TCEQ REGULATORY GUIDANCE
Remediation Division
RG-366/TRRP-25 ● Revised March 2009

Critical PCLs

Overview of This Document

Objectives: To explain the role of the critical protective concentration level (PCL) in the Texas Risk Reduction Program (TRRP) rule and outline the steps to determine the critical PCL on a site-specific basis.

Audience: Regulated Community and Environmental Professionals

References: The Texas Risk Reduction Program (TRRP) rule, together with conforming changes to related rules, is contained in 30 TAC Chapter 350. The TRRP rule was initially published in the September 17, 1999 Texas Register (24 TexReg 7413-7944) and was amended in 2007 (effective March 19, 2007; 32 TexReg 1526-1579).

Find links to download the TRRP rule and preamble, Tier 1 PCL tables, and other TRRP information at: <www.tceq.state.tx.us/remediation/trrp/>.

Contact: TCEQ Remediation Division Technical Support Section – 512-239-2200, or mtechsup@tceq.state.tx.us

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PCL Nomenclature for the Default Exposure Pathways

- PCL for groundwater ingestion;
- $^{GW}GW_{Class\ 3}$—PCL for Class 3 groundwater;
- $^{Air}GW_{Inh\text{-}V}$—PCL for inhalation of volatiles from groundwater;
- ^{SW}GW—PCL for groundwater discharge to surface water;
- $^{Tot}Soil_{Comb}$—surface soil PCL for combined soil ingestion, dermal contact, inhalation of volatiles and particulates, and for residential land use, ingestion of above-ground and below-ground vegetables;
- $^{GW}Soil$—PCL for surface and subsurface soil to protect groundwater;
- $^{Air}Soil_{Inh\text{-}V}$—PCL for inhalation of volatiles from subsurface soil;
- $^{Air}Air_{Inh}$—air PCL for inhalation; and
- ^{SW}SW—surface water PCL.

Introduction

As part of conducting an affected property assessment under TRRP, the person is required to determine a critical protective concentration level (PCL) for each chemical of concern (COC) in each affected environmental medium that does not meet the screening criteria listed in §350.71(k). TRRP establishes a process for setting human health and ecological PCLs that yields different PCLs for the different exposure pathways associated with each affected environmental medium for each COC. A critical PCL is the lowest PCL for each COC that is applicable to each affected

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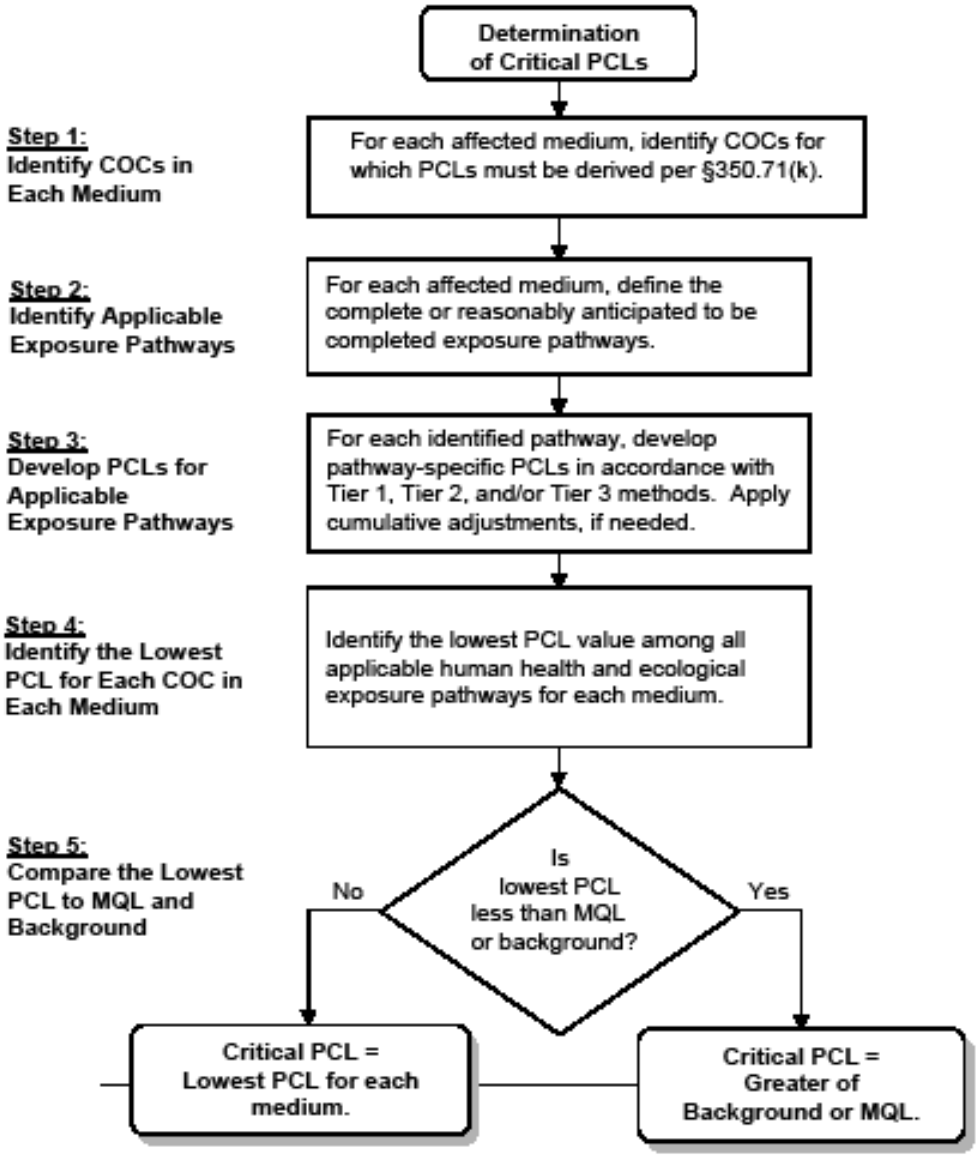
environmental medium. Critical PCLs are important because they are used to determine when and where a response action is necessary. If the concentration of a COC in an environmental medium exceeds the critical PCL for that COC and environmental medium, then a response action is required. The response action is triggered to ensure that any current and future exposures are protective. However, it is important to note that exceeding a critical PCL in an environmental medium does not necessarily mean that unprotective exposures have occurred. Additionally, critical PCLs are used to determine when notifications in accordance with §350.55 must be conducted, and to determine the level of required performance for analytical methods in determining COC concentrations. The purpose of this document is to describe the process for determining the critical PCL for each affected medium and COC (Figure 1). The context of the document is primarily focused on establishing critical PCLs for response action determinations.

For each COC and each affected medium (surface soil, subsurface soil, groundwater, etc.), the critical PCL is the lowest PCL value among all applicable human health exposure pathways and ecological exposure pathways (§350.4(a)(19)). For example, if the PCL values for COC X for applicable surface soil exposure pathways are 5, 10, and 100 mg/kg, then the critical PCL for COC X in surface soil is 5 mg/kg, unless the background concentration or method quantitation level (MQL) for the COC is a higher concentration (Figure 1).

If the background concentration or the MQL is greater than the lowest PCL for a COC, then the background concentration or MQL becomes the critical PCL. The MQL is defined in §350.4(a)(54). To use the MQL as the critical PCL, the MQL must be based on the standard available method providing the lowest quantitation level for that COC, as defined in §350.54(e)(3). The TCEQ may require that the person demonstrate that a lower MQL is not achievable or is not practicable, using standard available analytical methods (see *Review and Reporting of COC Concentration Data* (RG-366/TRRP-13)).

This guide addresses the exposure pathways which must be evaluated to determine the critical PCL for each affected environmental medium and describes application of the critical PCL under Remedy Standards A and B. At individual affected properties, additional exposure pathways may apply. Additional guidance on exposure pathways can be found in *Exposure Pathway Evaluation* (RG-366/TRRP-9).



NOTES:

- Background must be determined in accordance with §350.51(l) or (m).
- The MQL must be based on the standard available method that provides the lowest MQL for that COC (§350.54(e)(3)).
- MQL = Method Quantitation Limit
  PCL = Protective Concentration Level
  COC = Chemical of Concern

Figure 1. Determination of Critical PCLs

Determination of the Critical PCLS

Determining the critical PCL for each COC in each exposure medium involves the following steps:

1. Identify COCs in each medium.
2. Identify applicable exposure pathways.
3. Develop PCLs for applicable exposure pathways.
4. Identify the lowest PCL for each COC in each medium.
5. Compare the lowest PCL to MQL and background (Figure 1).

Step 1: Identify COCs in Each Medium

COCs should be determined in accordance with *Target COCs* (RG-366/TRRP-10). A critical PCL must be determined for each COC that does not meet the screening criteria provided in §350.71(k). The COC screening process is conducted once the COC sampling program of the affected property assessment is completed and all concentration data are available for consideration.

Step 2: Identify Applicable Exposure Pathways

PCLs are determined only for affected media (i.e., environmental media containing COCs at concentrations above the assessment level (§350.4(a)(3)). For each affected medium, define the complete or reasonably anticipated to be completed exposure pathways. Figure 2 illustrates the default exposure pathways typically evaluated for each environmental medium. In addition to the exposure pathways shown on Figure 2, the person must also evaluate all other complete or reasonably anticipated to be completed exposure pathways that are applicable to the affected property being evaluated. Examples include, volatilization to indoor air or agricultural pathways (e.g., uptake of COCs in food products).

Step 3: Develop PCLs for Applicable Exposure Pathways

For each identified exposure pathway, the person must develop pathway-specific PCLs. Each PCL may be determined using Tier 1, Tier 2, or Tier 3. Different tiers may be used for different exposure pathways and/or different COCs. For affected media with more than 10 COCs, the pathway-specific PCLs may have to be adjusted in accordance with §350.72 to ensure that the cumulative risk and hazard limits are not exceeded. See *Risk Levels, Hazard Indices, and Cumulative Adjustment* (RG-366/TRRP-18) for guidance on adjustments for cumulative risk and hazard limits.

Step 4: Identify the Lowest PCL for Each COC in Each Medium

For each COC and each affected medium (surface soil, subsurface soil, groundwater, etc.), the critical PCL is the lowest PCL value among all applicable human health exposure pathways and ecological exposure pathways. Note that when ecological exposure pathways are determined to

be applicable, the timing for development of human health-based PCLs and ecological PCLs may not be the same. Commonly, human health PCL development may proceed at a faster pace. The project can proceed basing the critical PCL solely on the human health exposure pathways on an interim basis. However, once the applicable ecological PCLs are developed, the critical PCL identification process must be conducted again to take into account the ecological PCLs. Consequently, all decisions that are contingent on the critical PCL would then also need to be revisited.

The pathways typically evaluated to determine the critical PCL for each environmental medium are described below and illustrated in Figure 2.

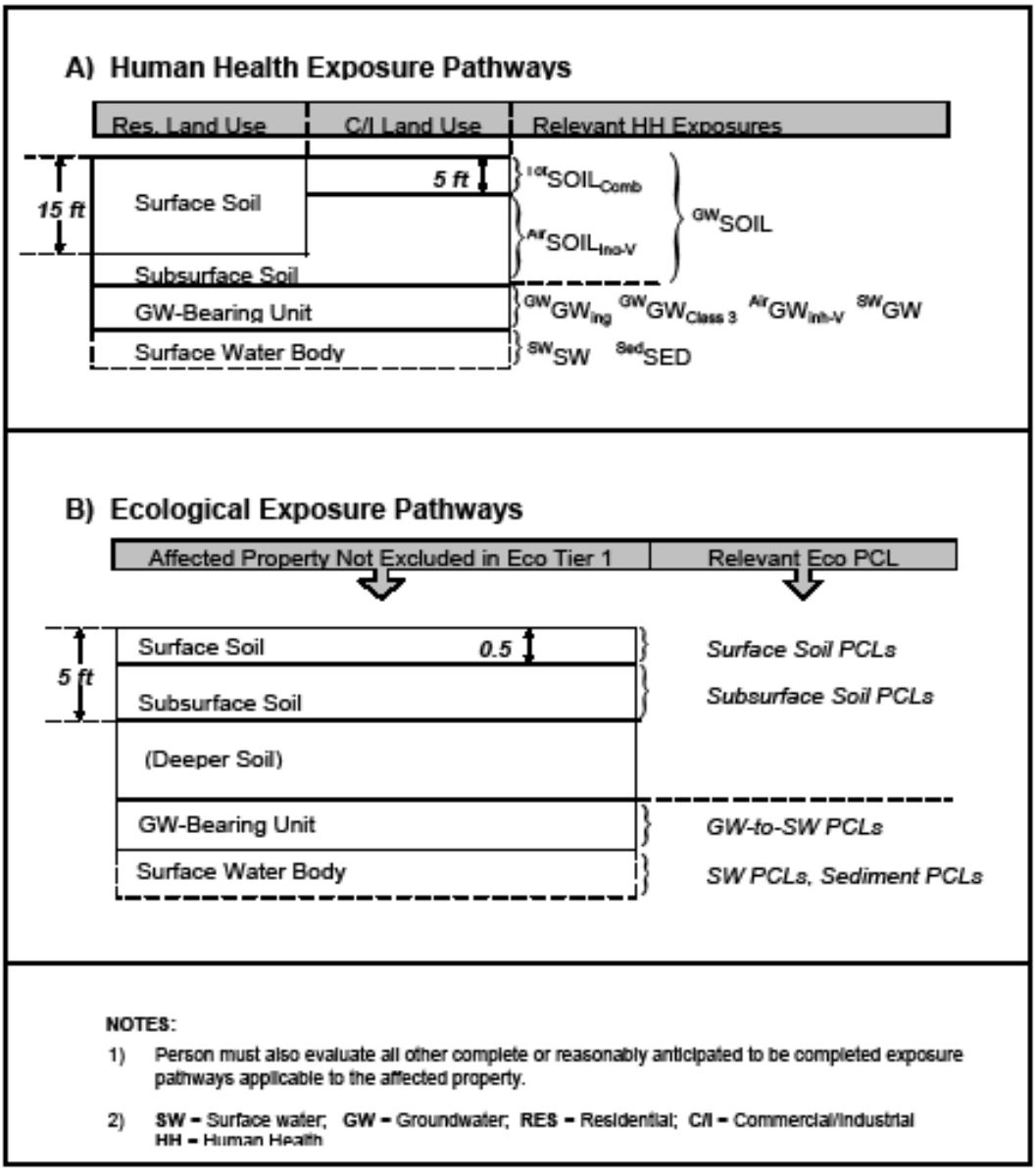


Figure 2. Typical Exposure Pathways for Determination of the Critical PCL

Surface Soil

For each COC, determine which PCL is the lowest by comparing PCLs for $^{Tot}Soil_{Comb}$, $^{GW}Soil$, and any other exposure pathway evaluated. If ecological PCLs are required for surface soil, the ecological PCLs for burrowing animals apply to the interval 0 to 5 ft. below ground surface (bgs) and the ecological PCLs for all other ecological receptors apply 0 to 0.5 ft. bgs. An ecological PCL can be the lowest PCL only in the portion of the surface soil where the ecological PCL applies. Therefore, for a given COC and assuming residential land use classification, the lowest PCLs conceivably can be different for different intervals in the surface soil. For example, the lowest PCL for the soil intervals 0 to 0.5 ft, 0.5 to 5 ft and from 5 to 15 ft. could each be different to reflect the different combination of human health and ecological exposure pathways that must be considered for those three surface soil intervals.

Subsurface Soil

For each COC, determine which PCL is the lowest by comparing PCLs for $^{Air}Soil_{Inh\text{-}V}$, $^{GW}Soil$, and any other exposure pathway evaluated. Ecological PCLs do not apply to subsurface soil deeper than 5 ft bgs.

Groundwater

For each COC, determine which PCL is the lowest by comparing PCLs for $^{GW}GW_{Ing}$, $^{Air}GW_{Inh\text{-}V}$, ^{SW}GW and any other exposure pathway evaluated. ^{SW}GW applies only at the point of groundwater discharge to surface water and, therefore, ^{SW}GW can be the lowest PCL only at locations used to evaluate groundwater discharge to surface water. ^{SW}GW is determined in accordance with §350.75(i)(4) based on the lowest of the human health or ecological PCLs for surface water.

Surface Water/Sediment

For each COC, determine which PCL is the lowest human health or ecological surface water PCL. Similarly, for each COC determine which PCL is the lowest human health or ecological PCL for sediment.

Step 5: Compare the Lowest PCL to MQL and Background

For each COC in each environmental medium, if the MQL or background concentration is greater than the lowest PCL established in Step 4, then the greater of the MQL or background concentration may be used as the critical PCL. Otherwise, the lowest PCL concentration established in Step 4 for each COC and environmental medium is the critical PCL.

Background

To use background as the critical PCL for surface soil or subsurface soil, background must be determined site-specifically in accordance with

§350.51(l) or by using the Texas median-specific background concentrations in accordance with §350.51(m). TCEQ guidance document *Determining Representative Concentrations* (RG-366/TRRP-15) provides additional guidance on the determination of background for soil, groundwater, and other environmental media.

MQL

To use the MQL as the critical PCL, the person must use the MQL for the standard available laboratory method providing the lowest MQL for that COC and medium per §350.54(e)(3). The TCEQ may require that the person demonstrate that a lower MQL is not achievable or is not practicable, using standard available analytical methods (see TCEQ guidance document *Review and Reporting of COC Concentration Data* (RG-366/TRRP-13)).

Application of the Critical PCL Under Remedy Standards A and B

Acceptable methods for comparison of site COC concentrations to the critical PCL are described in §350.79 and in TCEQ guidance document Determining Representative Concentrations (RG-366/TRRP-15). If COC concentrations in any environmental medium exceed the critical PCL, then a response action is required in accordance with Remedy Standard A or Remedy Standard B (see TCEQ guidance document Application of Remedy Standards A and B (RG-366/TRRP-28), for information on the remedy standards). The PCL exceedance zone is the lateral and vertical extent of all environmental media that contains COCs at concentrations greater than the critical PCL.

Remedy Standard A

Under Remedy Standard A, all environmental media containing COCs at concentrations above the critical PCL must be removed and/or decontaminated to a concentration less than or equal to the critical PCL.

Remedy Standard B

Under Remedy Standard B, all environmental media containing COCs at concentrations above the critical PCL must be removed, decontaminated, and/or controlled. If controls are used under Remedy Standard B, then the controls must address all exposure pathways for which the COC concentration exceeds the pathway-specific PCL. For example, for Class 2 groundwater, a plume management zone may be established to address an exceedance of PCLs for the groundwater ingestion pathway ($^{GW}GW_{Ing}$). However, an additional response action may be required to address an exceedance of the groundwater-to-surface water pathway (^{SW}GW). In addition, control measures that are effective for the prevention of human

health exposures may not be able to prevent unacceptable ecological exposures. Therefore, an additional remedial strategy may be needed to address ecological exposures.

Under either Remedy Standard A or B, if statistical methods are used to demonstrate that the critical PCL has been achieved, be sure to consult TCEQ guidance document *Determining Representative Concentrations* (RG-366/TRRP-15) for guidance on application of statistical methods under TRRP.

Case Study Example

A tanker truck transporting COC X has crashed in a residential neighborhood resulting in the release of COC X on a residential yard and an adjacent undeveloped lot. Following mitigation of the spill and removal of as much of COC X as possible, the person has decided to apply TRRP instead of the 30 TAC 327 Spill Rules (see TCEQ guidance document *TRRP Applicability and Grandfathering* (RG-366/TRRP-2) for additional information on applicability of TRRP). The critical PCLs for this affected property were determined as follows.

Step 1: Identify COCs in Each Medium

Because only COC X was released and COC X does not generate daughter product COCs, COC X is the only COC. In the affected property assessment, COC X was found at concentrations above the assessment level in surface soil, subsurface soil, and groundwater. No other affected media were identified. Based on the results of the affected property assessment, COC X did not meet the screening criteria defined in §350.71(k). Therefore, a critical PCL must be developed for COC X. The affected property includes both the residential yard and the undeveloped lot.

Step 2: Identify Applicable Exposure Pathways

The residential yard was found to meet the Tier 1 Ecological Exclusion Criteria; however, the undeveloped lot did not meet the ecological exclusion criteria for soils. Based on this analysis, only the following complete or reasonably anticipated to be completed pathways were identified:

RESIDENTIAL YARD		UNDEVELOPED LOT	
Exposure Medium	Complete Exposure Pathways	Exposure Medium	Complete Exposure Pathways
Surface Soil	$^{Tot}Soil_{Comb,}$ $^{GW}Soil_{Ing}$	Surface Soil	$^{Tot}Soil_{Comb,}$ $^{GW}Soil_{Ing}$, Ecological PCL for aboveground receptors (0-0.5 ft bgs only), Ecological PCL for burrowing animals (0-5 ft bgs only)
Subsurface Soil	$^{Air}Soil_{Inh\text{-}v,}$ $^{GW}Soil_{Ing}$	Subsurface Soil	$^{Air}Soil_{Inh\text{-}v,}$ $^{GW}Soil_{Ing}$
Groundwater	$^{GW}GW_{Ing,}$ $^{Air}GW_{Inh\text{-}v}$	Groundwater	$^{GW}GW_{Ing,}$ $^{Air}GW_{Inh\text{-}v}$

bgs = below ground surface ft = feet

Step 3: Develop PCLs for Applicable Exposure Pathways

Residential standards (rather than commercial/industrial) were applied to the undeveloped lot to avoid the need for an institutional control for the undeveloped lot following response action completion. The following PCLs were developed for each complete exposure pathway:

Table 1. Complete Exposure Pathway PCLs

Complete Exposure Pathway	PCL
$^{Tot}Soil_{Comb}$	25 mg/kg
$^{GW}Soil_{Ing}$	200 mg/kg
$^{Air}Soil_{Inh\text{-}v}$	40 mg/kg
Ecological PCL for aboveground receptors	10 mg/kg
Ecological PCL for burrowing animals	20 mg/kg
$^{GW}GW_{Ing}$	2 mg/L
$^{Air}GW_{Inh\text{-}v}$	150 mg/L

Step 4: Identify the Lowest PCL for Each COC in Each Medium

Critical PCLs for each affected medium were determined as follows:

RESIDENTIAL YARD		
Exposure Medium	**Complete Exposure Pathways**	**Lowest PCL**
Surface Soil	$^{Tot}Soil_{Comb}$ (25 mg/kg), $^{GW}Soil_{Ing}$ (200 mg/kg)	25 mg/kg
Subsurface Soil	$^{Air}Soil_{Inh\text{-}v}$ (40 mg/kg), $^{GW}Soil_{Ing}$ (200 mg/kg)	40 mg/kg
Groundwater	$^{GW}GW_{Ing}$ (2 mg/L), $^{Air}GW_{Inh\text{-}v}$ (150 mg/L)	2 mg/L

UNDEVELOPED LOT		
Exposure Medium	**Complete Exposure Pathways**	**Lowest PCL**
Surface Soil (0-0.5 ft bgs)	$^{Tot}Soil_{Comb}$ (25 mg/kg), $^{GW}Soil_{Ing}$ (200 mg/kg), Ecological PCL for above-ground receptors (10 mg/kg), Ecological PCL for burrowing animals (20 mg/kg)	10 mg/kg
Surface Soil (0.5 ft–5 ft bgs)	$^{Tot}Soil_{Comb}$ (25 mg/kg), $^{GW}Soil_{Ing}$ (200 mg/kg), Ecological PCL for burrowing animals (20 mg/kg)	20 mg/kg
Subsurface Soil	$^{Air}Soil_{Inh\text{-}v}$ (40 mg/kg), $^{GW}Soil_{Ing}$ (200 mg/kg)	40 mg/kg
Groundwater	$^{GW}GW_{Ing}$ (2 mg/L), $^{Air}GW_{Inh\text{-}v}$ (150 mg/L)	2 mg/L

Step 5: Compare the Lowest PCL to Background and MQL

If COC X was an inorganic COC or an organic COC where anthropogenic background concentrations are of issue, then the background

concentration of COC X should be considered. However, for this example, COC X is an organic COC that is not naturally occurring in the environment. Additionally, no anthropogenic background concentration is suspected and therefore background is not relevant to this case. In such situations, "background" is essentially defined as the MQL for the best standard available method. The MQL for the best standard available method is 0.01 mg/kg in soil and 0.005 mg/L in water. As a result, the MQL is not a critical PCL for this case. The critical PCL for each affected medium is illustrated in Figure 3.

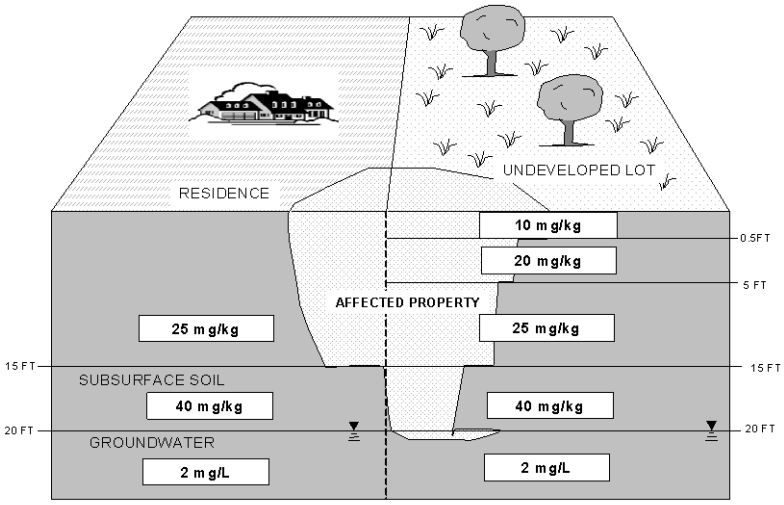


Figure 3. Critical PCLs for COC X for Each Environmental Medium

Because both tracts of affected land are classified as residential land use for purposes of PCL development, the critical PCLs are the same for the residential yard and the undeveloped lot, except for the upper 5 ft. of surface soil (Figure 3). As explained earlier, ecological PCLs are applicable to the undeveloped lot in this case example. Therefore, the critical PCLs for the upper 5 ft. of the surface soil interval are different for the residential yard and the undeveloped lot. For the undeveloped lot, two different critical PCLs apply to the upper 5 ft. of surface soil to reflect the two different ecological exposure pathways applicable to the 0 to 0.5 ft. and 0.5 to 5 ft. intervals.