Focus on **Developing *Soil* Cleanup Standards Under the Model Toxics Control Act**

from Department of Ecology's Toxic Cleanup Program

Background

The Washington Department of Ecology (Ecology) adopted changes to the Model Toxics Control Act (MTCA) Cleanup Regulation, chapter 173-340 WAC, on February 12, 2001. These changes became effective on August 15, 2001. This document provides an overview of the requirements and procedures for developing soil cleanup standards under this revised regulation.

What is a soil cleanup standard?

A soil cleanup standard consists of a concentration (cleanup level) that must be met at a specified location within the soil (point of compliance). It also includes any additional regulatory requirements that may be specified in applicable state or federal laws.

What land uses are soil cleanup levels based on?

Soil cleanup levels must be based on the reasonable maximum exposure expected to occur under both current and future site use conditions. The regulation allows for the establishment of soil cleanup levels based on two types of land use – **unrestricted land use** and **industrial land use**. Unless a site qualifies as an industrial property, soil cleanup levels must be based on unrestricted land use. The regulation sets forth criteria for determining whether a site qualifies as an industrial property. See WAC 173-340-745(1).

For **unrestricted land use**, the soil cleanup level must be based on the reasonable maximum exposure expected to occur under residential land use conditions, the land use conditions requiring the most protective cleanup levels. Unrestricted (residential) soil cleanup levels are based on a child exposure scenario. Restrictions on the future use of the land are not required where the unrestricted soil cleanup levels are met at the applicable point of compliance.

For **industrial land use**, the soil cleanup level may be based on the reasonable maximum exposure expected to occur under industrial land use conditions. Industrial soil cleanup levels are based on an adult worker exposure scenario. Restrictions on the future use of the land are required if industrial soil cleanup levels are established, even if the cleanup levels are met.

Land uses other than unrestricted and industrial (such as commercial, recreational, or agricultural) may not be used for the purpose of establishing cleanup levels. However, these land uses may be used for the purpose of assessing the protectiveness of a remedy that does not achieve cleanup standards. See WAC 173-340-708(3).

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What options are available for establishing soil cleanup levels?

For **unrestricted land use**, the regulation provides two options for establishing soil cleanup levels – **Method A** and **Method B**. The regulation does not provide for the establishment of Method C soil cleanup levels for unrestricted land use. **See Figure 1**.

For **industrial land use**, the regulation provides two options for establishing soil cleanup levels – **Method A** and **Method C**. The regulation does not provide for the establishment of Method B soil cleanup levels for industrial land use. **See Figure 2**.

Each of these methods and the criteria for their use are described below.

When may Method A be used to establish soil cleanup levels and how is a Method A cleanup level established?

Method A may be used to establish soil cleanup levels at routine sites and sites with relatively few hazardous substances.

The regulation provides for the establishment of Method A soil cleanup levels for either unrestricted land use (see WAC 173-340-740(2)) or industrial land use (see WAC 173-340-745(3)). The regulation sets forth criteria for determining whether a site qualifies as an industrial property. See WAC 173-340-745(1).

Under Method A **(see Figure 3)**, the cleanup level is based on the most stringent of the following concentrations:

- **Concentration listed in Table 740-1 (unrestricted) or Table 745-1 (industrial).** The cleanup level must be at least as stringent as the concentration listed in Table 740-1 (unrestricted land use) or, if applicable, Table 745-1 (industrial land use).
- **Concentrations established under applicable state and federal laws.** The cleanup level must be at least as stringent as the most stringent concentration established under applicable state and federal laws.
- **Concentrations that protect the environment.** Unless it can be demonstrated that environmental impacts are not a concern at the site, the cleanup level must be at least as stringent as concentrations that result in no significant adverse effects on the protection and propagation of terrestrial ecological receptors (plants and animals).

If neither Table 740-1 (or Table745-1, if applicable) nor the applicable state and federal laws provide a value, then the Method A cleanup level is based on the natural background concentration or the practical quantitation limit (PQL), whichever is higher.

When may Method B be used to establish soil cleanup levels and how is a Method B cleanup level established?

Method B may be used to establish soil cleanup levels at any site.

Method B cleanup levels are based on the reasonable maximum exposure expected to occur under residential land use conditions, the land use conditions requiring the most protective cleanup levels.

Method B is divided into two tiers: **Standard** and **Modified**. Under both standard and modified Method B **(see Figures 4 and 5)**, the cleanup level is based on the most stringent of the following concentrations:

- **Concentrations established under applicable state and federal laws.** The cleanup level must be at least as stringent as the most stringent concentration established under applicable state and federal laws.
- **Concentrations that protect human health.** The cleanup level must be at least as stringent as concentrations that protect human health.

For hazardous substances for which sufficiently protective, health-based concentrations have been established under applicable state and federal laws, the most stringent of those concentrations is used. A concentration established under applicable state and federal laws is sufficiently protective if the excess cancer risk does not exceed 1 in 100,000 (1×10^{-5}) and the hazard quotient does not exceed one (1). If the concentration is not sufficiently protective, then either the concentration must be adjusted downward in accordance with WAC 173-340-740(5)(b) or a protective concentration must be calculated using the equations provided in the regulation.

For hazardous substances for which health-based concentrations have not been established under applicable state and federal laws, a protective concentration must be calculated using the equations provided in the regulation.

Under standard Method B, protective concentrations are calculated using the standard equations and default assumptions provided in the regulation **(see Tables 1 and 2)**.

Under modified Method B, specified default assumptions may be adjusted based on site-specific or chemical-specific data. The regulation describes which parameters may be adjusted and how they may be adjusted.

- **Concentrations that protect the environment.** Unless it can be demonstrated that environmental impacts are not a concern at the site, the cleanup level must be at least as stringent as concentrations that result in no significant adverse effects on the protection and propagation of terrestrial ecological receptors (plants and animals).

When may Method C be used to establish soil cleanup levels and how is a Method C cleanup level established?

Method C may be used to establish soil cleanup levels only at sites where industrial land use represents the reasonable maximum exposure. To qualify for use of Method C, several conditions must be met, including the following:

- The site meets the definition of an industrial property (see WAC 173-340-200 and 173-340-745(1)(a)(i));
- The cleanup action for the site includes appropriate institutional controls to limit exposure to residual hazardous substances, including (at a minimum) the placement of a covenant on the property restricting future property use to industrial uses; and
- The residual hazardous substances will not pose a threat to human health or the environment.

Under Method C **(see Figures 4 and 5)**, cleanup levels are established the same as under Method B, except that:

- Concentrations that are protective of human health are calculated using a less stringent target cancer risk for individual hazardous substances (1 in 100,000) and less stringent default exposure assumptions **(see Tables 1 and 2**); and
- Concentrations that are protective of the environment need only be protective of wildlife (not plants and soil biota).

What exposure pathways must be considered when establishing soil cleanup levels under Method B and Method C to ensure protection of human health?

Persons can be exposed to soil contamination either directly through soil contact (ingestion and dermal absorption) or indirectly through other media (ground water ingestion and vapor inhalation) as soil contamination leaches into the ground water and volatilizes into the air. While some of these exposure pathways must always be evaluated (soil ingestion and leaching), other exposure pathways (dermal absorption and vapor inhalation) need only be evaluated under certain conditions. The following discussion provides an overview of each of these exposure pathways, as well as an overview of the conditions under which they must be evaluated and the methods that may be used to conduct an evaluation.

- **Direct Contact Pathway:** The direct contact exposure pathway consists of two different exposure pathways – **ingestion** and **dermal absorption**. The ingestion exposure pathway involves ingestion of soil particles and the subsequent absorption of contaminants through the gastrointestinal system. The dermal absorption exposure pathway involves dermal contact with soil particles and the subsequent absorption of contaminants through the skin.

  Scientists know that people ingest and have skin contact with small amounts of dust and dirt on a daily basis. Adults inadvertently ingest dirt through swallowing dust and ingesting food with dust and dirt particles on it. Contact with dirt and dust can occur through construction activities, gardening, yard work, outdoor recreational activities, and eating home-grown vegetables. Exposure is not limited to outdoor activities since dust and dirt is tracked into the home or place of work by people and pets. Young children love to play and dig in dirt and often ingest much higher levels than adults due to hand-to-mouth activity.

  To address this concern, the regulation requires an evaluation of the direct contact exposure pathway at every site. However, the regulation does not always require an evaluation of dermal absorption as part of the direct contact exposure pathway. The regulation only requires an evaluation of dermal absorption for petroleum mixtures and for other hazardous substances under certain conditions.

  For *petroleum mixtures*, the regulation requires a concurrent evaluation of ingestion and dermal absorption.

  For *hazardous substances other than petroleum mixtures*, the regulation requires a concurrent evaluation of ingestion and dermal absorption only if a site-specific risk assessment is conducted under modified Method B or C that significantly increases soil cleanup levels. Otherwise, the regulation only requires an evaluation of ingestion.

  Protective concentrations are established using the equations provided in the regulation. To calculate protective concentrations using these equations, certain assumptions must be made regarding exposure – how much soil is ingested and comes in contact with the skin, and how often this occurs.

  Under *standard Method B and C*, protective concentrations are calculated using the default values provided in the regulation **(see Tables 1 and 2)**.

  Under *modified Method B and C*, specified default values may be adjusted based on site-specific or chemical-specific data. The regulation describes which parameters may be adjusted and how they may be adjusted.

- **Leaching Pathway (Protection of Ground Water):** Many hazardous substances can leach from the soil and pollute the ground water or nearby surface water. The potential for this to occur must be evaluated when establishing soil cleanup levels.

  Protective soil concentrations are defined as concentrations that will not cause an exceedance of the ground water cleanup levels established under WAC 173-340-720. To establish protective soil concentrations, one or more of the methods described in WAC 173-340-747 may be used. These methods include two fate and transport models (the 3-phase and 4-phase equilibrium partitioning models), alternative fate and transport models, leaching tests, and the use of site-specific empirical data. See WAC 173-340-747.

  Many hazardous substances commonly found at contaminated sites are very mobile and can be readily leached from the soil. For this reason, evaluation of the leaching pathway often results in the establishment of more stringent soil cleanup levels than would have been required to merely address the direct contact exposure pathway.

- **Vapor Pathway:** For hazardous substances that readily evaporate (such as gasoline and solvents), the inhalation of vapors arising from contaminated soil may be a significant exposure pathway. These vapors can accumulate in buildings or utility manholes and access vaults and even outdoors during calm weather conditions.

  To address this concern, the regulation requires the evaluation of the vapor pathway under certain specified conditions. Under standard Method B or standard Method C, the vapor pathway must be evaluated whenever the hazardous substance is a volatile organic compound and one of the following conditions exist:

  (1) For gasoline range organics, whenever the TPH concentration is significantly higher than a concentration derived for protection of potable ground water under WAC 173-340-747(6) using default assumptions;

  (2) For diesel range organics, whenever the TPH concentration is greater than 10,000 mg/kg;

  (3) For other volatile organic compounds, including TPH components, whenever the concentration is significantly higher than a concentration derived for protection of potable ground water under WAC 173-340-747(4).

  Under modified Method B or modified Method C, the vapor pathway must be evaluated whenever of one the above conditions exist or whenever the modifications to the standard equations or default values for evaluating the direct contact pathway would result in a significantly higher cleanup level than would be calculated without those proposed changes.

  Protective soil concentrations are defined as concentrations that will not cause an exceedance of the air cleanup levels established under WAC 173-340-750. Protective soil concentrations may be determined using one or more of the methods described in the regulation. These methods include measurements of soil vapors, measurements of air concentrations, and air quality modeling. See WAC 173-340-740(3)(c)(iv)(B) and 173-340-745(5)(c)(iv)(B).

- **Other Pathways:** There are many other ways persons can be exposed to soil contamination. Ecology may require evaluation of exposure through other pathways on a site-specific basis when necessary to protect human health.

How is environmental protection considered when establishing a soil cleanup level?

In addition to accounting for human health impacts, soil cleanup levels must also account for any potential impacts to terrestrial ecological receptors (plants and animals). The regulation establishes a tiered process for evaluating threats to terrestrial ecological receptors. This process is set forth in WAC 173-340-7490 through 173-340-7494. These sections define the requirements and procedures for the following:

- Determining whether soil contamination may pose a threat to the terrestrial environment;
- Characterizing current or potential threats to terrestrial ecological receptors exposed to hazardous substances; and
- Establishing site-specific cleanup standards for the protection of terrestrial ecological receptors.

See **Figure 6** for a visual depiction of the terrestrial ecological evaluation process.

The process excludes from further evaluation those sites that do not pose a current or potential threat to terrestrial ecological receptors. To qualify for an "exclusion," a site must meet one of the four criteria specified in the regulation. See WAC 173-340-7491(1). Ecology expects most sites to be excluded from further evaluation, particularly those sites in dense urban areas.

Sites that do not qualify for an exclusion under WAC 173-340-7491(1) must conduct a more thorough terrestrial ecological evaluation. The process provides for two types of evaluations – simplified and site-specific. Simplified evaluations may be conducted at ecologically less important sites. Site-specific evaluations must be conducted at

ecologically more important sites. Criteria are specified in the regulation to determine whether a site-specific evaluation is required. See WAC 173-340-7491(2).

The requirements and procedures for conducting a simplified evaluation are provided in WAC 173-340-7492. The requirements and procedures for conducting a site-specific evaluation are provided in WAC 173-340-7493.

Unless it can be demonstrated that terrestrial ecological impacts are not a concern at the site (either by qualifying for an exclusion or by conducting a simplified or site-specific evaluation), protective concentrations must be established. Protective concentrations are defined as concentrations that result in no significant adverse effects on the protection and propagation of terrestrial ecological receptors (plants and animals).

Why are so many of the Method A soil cleanup levels for industrial land use the same as those for unrestricted land use?

Many of the soil cleanup levels in Tables 740-1 are identical to those in Table 745-1 because the cleanup levels are based on concentrations that are protective of ground water. The ability of a substance to leach into the ground water does not depend on the land use; rather, it depends on the properties of the substance and the soil it is leaching through. Consequently, many of the table values end up being identical for both unrestricted and industrial land uses.

Are there any special considerations for establishing soil cleanup levels for petroleum mixtures?

Yes. Cleanup levels must be established for the total petroleum hydrocarbon (TPH) mixture as a whole, as well as for individual hazardous substances (TPH components) within the mixture, such as benzene, ethylbenzene, toluene, and xylene.

Method A: When using Method A, use the values for TPH and TPH components in Table 740-1 (or Table 745-1, if applicable) as cleanup levels, paying particular attention to the requirements in the footnotes. The TPH values have been pre-calculated for various petroleum products using assumed product compositions.

Method B and Method C: To establish a site-specific TPH cleanup level under Method B or C, the composition of the petroleum mixture in the soil must be determined. Determining the composition requires the analysis of either the soil or the product released for petroleum fractions and other toxic components likely to be present. See Table 830-1 for a list of contaminants to test for when establishing cleanup levels for petroleum mixtures.

- **Direct Contact Pathway:** For petroleum mixtures, the regulation requires a concurrent evaluation of ingestion and dermal absorption. The petroleum mixture composition is used in Equation 740-3 (or, if using Method C, Equation 745-3) to calculate a protective concentration for TPH that takes into account the combined noncarcinogenic effects of the petroleum mixture. Protective concentrations for individual TPH components are established using Equations 740-4 and 740-5 (or, if using Method C, Equations 745-4 and 745-5). The TPH concentration may need to be adjusted downward to take into account the protective concentrations for individual TPH components.
- **Leaching Pathway:** Protective concentrations for TPH and the TPH components must be established using the methods described in WAC 173-340-747.
- **Vapor Pathway:** Since TPH and TPH components are volatile organic compounds, the vapor pathway must be evaluated whenever one of the conditions specified in the regulation exists at a site. Protective concentrations may be determined using one or more of the methods described in the regulation. See the above discussion of the vapor pathway for more information.

In addition to accounting for human health impacts, soil cleanup levels for TPH and the TPH components must also account for any potential impacts to terrestrial ecological receptors (plants and animals), just as for any other hazardous substance.

Are there any additional considerations when establishing soil cleanup levels?

Yes. Soil cleanup levels may need to be adjusted either downward or upward based on the following additional considerations:

- **Downward adjustment based on total site risk:** Soil cleanup levels for individual hazardous substances may need to be adjusted downward to take into account the additive health effects resulting from exposure to multiple hazardous substances and/or multiple exposure pathways. The cleanup levels need only be adjusted if the hazard index exceeds 1 or the total excess cancer risk exceeds 1 in 100,000. This requirement does not apply when using Method A.
- **Downward adjustment to cleanup levels based on applicable state and federal laws:** Soil cleanup levels based on applicable state and federal laws that exceed an excess cancer risk of 1 in 100,000 or a hazard index of 1 must be adjusted downward so that the total excess cancer risk does not exceed 1 in 100,000 and a hazard index of 1.
- **Upward adjustment based on natural background and PQL:** Soil cleanup levels for individual hazardous substances must not be set below the practical quantitation limit (PQL) or natural background concentration, whichever is higher.

May the department establish more stringent cleanup levels?

Yes. The department may establish cleanup levels that are more stringent than those required under the applicable method when the department determines, based on a site-specific evaluation, that such levels are necessary to protect human health and the environment. The establishment of more stringent cleanup levels must comply with WAC 173-340-702 and 173-340-708.

Where in the soil do the cleanup levels have to be met?

The point of compliance defines the point or points on a site where cleanup levels must be met. The term includes both "standard" and "conditional" points of compliance. The point of compliance for soil depends on the exposure pathway that the soil cleanup level is based on.

- For soil cleanup levels **based on direct contact**, the point of compliance is defined as throughout the site from the ground surface to fifteen feet below the ground surface.
- For soil cleanup levels **based on leaching (protection of ground water**), the point of compliance is defined as throughout the site. This means that the point of compliance extends throughout the soil profile and may extend below the water table.
- For soil cleanup levels **based on vapors**, the point of compliance is defined as throughout the site from the ground surface to the uppermost ground water saturated zone (e.g., water table).
- For soil cleanup levels **based on protection of the environment**, the standard point of compliance is defined as throughout the site from the ground surface to fifteen feet below the ground surface. For sites with institutional controls to prevent excavation of deeper soil, a conditional point of compliance may be set at the biologically active soil zone. This zone is assumed to extend to six feet. Ecology may approve a different depth based on site-specific information.

See **Figure 7** for a visual depiction of these points of compliance.

Is there an exception to the requirement that soil cleanup levels must be met at the point of compliance?

Yes. Where a cleanup action involves containment of soils with hazardous substance concentrations exceeding cleanup levels at the point of compliance, the cleanup action may be determined to comply with cleanup standards, provided the requirements specified in WAC 173-340-740(6)(f) are met.

What measurements are required to demonstrate compliance with the soil cleanup levels?

Soil sampling is required to determine if the soil cleanup level has been met at the designated point of compliance. Individual soil samples may be compared directly with the cleanup level if there is documented, reliable information that the soil samples have been taken from locations where the worst soil contamination is likely to be found. Otherwise, statistical methods must be used to determine if the soils have met the cleanup level. If the leaching pathway is a concern at a site, ground water monitoring may also be required to verify that the soil cleanup level is adequately protecting ground water. Similarly, for vapor concerns, it may be necessary to conduct verification soil vapor monitoring or monitoring of the ambient air or the air in buildings or other structures at the site. Monitoring for other exposure pathways will be determined on a case-by-case basis.

For More Information / Special Accommodation Needs

If you would like more information on setting cleanup standards or cleaning up sites, please call us toll-free at **1-800-826-7716**, or contact your regional Washington State Department of Ecology office listed below. Information about site cleanup, including access to a variety of technical guidance documents, is also accessible through our Internet address: http://www.ecy.wa.gov/programs/tcp/cleanup.html.

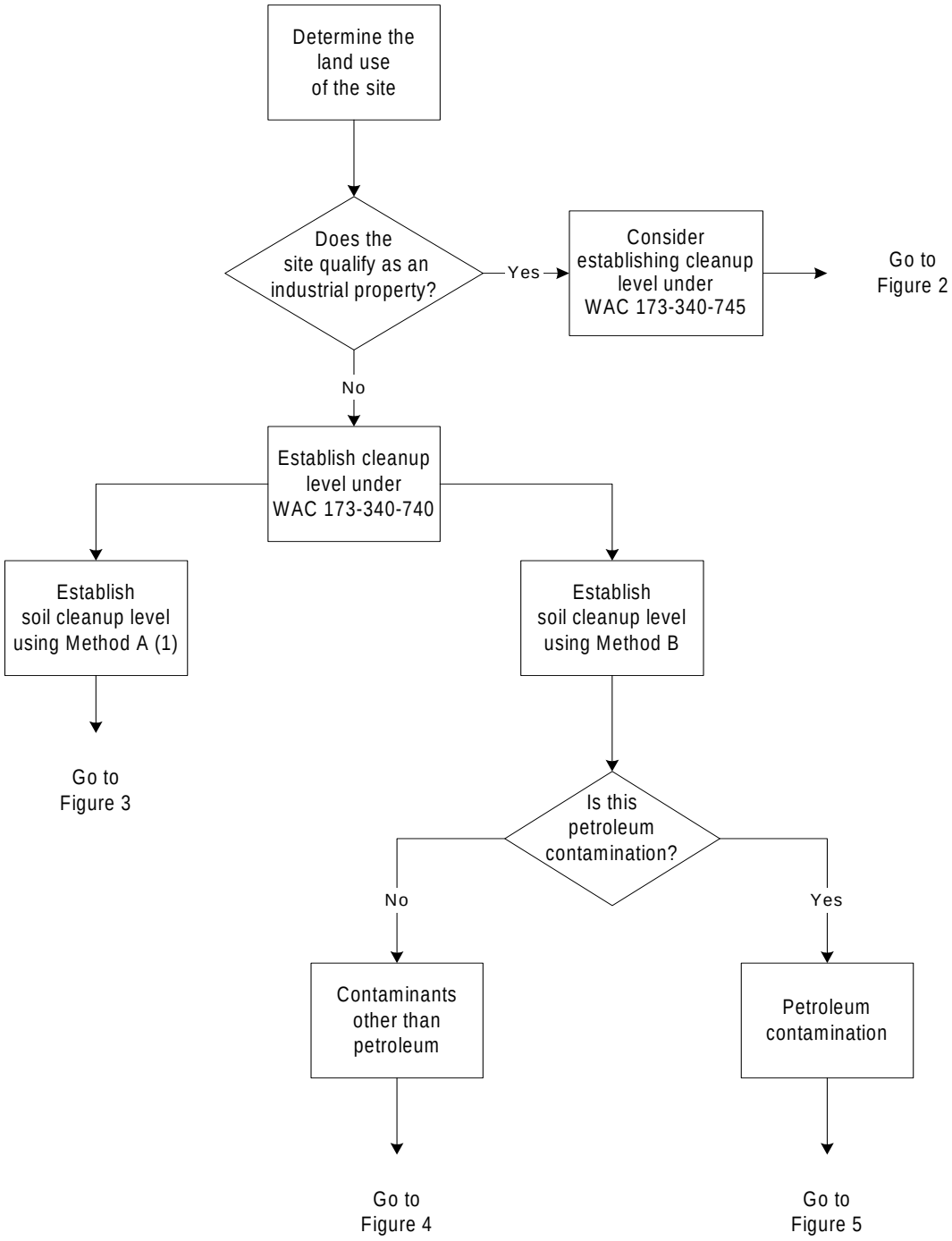
Regional Office	Phone / *TTY	Regions/Counties
Northwest	**425/649-7000**	Island, King, Kitsap, San Juan, Skagit, Snohomish, Whatcom
Southwest	**360/407-6300**	Southwestern Washington, Olympic Peninsula, Pierce, Thurston and Mason
Central	**509/575-2490**	Benton, Chelan, Douglas, Kittitas, Klickitat, Okanogan, Yakima
Eastern	**509/329-3400**	Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman

TTY: 711 or 1-800-833-6388.

Disclaimer Notice: This document is intended to help the user understand WAC 173-340-740 and 173-340-745. It does not establish or modify regulatory requirements.

If you require this publication in an alternate format, please contact the appropriate Regional Office listed above or (TTY) at 711 or 1-800-833-6388.

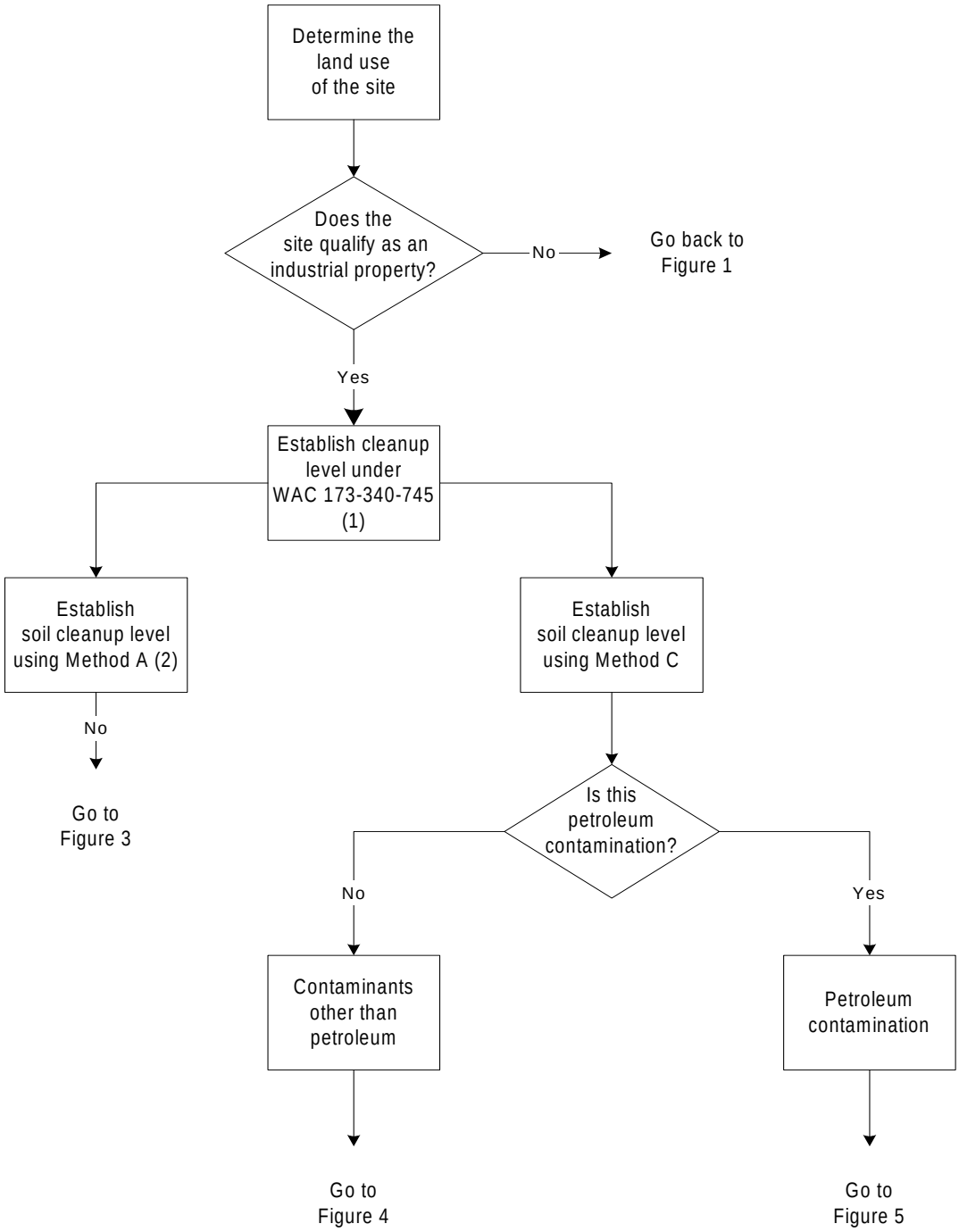
Figure 1: Process for Establishing Soil Cleanup Standards under WAC 173-340-740



NOTES:
(1) Method A is available only for qualifying sites.

Disclaimer Notice: This figure is intended to help the used to understand WAC 173-340-740. It does not establish or modify regulatory requirements.

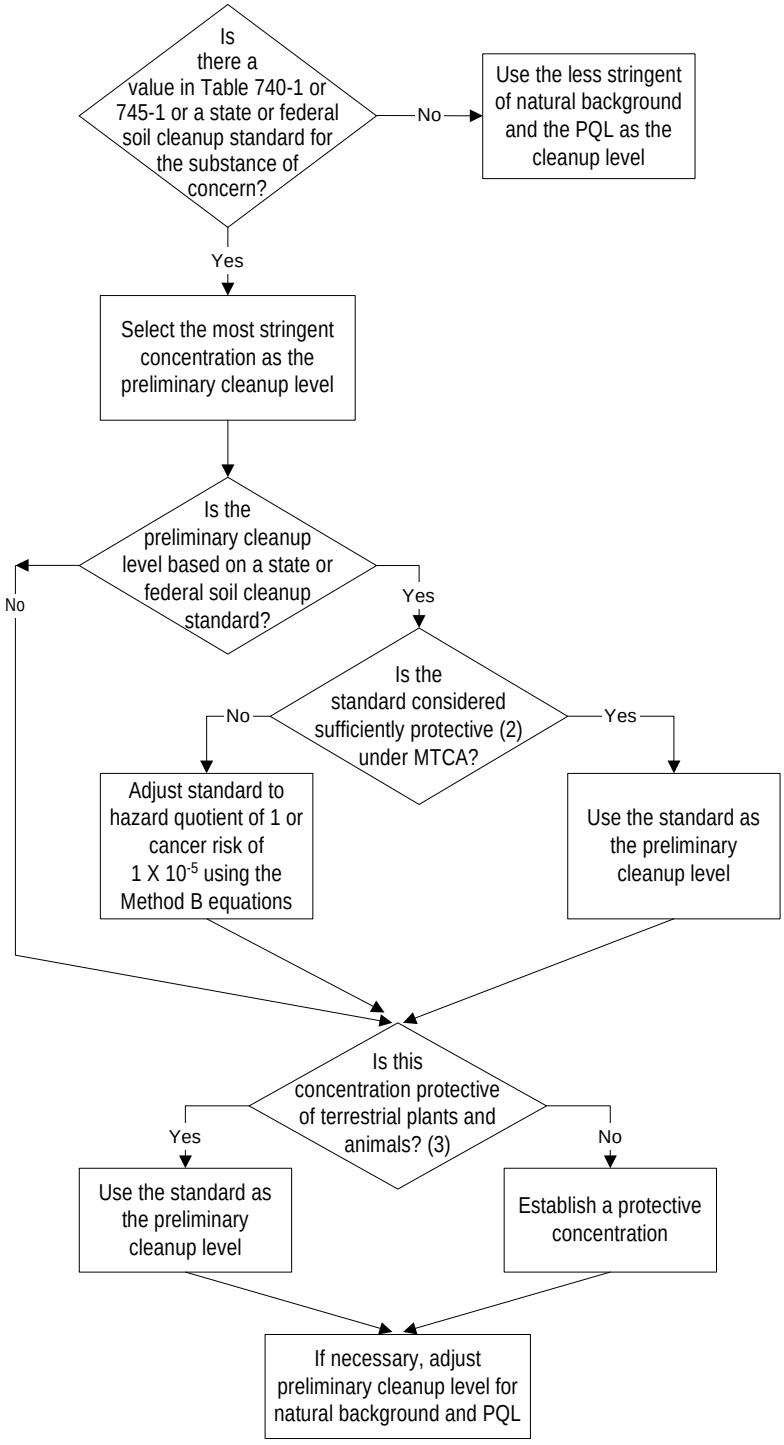
Figure 2: Process for Establishing Soil Cleanup Standards under WAC 173-340-745



NOTES:
(1) Method B may also be used if a person wants to avoid future restrictions on the use of the property.
(2) Method A is available only for qualifying sites. See WAC 173-340-704.

Disclaimer Notice: This figure is intended to help the used to understand WAC 173-340-745. It does not establish or modify regulatory requirements.

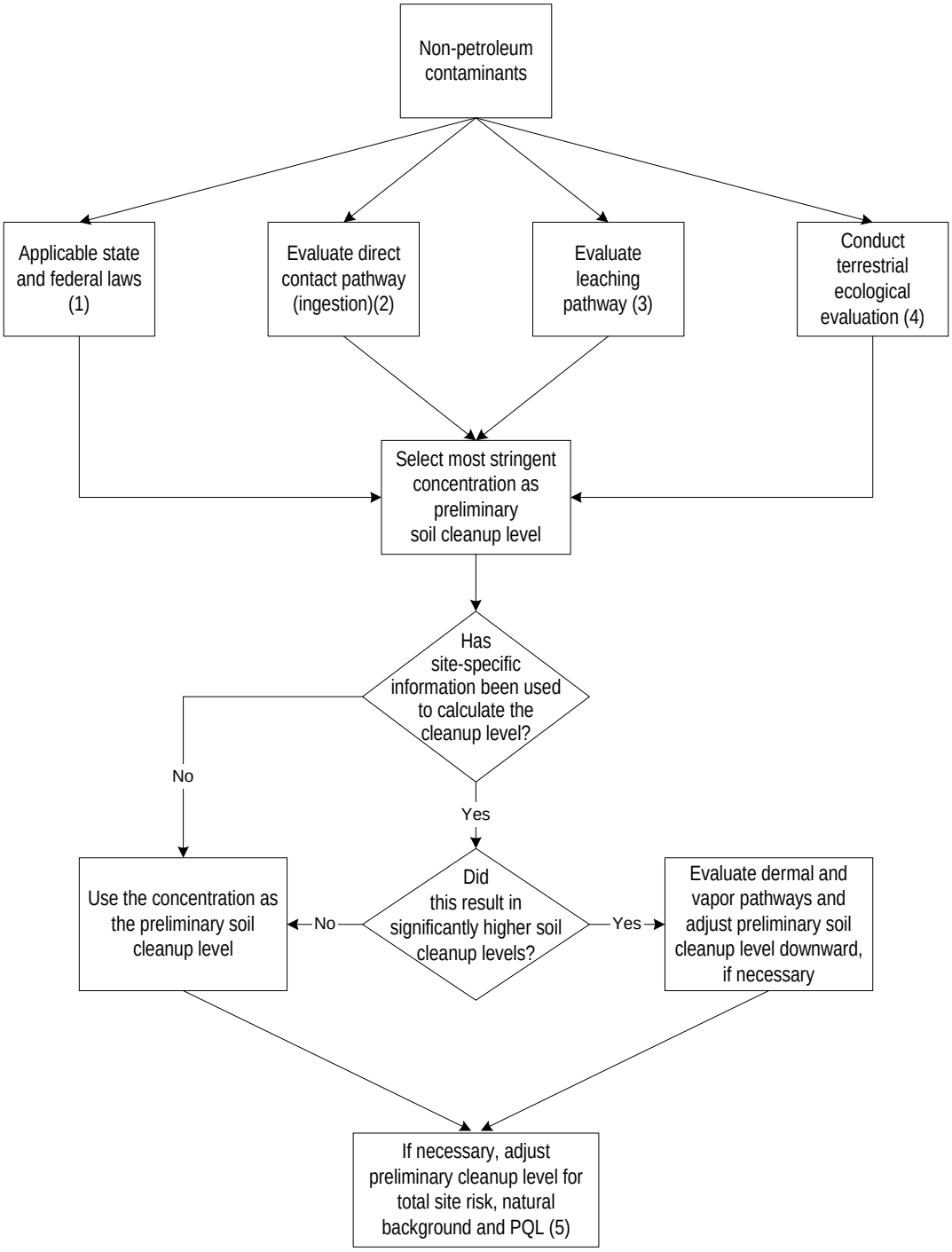
Figure 3: Establishing Method A Soil Cleanup Levels under WAC 173-340-740(2) and 745(3)[1]



NOTES
(1) Method A can only be used at qualifying sites. See WAC 173-340-704.
(2) The standard must be based on a hazard quotient of 1 or less or a cancer risk of 1 x 10^{-5} or less. The Method B equations may be used to determine if a standard is sufficiently protective.
(3) See WAC 173-340-7490 through 7494.

Disclaimer Notice: This figure is intended to help the user understand WAC 173-340-740 & 745. It does not establish or modify regulatory requirements.

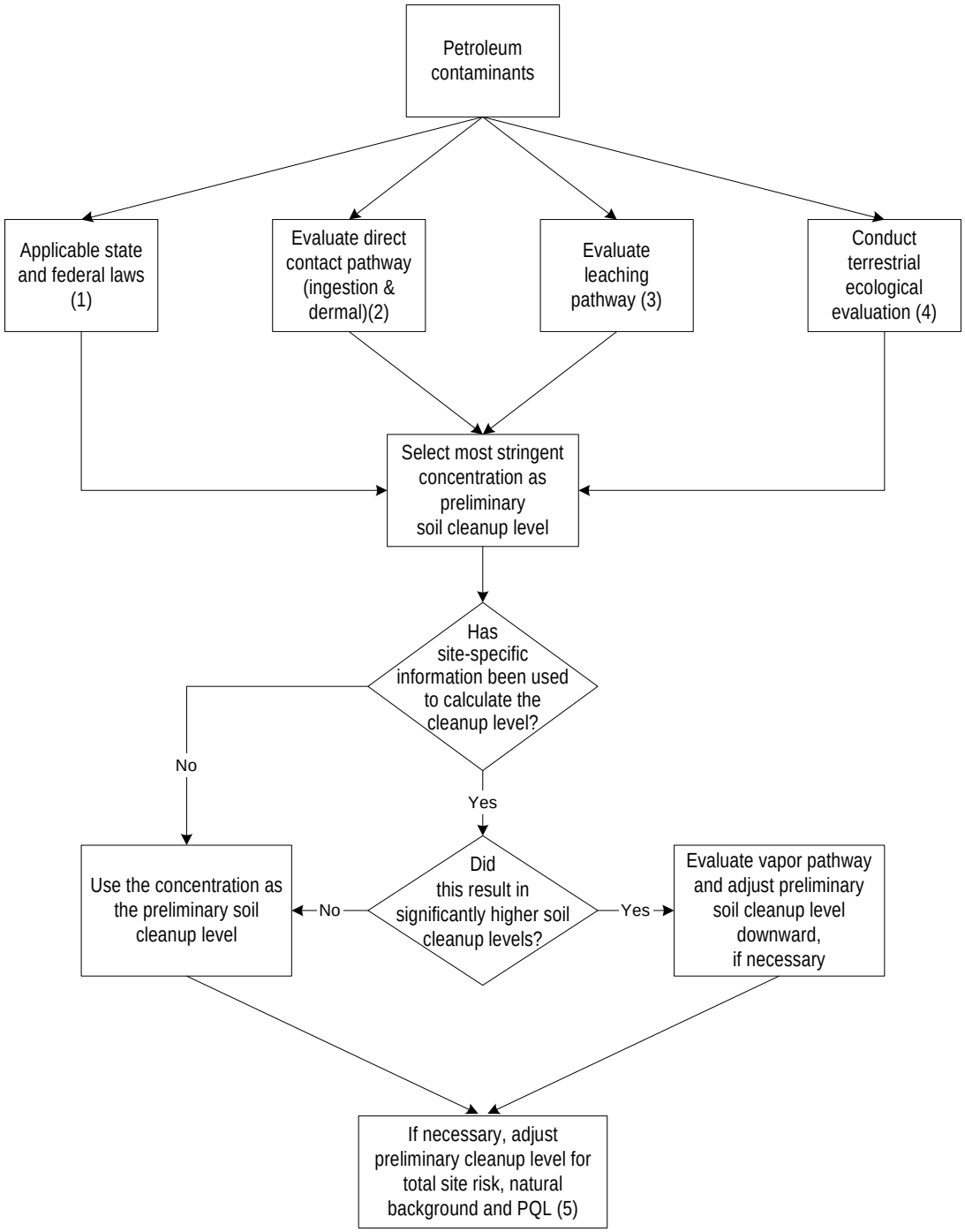
Figure 4: Establishing Method B and C Soil Cleanup Levels for Contaminants Other than Petroleum under WAC 173-340-740 and 745



NOTES:
(1) The standard must be based on a hazard quotient of 1 or less or a cancer risk of 1 x 10^{-5} or less. The Method B (or if applicable, Method C) equations may be used to determine if a standard is sufficiently protective.
(2) Under Method B, use equations 740-1 and 740-2; under Method C, use equations 745-1 and 745-2.
(3) Use the procedures in WAC 173-340-747.
(4) Use the procedures in WAC 173-340-7490 through 7494.
(5) See WAC 173-340-740(5) and 745(6).

Disclaimer Notice: This figure is intended to help the used to understand WAC 173-340-740 & 745. It does not establish or modify regulatory requirements.

Figure 5: Establishing Method B and C Soil Cleanup Levels for Petroleum Contamination under WAC 173-340-740 and 745



NOTES:
(1) The standard must be based on a hazard quotient of 1 or less or a cancer risk of 1×10^{-5} or less. The Method B (or if applicable, Method C) equations may be used to determine if a standard is sufficiently protective.
(2) Under Method B, use equations 740-4 and 740-5 for individual petroleum components and equation 740-3 for the petroleum mixture; under Method C, use equations 745-4 and 745-5 for individual petroleum components and equation 745-3 for the petroleum mixture.
(3) Use the procedures in WAC 173-340-747.
(4) Use the procedures in WAC 173-340-7490 through 7494.
(5) See WAC 173-340-740(5) and 745(6).

Disclaimer Notice: This figure is intended to help the used to understand WAC 173-340-740 & 745. It does not establish or modify regulatory requirements.

Figure 6: Conceptual Depiction of Terrestrial Ecological Evaluation Process under WAC 173-340-7490 through 7494

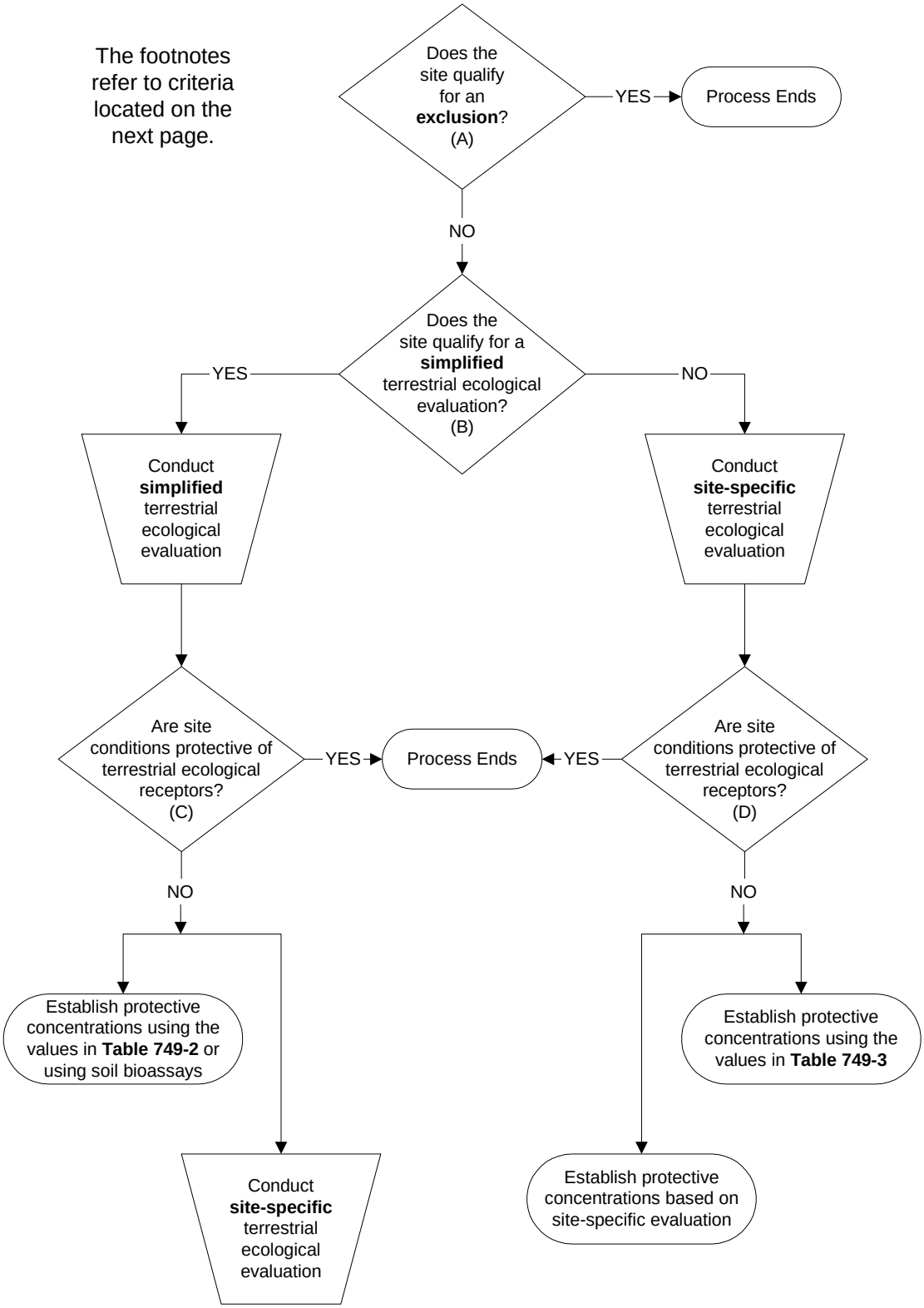


Figure 6: Conceptual Depiction of Terrestrial Ecological Evaluation Process under WAC 173-340-7490 through 7494

Footnotes

A. The site qualifies for an exclusion IF: ***(see WAC 173-340-7491(1))***

1. All soil contamination is, or will be, located below the point of compliance (15 feet; or 6 feet with institutional controls);
2. All soil contamination is, or will be, covered by buildings, paved roads, pavement, or other physical barriers that will prevent plants or wildlife from being exposed AND institutional controls are in place to maintain those barriers and prevent potential exposures;
3a. For certain highly toxic substances (e.g., dioxins, furans, PCBs, pentachlorophenol, and pesticides), there is less than 1/4 acre of contiguous undeveloped land on or within 500 feet of any area of the site affected by those substances; AND
3b. For other hazardous substances, there is less than 1.5 acres of contiguous undeveloped land on the site or within 500 feet of any area of the site; **OR**
4. Soil concentrations do not exceed natural background concentrations.

B. The site qualifies for a simplified terrestrial ecological evaluation UNLESS:
(see WAC 173-340-7491(2))

1. The site is on, or directly adjacent to, an environmentally sensitive area (e.g., greenbelts, protected wetlands, forest lands, wildlife management areas, and some parks and outdoor recreation areas);
2. The site is used by threatened or endangered species;
3. The site is located on a property that contains at least 10 acres of native vegetation within 500 feet of the site (area of contamination), not including vegetation beyond the property boundary; **OR**
4. The department determines that the site may present a risk to significant wildlife populations.

C. The simplified terrestrial ecological evaluation may be ended IF: ***(see WAC 173-340-7492(2))***

1. Exposure Analysis (2 options)

a. The area of soil contamination is 350 square feet or less; **OR**
b. The land use at the site and surrounding area makes substantial wildlife exposure unlikely. Use Table 749-1 to make this demonstration.

2. Pathways Analysis (1 option)

For substances listed in Table 749-2, there are no potential exposure pathways from soil contamination. Incomplete pathways may be due to man-made physical barriers, including barriers constructed as part of a remedy. If the pathways are incomplete based on the existence of such barriers, institutional controls are required to ensure that the barriers are maintained.

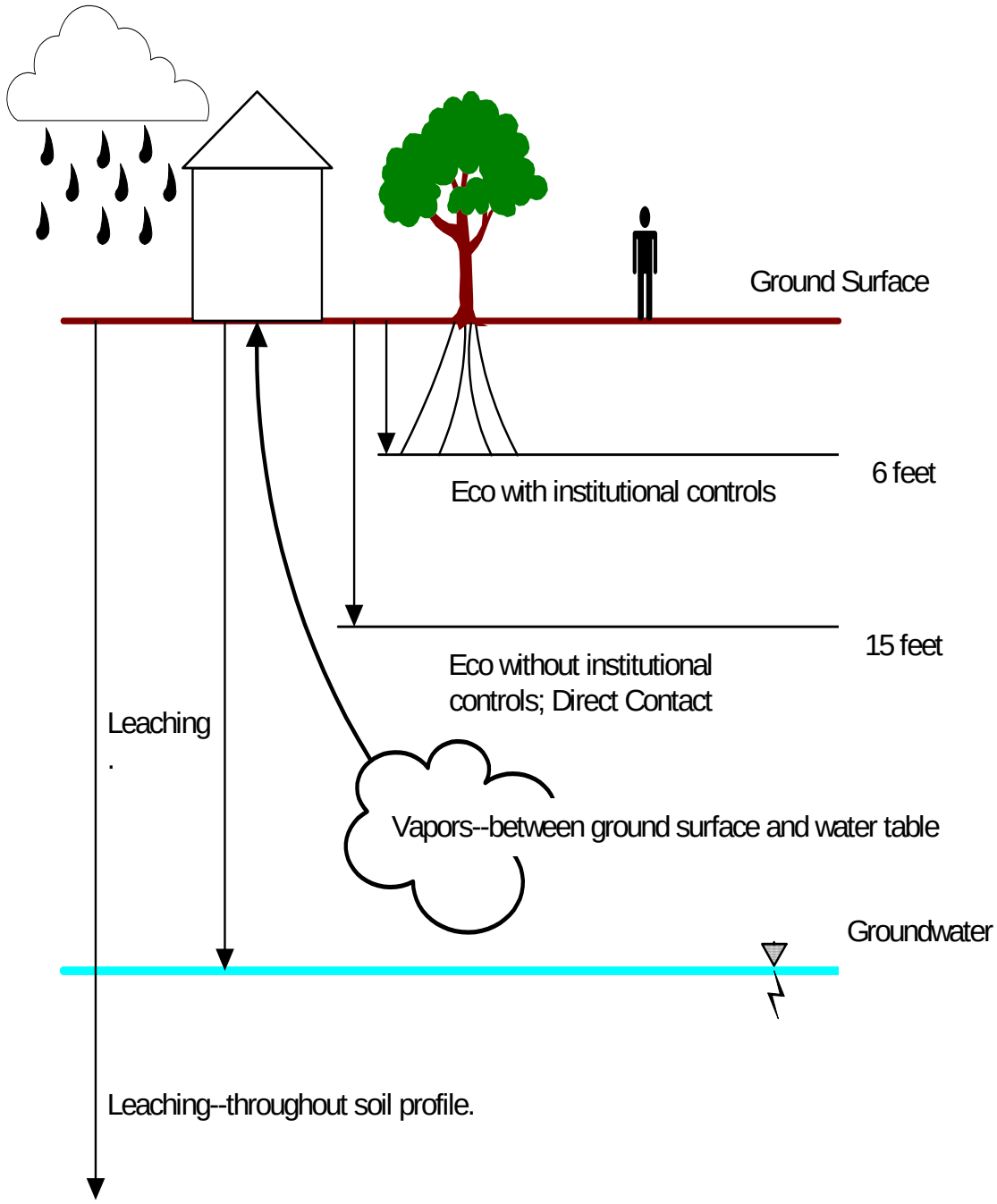
3. Contaminants Analysis (2 options)

a. For substances listed in Table 749-2 with a value, the soil concentration does not exceed the value in Table 749-2 at the point of compliance (15 feet, or 6 feet with institutional controls). For substances listed in Table 749-2 without a value, the soil concentration is demonstrated to not be toxic at the point of compliance (15 feet, or 6 feet with institutional controls) using a bioassay; **OR**
b. For substances listed in Table 749-2, the soil concentration is demonstrated to not be toxic at the point of compliance (15 feet, or 6 feet with institutional controls) using a bioassay.

D. Methods for conducting a site-specific evaluation include: ***(see WAC 173-340-7493(3))***

1. Conducting literature survey.
2. Conducting soil bioassays.
3. Using wildlife exposure models.
4. Using biomarkers.
5. Conducting site-specific field studies.
6. Using weight of evidence approach.
7. Using other methods approved by Ecology.

Figure 7: Point of Compliance for Soils under WAC 173-340-740 and 745



Disclaimer Notice: This figure is intended to help the user understand WAC 173-340-740 & 745. It does not establish or modify regulatory requirements.

Table 1: Summary of Default Values for Soil Direct Contact (Ingestion only) Equations under WAC 173-340-740 and 745

Factor	Method B[1]		Method C[2]	
	Noncarcinogens	Carcinogens	Noncarcinogens	Carcinogens
Soil Ingestion Rate (SIR)	200 mg day	200 mg day	50 mg day	50 mg day
Gastrointestinal Absorption fraction (AB1) (unitless)	1.0	1.0	1.0	1.0
Exposure Frequency (EF) (unitless)	1.0	1.0	0.4	0.4
Average Body Weight (ABW)	16 Kg	16 Kg	70 Kg	70 Kg
Exposure Duration (ED)	6 yrs	6 yrs	20 yrs	20 yrs
Averaging Time (AT)	6 yrs	75 yrs	20 yrs	75 yrs
Noncarcinogen Risk ● Hazard Quotient (HQ) ● Hazard Index (HI) (Unitless)	 1 1		 1 1	
Carcinogen Risk ● Single Substance ● Total Risk (Unitless)		 1×10^{-6} 1×10^{-5}		 1×10^{-5} 1×10^{-5}

(1) For allowable modifications to these default values under Modified Method B, see WAC 173-340-740(3)(c).

(2) For allowable modifications to these default values under Modified Method C, *see WAC 173-340-745(5)(c).*

Table 2: Summary of Default Values for Soil Direct Contact (Ingestion and Dermal) Equations under WAC 173-340-740 and 745

Factor	Method B[1]		Method C[2]	
	Noncarcinogens	Carcinogens	Noncarcinogens	Carcinogens
Soil Ingestion Rate (SIR)	200 mg/day	200 mg/day	50 mg/day	50 mg/day
Gastrointestinal Absorption fraction (AB1) (unitless)	1.0	1.0	1.0	1.0
Exposure Frequency (EF) (unitless)	1	1	0.7	0.7
Average Body Weight (ABW)	16 Kg	16 Kg	70 Kg	70 Kg
Exposure Duration (ED)	6 yrs	6 yrs	20 yrs	20 yrs
Averaging Time (AT)	6 yrs	75 yrs	20 yrs	75 yrs
Skin Surface Area (SA)	2200 cm^2	2200 cm^2	2500 cm^2	2500 cm^2
Soil Adherence Factor (AF)	$\frac{0.2\ mg}{cm^2\text{-day}}$	$\frac{0.2\ mg}{cm^2\text{-day}}$	$\frac{0.2\ mg}{cm^2\text{-day}}$	$\frac{0.2\ mg}{cm^2\text{-day}}$
Dermal Absorption Fraction (ABS) (unitless)				
● Inorganics	0.01	0.01	0.01	0.01
● Highly Volatile VOC's*	0.0005	0.0005	0.0005	0.0005
● Lower Volatile VOC's**	0.03	0.03	0.03	0.03
● Other organics	0.1	0.1	0.1	0.1
Gastrointestinal Absorption Conversion Factor (GI) ***				
● Inorganics	0.2	0.2	0.2	0.2
● Volatile organics	0.8	0.8	0.8	0.8
● Other organics	0.5	0.5	0.5	0.5
Non-cancer Risk (unitless)				
● Hazard Quotient (HQ)	1		1	
● Hazard Index (HI)	1		1	
Cancer Risk (unitless)				
● Single Substance		1×10^{-6}		1×10^{-5}
● Total Risk		1×10^{-5}		1×10^{-5}

* Highly volatile VOC's are volatile organic compounds with a vapor pressure > = benzene.
** Lower volatile VOC's are volatile organic compounds with a vapor pressure < benzene.
*** Unitless factor used to convert an oral RfD or CPF to dermal RfD or CPF.

(1) For allowable modifications to these default values under Modified Method B, see WAC 173-340-740(3)(c).

(2) For allowable modifications to these default values under Modified Method C, see WAC 173-340-745(5)(c).