GEORGIA
DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION DIVISION

Land Branch Technical Guidance Updates

David Hayes
Voluntary Remediation Unit Manager

Georgia Brownfield Association Workshop
February 28, 2020

ENVIRONMENTAL PROTECTION DIVISION

About EPD | Forms & Permits | Rules, Laws & Enforcement | Public Announcements | Outreach | Emergency Response

About EPD
- Contact Us
- Air Protection
- Land Protection
  - Asbestos
  - Hazardous Waste
  - Lead-Based Paint
  - Recovered Materials

Land Protection Branch Technical Guidance

General Topics

- ***Draft*** **Area Averaging Approach to Soil Cleanups** - *Public Comments Under Review*
- **FAQs for Evaluating the Soil-to-Groundwater Pathway**
- **Groundwater Contaminant Fate & Transport Modeling**
- **Vapor Intrusion**
- **Guidance for Demonstrating Completion of Soil Removal Actions at Corrective Action Sites**

GUIDANCE OVERVIEW

- Soil-to-Groundwater Migration Pathway (a.k.a. leaching)
- Area Averaging Approach to Soil Compliance for Direct Contact Exposure Scenarios
- Vapor Intrusion

WHY DEVELOP GUIDANCE?

- Provide technical assistance to stakeholders
- Provide for streamlined EPD review
- Promote consistency

AREA AVERAGING UPDATE

DRAFT GUIDANCE:

"Area Averaging Approach to Soil Compliance for Direct Contact Exposure Scenarios"

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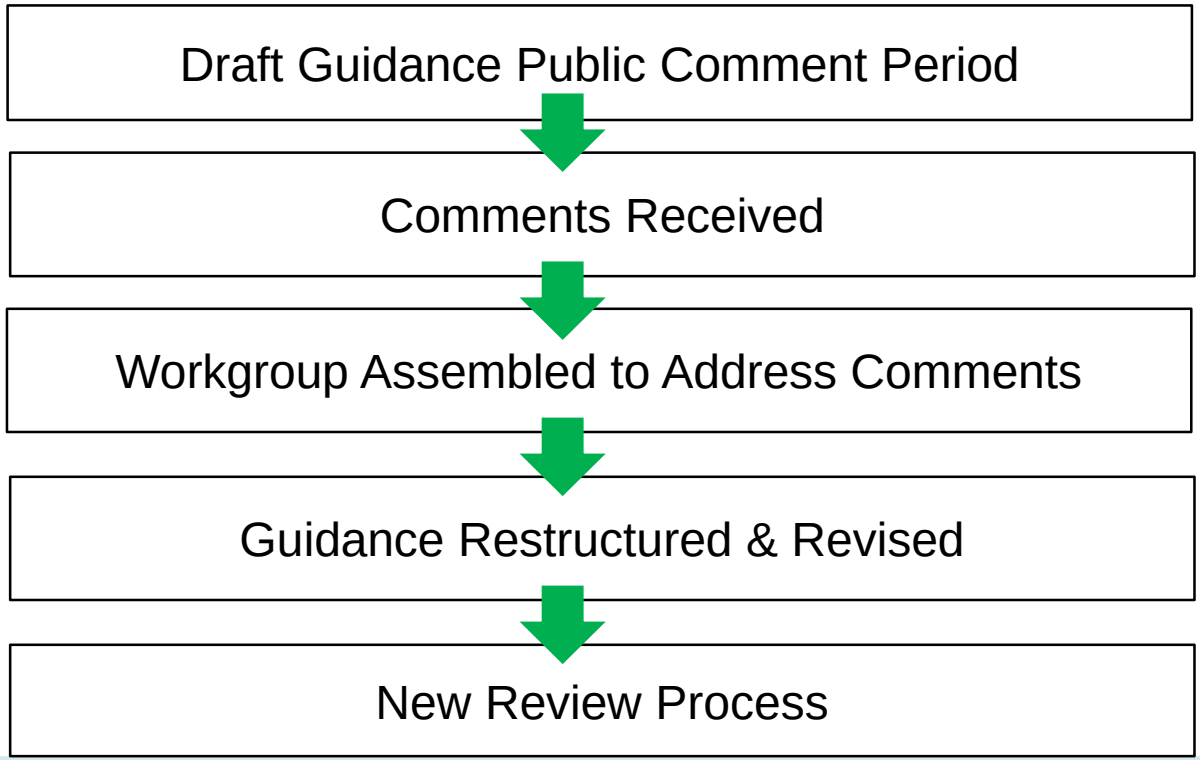
Land Protection Branch
Hazardous Waste Corrective Action Program
Hazardous Waste Management Program
Response & Remediation Program
Risk Assessment Program

AREA AVERAGING UPDATE



AREA AVERAGING UPDATE

- Revised draft undergoing EPD management review
- Revised draft will be posted on EPD website
- New public comment / stakeholder engagement period

VAPOR INTRUSION UPDATE

- Technical Advisory Committee approach
- Draft undergoing EPD management / Advisory Committee review
- Public comment / stakeholder engagement period following release of draft guidance

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Leaching Guidance Overview

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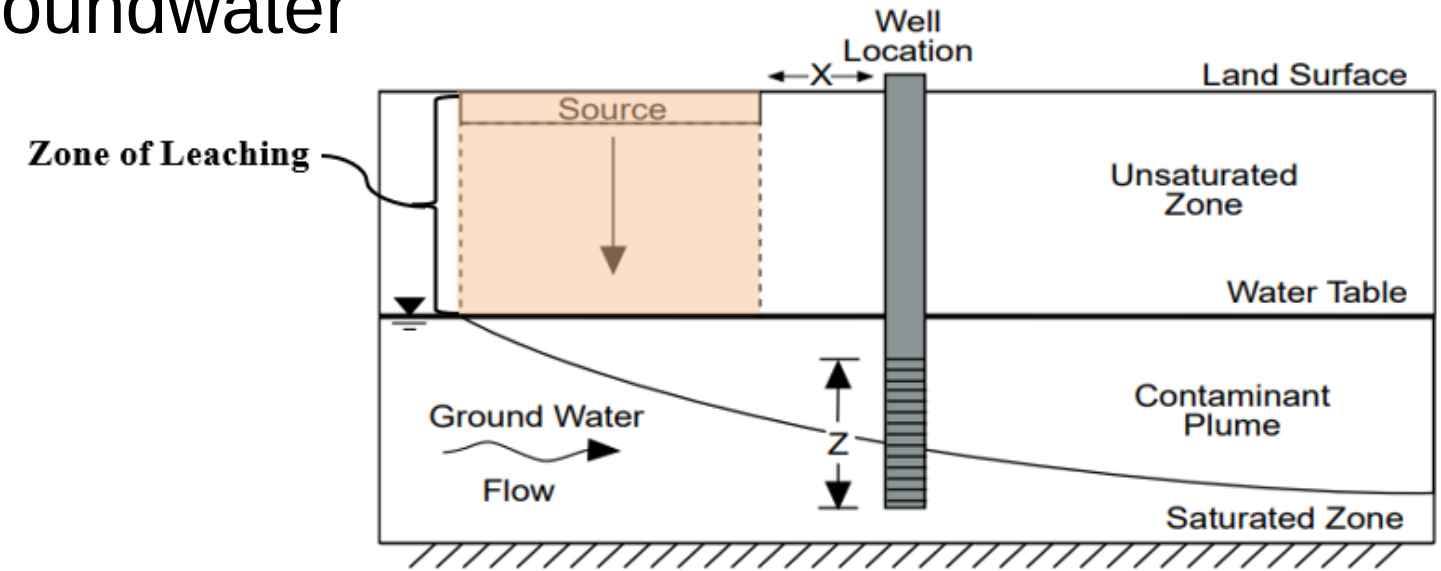
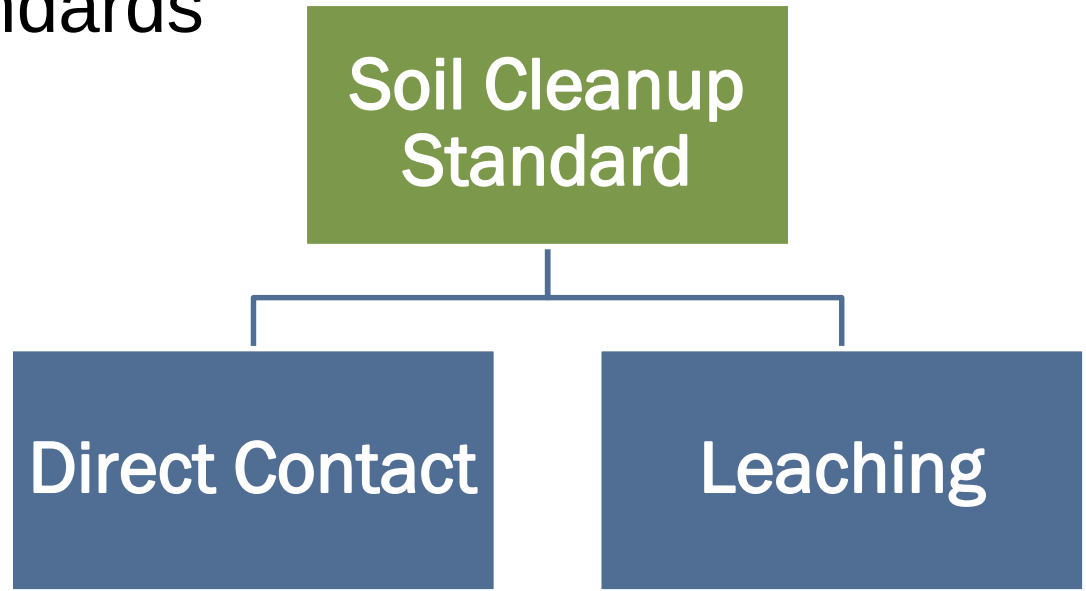
WHAT IS LEACHING?

- Migration of contaminants from soil to groundwater



IMPORTANCE OF LEACHING EVALUATION

- Exposure pathway evaluated to determine soil cleanup standards



HOW IS LEACHING EVALUATED?

- Model
- Laboratory leaching test
- Observation-based approach (e.g., old soil release but no groundwater impacts)

STAKEHOLDER ENGAGEMENT

- Oct. 2018: draft document posted for public comment
- Dec. 2018: GIEC Workshop / Roundtable
- Jan. – March 2019: formal comments received
  - GIEC, Ashland, & GBA
- May 2019: meetings with stakeholder groups
- May – Oct. 2019: revisions to document

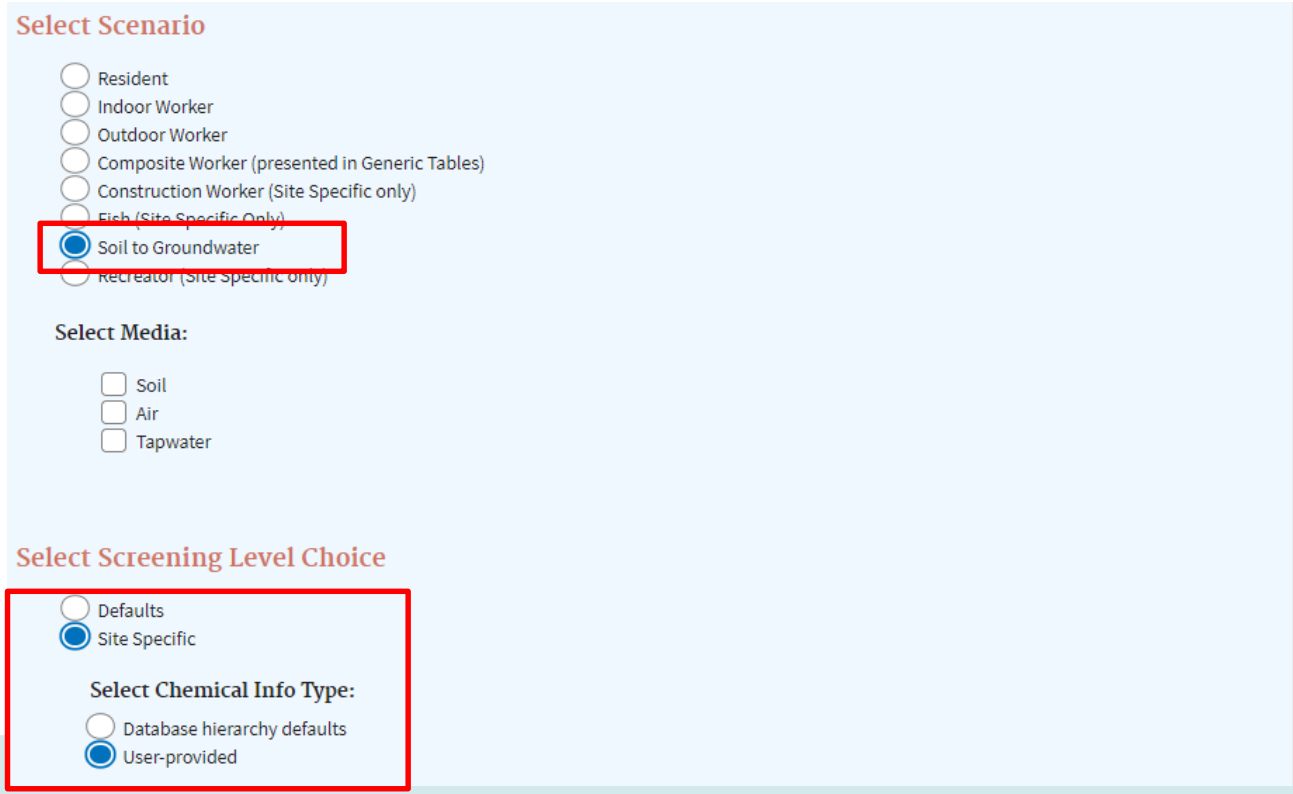
NOTABLE UPDATES

- Key Terms Section
- Removed Question 2: When is an evaluation required?
- Soil Saturation Limit (e.g., PCE C_{sat} = 170 mg/kg)
- Adjust extraction fluid pH for SPLP test
- EPA RSL Calculator
- EPA Mass Limit Equation
- Revised Question 9: How are measured soil concentrations compared to protective levels?

DOCUMENT OVERVIEW

- Frequently Asked Questions format
- Partition Equation (basic model) $C_t = C_w\left(K_d + \frac{\theta_w + \theta_a H'}{\rho_b}\right)$
- Leaching tests (TCLP, SPLP)
- Recommendations for data collection and reporting
- Analysis of leaching test results
- Models
- Comparing soil concentrations to leaching values
- Observation-based approach

EPA RSL CALCULATOR



EPA RSL CALCULATOR

User-provided Inputs

- Change or remove any of the following parameters. The master database will not be used.

Regional Screening Levels (RSLs)

- Home Page
- User's Guide
- What's New
- Frequent Questions
- Equations
- RSL Calculator
- Generic Tables

enter site-specific K_d

enter acceptable groundwater concentration

Chemical	Organic Carbon Partition Coefficient Koc (L/kg)	Soil-Water Partition Coefficient K_d (cm^3/g)	Skin Permeability Constant K_p (cm/hr)	Fraction of Chemical that is ultimately absorbed FA (unitless)	Maximum Contamination Limit MCL (µg/L)	Water Solubility S (mg/L)	Volatile Compound?
Tetrachloroethylene	9.49E+01		3.34E-02	1	5.00E+00	206	Yes

EPA RSL CALCULATOR

Dilution Factor for Migration to Groundwater Equations and Parameters

Dilution Attenuation Factor

.	K (aquifer hydraulic conductivity) m/yr	1	DAF (dilution attenuation factor) unitless
.	L (source length parallel to ground water flow) m	.	i (hydraulic gradient) m/m
.	d (mixing zone depth) m - site-specific	0.18	I (infiltration rate) m/yr
.	d_a (aquifer thickness) m - site-specific		

NOTES:

1. If DAF is known, enter it, or enter your own site-specific values to calculate it.
2. When DAF is entered or calculated, the values for the blue DAF box in the Migration to Groundwater section below will be populated. If DAF is not entered or calculated, the default value will be used.

EPA RSL CALCULATOR

Migration to Groundwater Common Parameters

1 DAF (dilution attenuation factor) unitless	1.5 ρ_b (dry soil bulk density) kg/L

- (•) Method 1 - Partitioning
- ( ) Method 2 - Mass Limit

NOTES:

1. If DAF is known, enter it in the Dilution Factor section above. When DAF is entered or calculated in the section above, the value for the blue DAF box in this section will be populated. If DAF is not entered or calculated, the default value will be used.
2. The Partitioning Equation for Migration to Ground Water is used by default. To use the Mass-Limit Equation, select the Method 2 Equation toggle and enter the parameters below.

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Partitioning Equation and Parameters

H` Determination at Temperature other than 25 degrees Celsius

Method 1

0.002 foc (fraction organic carbon in soil) g/g	0.134 θ_a (air-filled soil porosity) L_{air}/L_{soil}
0.434 n (soil porosity) L_{pore}/L_{soil}	0.3 θ_w (water-filled soil porosity) L_{water}/L_{soil}
2.65 ρ_s (soil particle density) kg/L	25 T_w (groundwater temperature) °Celsius

EXAMPLE: SOIL TYPE 2 RRS FOR PCE

- PCE in soil
- Approved values for:
  - Protection of Direct Contact = 81 mg/kg
  - Type 2 RRS for groundwater = 41 ug/L
- Extent of contamination is less than 0.5 acre
  - Use DAF = 20

EXAMPLE: SOIL TYPE 2 RRS FOR PCE

User-provided Inputs

- Change or remove any of the following parameters. The master database will not be used.

(RSLs)

- Home Page
- User's Guide
- What's New
- Frequent Questions
- Equations
- RSL Calculator
- Generic Tables

Chemical	Organic Carbon Partition Coefficient Koc (L/kg)	Soil-Water Partition Coefficient K_d (cm^3/g)	Skin Permeability Constant K_p (cm/hr)	Fraction of Chemical that is ultimately absorbed FA (unitless)	Maximum Contamination Limit MCL (µg/L)	Water Solubility S (mg/L)	Volatile Compound?
Tetrachloroethylene	9.49E+01		3.34E-02	1	41	206	Yes

EXAMPLE: SOIL TYPE 2 RRS FOR PCE

Dilution Factor for Migration to Groundwater Equations and Parameters

Dilution Attenuation Factor

.	K (aquifer hydraulic conductivity) m/yr	20	DAF (dilution attenuation factor) unitless
.	L (source length parallel to ground water flow) m	.	i (hydraulic gradient) m/m
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NOTES:

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Top of Page

Migration to Groundwater Common Parameters

20	DAF (dilution attenuation factor) unitless	1.5	ρ_b (dry soil bulk density) kg/L

- (•) Method 1 - Partitioning
- ( ) Method 2 - Mass Limit

EXAMPLE: SOIL TYPE 2 RRS FOR PCE

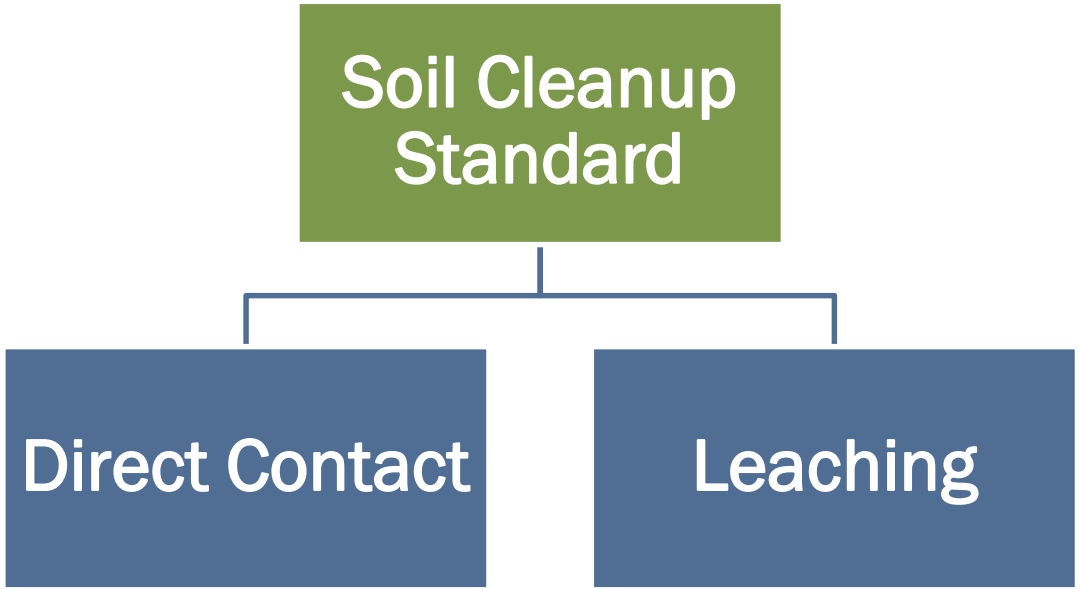
Site-specific

Regional Screening Levels (RSL) for Soil to Groundwater

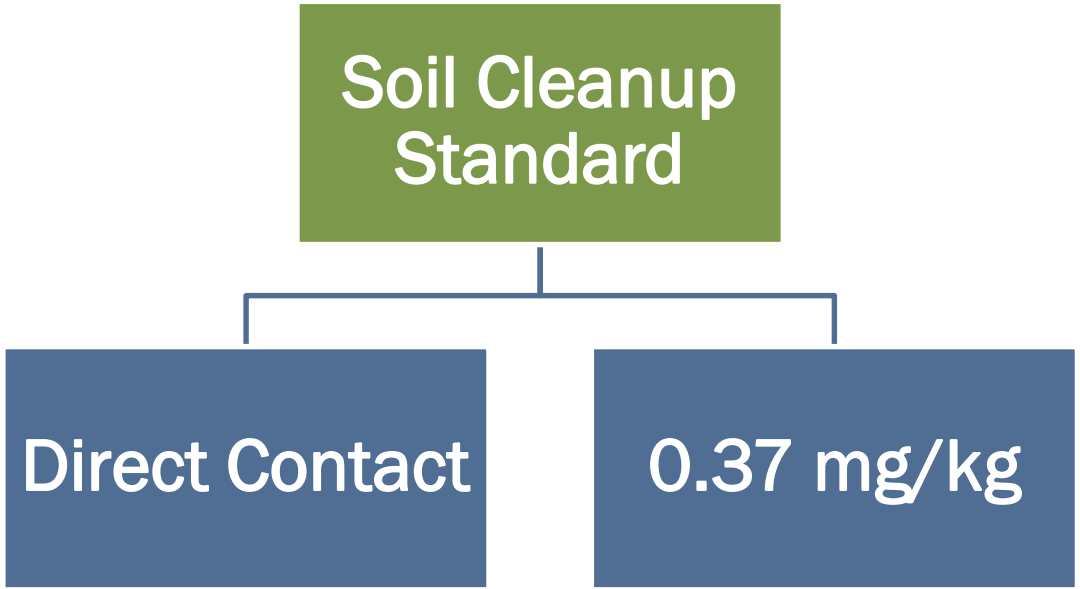
Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; D = DWSHA; W = TEF applied; E = RPF applied; G = see user's guide; U = user provided; ca = cancer; nc = noncancer; * = where: nc SL < 100X ca SL; ** = where nc SL < 10X ca SL; SSL values are based on DAF=1; max = ceiling limit exceeded; sat = Csat exceeded.

Chemical	arcinogenic SL TR=1E-05 (ug/L)	Water Concentration (Adult) (mg/L)	Water Concentration (Child) (mg/L)	Water Concentration (Cancer) (mg/L)	Maximum Contaminant Level (MCL) (ug/L)	Water Concentration (MCL) (mg/L)	MCL-based SL (mg/kg)
Tetrachloroethylene	3E+02	1.01E+00	8.12E-01	2.26E+00	4.10E+01	8.20E-01	3.73E-01

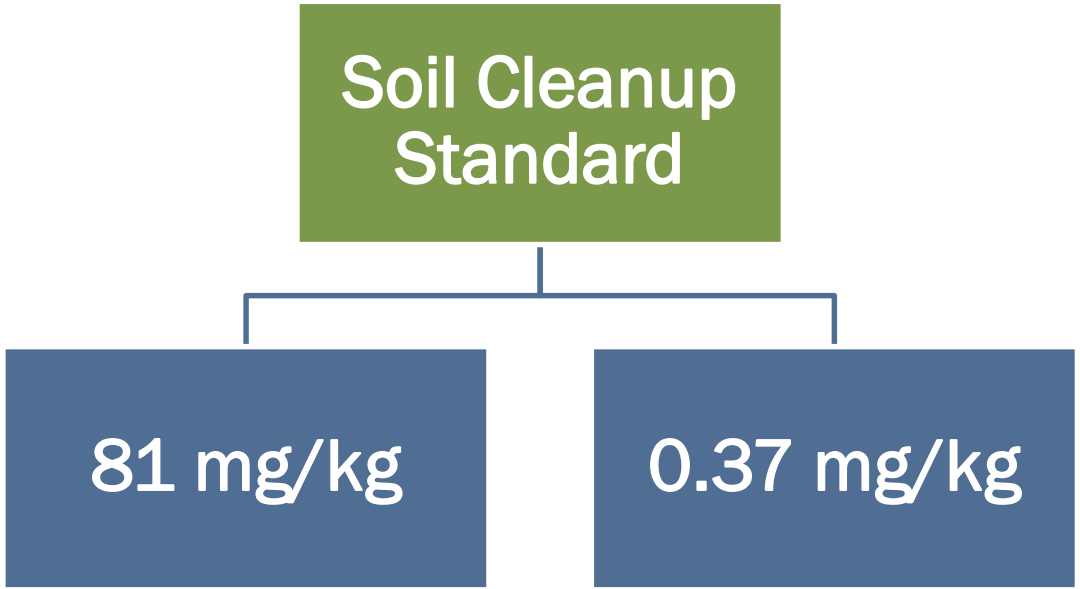
EXAMPLE: SOIL TYPE 2 RRS FOR PCE



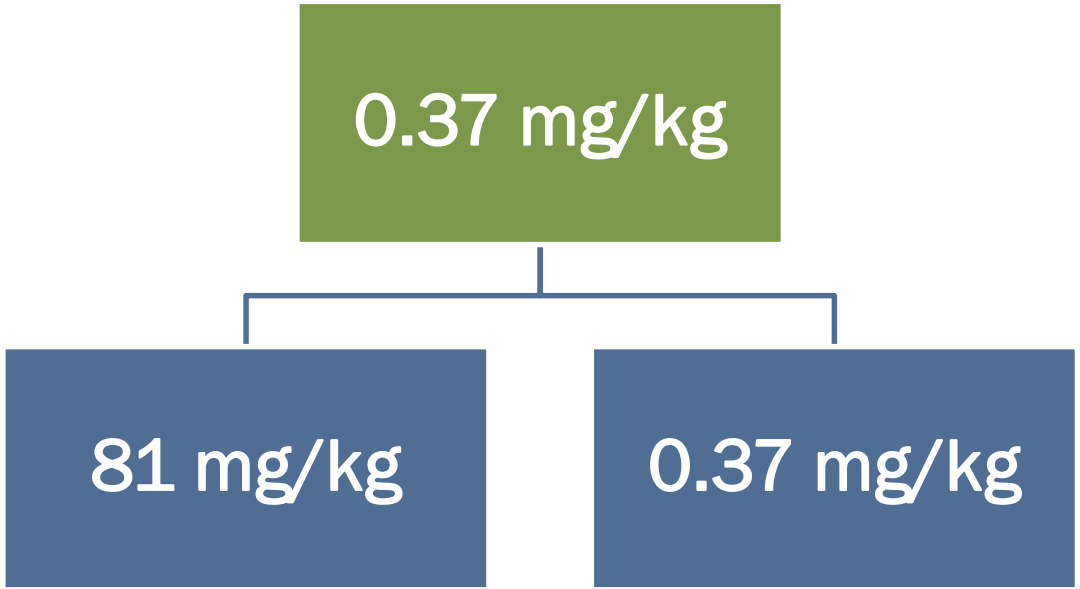
EXAMPLE: SOIL TYPE 2 RRS FOR PCE



EXAMPLE: SOIL TYPE 2 RRS FOR PCE



EXAMPLE: SOIL TYPE 2 RRS FOR PCE



SUMMARY

- Partition Equation
- Mass Limit Equation
- More consistency for leaching test data / interpretation
- Observation-based approach
- SSG Averaging Concepts

QUESTIONS & COMMENTS

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