to be incorporated prior to finalizing the document.

Response – The requested change was made to the guidance.

Comment No. 2 – A popular situation not covered in the guidance is the redevelopment of a property for mixed uses with residential apartments or condominiums above ground, retail shops at ground level, and a one to four story integral underground parking structure. Such a redevelopment frequently extends from lot line to lot line. Such a redevelopment produces two special situations:

- **Groundwater** – if the property has a shallow perched groundwater layer and a much deeper aquifer, the excavation for the parking structure may remove all of the perched groundwater. This makes moot the question of whether the groundwater was contaminated and reduces the site to a soil only question of contamination.
- **Soil Vapor Intrusion** – underground parking structures have large-scale air handling systems with frequent changes of air to control the risk from vehicle exhaust. Vapor intrusion from the soil adds little risk to the greater risk from the vehicle exhausts and the existing air handling system can easily handle the additional vapor. Therefore, sites with underground parking structures should be exempt from assessing vapor intrusion risks on the grounds that the building already has an engineered solution in place.

Response – For situations where contaminants are present in perched groundwater and then completely removed as part of the remedial action, the site would be eligible to use Groundwater Model Remedy No. 1.

Regarding vapor intrusion, while underground parking structures typically have large scale air handling systems to deal with vehicle exhaust, the potential still exists for chemical vapors to enter these buildings if the parking structure does not extend under the entire building footprint or if elevator shafts extend below the base of the parking structure and potentially induce vapor migration due to the negative pressure created. While there may be situations where the parking structure is determined to provide the necessary protection for the VI pathway, this would be a case-by-case determination and not a blanket exemption.

Comment No. 3 – On page 14 in the second to last paragraph, there is a reference to the *Guidance for Remediation of Petroleum Contaminated Sites*. However, it looks like it is referencing the old version of the document. The page numbers referenced (p. 137-140) are incorrect for the new version of the document released in June 2016. The section referenced (Chapter 10) starts on page 151 in the updated *Guidance for Remediation of Petroleum Contaminated Sites*.

Response – The guidance was updated to include the new page numbers.

Comment No. 4 – The first sentence in Chapter 6, paragraph 2 is missing an “is” between site and located.

Response – The guidance was revised to include the missing word.

Comment No. 5 – The last 2 sentences in the first paragraph of page 2 in Appendix A uses the phrase “may be” which makes it sound like Ecology is not certain about the location of these documents. Use of “can be” or “is” would sound better.

Response – The guidance was revised to replace “may be” with “can be”.

Comment No. 6 – The fourth paragraph on page 14 of Chapter 5 is actually a surprisingly dense and important block of information. The “For example...” half of that paragraph feels like it gets a little lost in the total amount of information conveyed in the paragraph. I think it would make this “Option 2” section clearer if everything starting from “For example...” was made into its own paragraph, or done in a “call-out” box below the paragraph, or given an additional off-set (indent it another level).

Response – An additional paragraph was created as requested.

Comment No. 7 – For Model Remedy #4, I think it should be called out that either an Environmental Covenant would be required if some form of a protective cap is already in place, or that Model Remedy #4 does not apply if some form of a protective cap is already in place.

Response – Model Remedy No. 4 applies to situations where source removal has resulted in the Method B cleanup levels being met throughout the property. The only potential situations that would require an environmental covenant would be if the remaining contamination and site-specific conditions are such that the vapor intrusion or terrestrial ecological pathways require some restrictions or controls.

Comment No. 8 – The first sentence in paragraph 2 of Chapter 3 under “Affected Media” indicates that the Method A soil cleanup levels cannot be exceeded beyond the source property in order to use a model remedy. However, there are a number of model remedies that allow for higher levels of contamination to be left in-place due to the presence of limitations such as buildings, roadways or safety concerns (e.g. model remedy 5), with the use of environmental covenants to address that contamination on the source property. Please clarify how concentrations higher than Method A levels for unrestricted use could be left in-place extending up to the roadway adjacent to the property boundary, with an expectation to meet the Method A levels immediately beyond the source property boundary.

Response – Ecology added a note to this section explaining why the Method A soil cleanup levels beyond the source property must be met when a model remedy is being used to address the contamination.

Comment No. 9 – The last 2 sentences on page 14 indicate that the direct contact TPH cleanup level may need to be adjusted downward to account for the residual saturation screening levels set out in Table 747-5 in Washington Administrative Code (WAC) 173-340-900. Explain when this adjustment would be warranted.

Response – Ecology is removing these two sentences from the guidance as a reduction is not necessary when an empirical demonstration is used to show the contaminant levels do not exceed the Method A groundwater cleanup levels.

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