CONSULTANTS' DAY 2015

20th Anniversary
DNR's Remediation & Redevelopment Program

Soil Standard Determination Methods & Processes

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Wisconsin DNR

WISCONSIN DEPT. OF NATURAL RESOURCES

Hosted by DNR's Remediation & Redevelopment Program

Environment Remediation and Redevelopment Redevelopment Partnership Cleanup

Key Points

- Soil Cleanup Standards (NR 720.10 or NR 720.12) – RCL
- Regional Screening Level - RSL
- Background Threshold Values – BTV
- Averaging – UCL

RR's Spreadsheet of Soil RCLs

Direct-Contact RCLs

1. ***Enter data in yellow cells.*** Numeric-only values under "INPUT Site Data." For ND, use detection limit. Do not type '-', 'NA' nor 'space bar.' Leav
2. ***After completing data entry, click "Get Summary" in*** Row 892. Click to go there.

Click to Clear INPUT Site Data Entries (Column H)

(Contaminants not in the provided list can be added starting at Row 880.)

Find ... Contaminant	CAS Number	NC RCL (mg/kg)	C RCL (mg/kg)	Not-To-Exceed D-C RCL (mg/kg)	Basis	Background Threshold Value (mg/kg)	INPUT Site Data (mg/kg)	Comparison / Flag E = Individual Exceedance!
Benzene	71-43-2	111.	1.49	1.49	ca			
Ethylbenzene	100-41-4	4,220.	7.47	7.47	ca			
Toluene	108-88-3	5,300.	-	818.	Csat			
Xylenes	1330-20-7	890.	-	258.	Csat			
Methyl tert-Butyl Ether (MTBE)	1634-04-4	23,800.	59.4	59.4	ca			
Dichloroethane, 1,2-	107-06-2	46.7	0.608	0.608	ca			
Dibromoethane, 1,2-	106-93-4	107.	0.047	0.047	ca			
Trichloroethylene	79-01-6	6.05	1.26	1.26	ca			
Tetrachloroethylene	127-18-4	115.	30.7	30.7	ca			
Vinyl Chloride	75-01-4	93.3	0.067	0.067	ca			
Dichloroethylene, 1,1-	75-35-4	342.	-	342.	nc			
Dichloroethylene, 1,2-trans-	156-60-5	1,560.	-	1,560.	nc			
Dichloroethylene, 1,2-cis-	156-59-2	156.	-	156.	nc			
Trichloroethane, 1,1,1-	71-55-6	12,300.	-	640.	Csat			
Carbon Tetrachloride	56-23-5	137.	0.854	0.854	ca			
Trimethylbenzene, 1,2,4-	95-63-6	89.8	-	89.8	nc			
Trimethylbenzene, 1,3,5-	108-67-8	782.	-	182.	Csat			
Naphthalene	91-20-3	188.	5.15	5.15	ca			
Benzo[a]pyrene	50-32-8	-	0.015	0.015	ca			
Acenaphthene	83-32-9	3,440.	-	3,440.	nc			
Acenaphthylene	208-96-8	-	-					
Anthracene	120-12-7	17,200.	-	17,200.	nc			
Benz[a]anthracene	56-55-3	-	0.148	0.148	ca			
Benzo(j)fluoranthene	205-82-3	-	0.377	0.377	ca			
Benzo[b]fluoranthene	205-99-2	-	0.148	0.148	ca			
Benzo[g,h,i]perylene	191-24-2	-	-					

Overview | Non-Industrial_DC_RCLs | Industrial_DC_RCLs | Summary_Soil_DC_Data | GW_RCLs

Concentrations from depth of 0 to 4 ft

Groundwater-Protective RCLs

A Find ... NR140 Substance	B NR 140 CAS	D Fed MCL (ug/l) (If Red, MCL>ES)	E NR 140 ES (ug/l)	F RCL-gw (mg/kg) DF=1	I Use 2, or input the calculated site-specific DF -->	J 2.00	K INPUT NUMERIC SOIL Site Data Max (mg/kg)	L Flag E = Individual Exceedance
Acetochlor	34256-82-1	-	7.	0.0056		0.0111		
Acetone	67-64-1	-	9,000.	1.8383		3.6766		
Alachlor	15972-60-8	2.	2.	0.0017		0.0033		
Aldicarb	116-06-3	3.	10.	0.0025		0.005		
Aluminum	7429-90-5	-	200.	300.		600.		
Antimony	7440-36-0	6.	6.	0.271		0.542		
Anthracene	120-12-7	-	3,000.	98.8636		197.7273		
Arsenic	7440-38-2	10.	10.	0.292		0.584		
[illegible]	1912-24-9	3.	3.	0.002		0.0039		
Barium	7440-39-3	2,000.	2,000.	82.4		164.8		
Bentazon	25057-89-0	-	300.	0.0657		0.1314		
Benzene	71-43-2	5.	5.	0.0026		0.0051		
Benzo(a)pyrene (PAH)	50-32-8	0.2	0.2	0.235		0.47		
Benzo(b)fluoranthene (PAH)	205-99-2	-	0.2	0.2397		0.4793		
Beryllium	7440-41-7	4.	4.	3.16		6.32		
Boron	7440-42-8	-	1,000.	3.208		6.416		
Bromodichloromethane (THM)	75-27-4	80.	0.6	0.0002		0.0003		
Bromoform (THM)	75-25-2	80.	4.4	0.0012		0.0023		
Bromomethane	74-83-9	-	10.	0.0025		0.0051		
Butylate	2008-41-5	-	400.	0.3887		0.7773		
Cadmium	7440-43-9	5.	5.	0.376		0.752		
Carbaryl	63-25-2	-	40.	0.0363		0.0726		
Carbofuran	1563-66-2	40.	40.	0.0156		0.0312		
Carbon disulfide	75-15-0	-	1,000.	0.2959		0.5919		
Carbon tetrachloride	56-23-5	5.	5.	0.0019		0.0039		
Chloramben	133-90-4	-	150.	0.0364		0.0729		
Chlorodifluoromethane	75-45-6	-	7,000.	2.8942		5.7885		
Chloroethane	75-00-3	-	400.	0.1133		0.2266		
Chloroform (THM)	67-66-3	80.	6.	0.0017		0.0033		
Chlorpyrifos	2921-88-2	-	2.	0.0294		0.0588		
Chloromethane	74-87-3	-	30.	0.0078		0.0155		

Overview | Non-Industrial_DC_RCLs | Industrial_DC_RCLs | Summary_Soil_DC_Data | GW_RCLs

Concentrations Nearest or At the Water Table

For a complete SI, a separate assessment of groundwater quality (via sampling) is needed.

Available at RR's "Resources for Environmental Professionals" Webpage

http://dnr.wi.gov/topic/Brownfields/Professionals.html

Where did RCLs come from?

- U.S. EPA RSL Web-Calculator

http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm

RCLs from EPA RSL Website

Regional Screening Table | Mid-Atlantic Risk Assessment | US EPA

EPA Reg. 3 Server

U.S. ENVIRONMENTAL PROTECTION AGENCY

Mid-Atlantic Risk Assessment

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Contact Us **Search:** All EPA Mid-Atlantic Risk Assessment

You are here: EPA Home » Mid-Atlantic Risk Assessment » Regional Screening Table

- Mid-Atlantic Hazardous Site Cleanup
- Risk Assessment
- Ecological Risk
- Human Health Risk

Regional Screening Table

You will need the free Adobe Reader to view some of the files on this page. See EPA's PDF page to learn more.

For assistance/questions please use the rbc table contact us page

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- User's Guide
- What's New
- FAQ
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- Calculator
- Generic Tables

Web-Calculator

Welcome to the "Regional Screening Levels for Chemical Contaminants at Superfund Sites" screening level/preliminary remediation goal website. This website was developed with DOE's Oak Ridge National Laboratory (ORNL) under an Interagency Agreement as an update of the EPA Region 3 RBC Table, Region 6 HHMSSL Table and the Region 9 PRG Table. Here you will find tables of risk-based screening levels, calculated using the latest toxicity values, default exposure assumptions and physical and chemical properties, and a calculator where default parameters can be changed to reflect site-specific risks. To ensure proper use of the screening level tables and the calculator, please review the What's New, User's Guide, Frequently Asked Questions, and Download Area links. Below is a general description of screening levels for chemical contaminants. If the calculator is used with non-default inputs in a decision on a Superfund site, it is recommended that the inputs be clearly identified and justified by the user.

Introduction

Superfund sites are addressed under the authority of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, which was amended by the 1986

Where did RCLs come from?

BTVs from USGS Report

http://pubs.usgs.gov/sir/2011/5202/

BTVs from USGS Report

Title: Distribution and Variation of Arsenic in Wisconsin Surface Soils, With Data on Other Trace Elements

Table 1–2. Statistical summary, including 95-percent upper confidence limit of the mean (95% UCL), of trace elem
Wisconsin. Summaries are for the entire dataset after outliers were removed. (*For the element molybdenum, the p
for the censored-data methods that were used in this report. None of the summary statistics were calculated for th

[Statistics are for concentrations in milligrams per kilogram]

BTV

Trace element	Number of samples	Non-detects (%)	Minimum detected value	Maximum detected value	Median	Mean	95% UCL of the mean
Aluminum	662	0	610	28,721	8,282	9,147	9,479
Arsenic	654	32.3	1.0	8.3	1.8	2.3	2.4
Barium	658	0	3.53	364	92.0	101	105
Calcium	607	0	22.9	14,536	1,931	2,831	3,025
Cadmium	642	38	0.10	1.07	0.15	0.23	0.25
Cobalt	661	1.5	0.51	22.0	6.34	6.61	6.87
Chromium	659	0	0.95	43.5	12.5	13.7	14.2

Page 41 of Report

RR's Spreadsheet of Soil RCLs

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Dichloroethylene, 1,2-trans-	156-60-5	1,560.	-	1,560.	nc			
Dichloroethylene, 1,2-cis-	156-59-2	156.	-	156.	nc			
Trichloroethane, 1,1,1-	71-55-6	12,300.	-	640.	Csat			
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Trimethylbenzene, 1,2,4-	95-63-6	89.8	-	89.8	nc			
Trimethylbenzene, 1,3,5-	108-67-8	782.	-	182.	Csat			
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Benzo[a]pyrene	50-32-8	-	0.015	0.015	ca			
Acenaphthene	83-32-9	3,440.	-	3,440.	nc			
Acenaphthylene	208-96-8	-	-					
Anthracene	120-12-7	17,200.	-	17,200.	nc			
Benz[a]anthracene	56-55-3	-	0.148	0.148	ca			
Benzo(j)fluoranthene	205-82-3	-	0.377	0.377	ca			
Benzo[b]fluoranthene	205-99-2	-	0.148	0.148	ca			
Benzo[g,h,i]perylene	191-24-2	-	-					

Overview | **Non-Industrial_DC_RCLs** | Industrial_DC_RCLs | Summary_Soil_DC_Data | GW_RCLs

If concentration < BTV, direct contact is ignored.

Available at RR's "Resources for Environmental Professionals" WebPage

http://dnr.wi.gov/topic/Brownfields/Professionals.html

Soil Data Summary Table

BRRTS #:	*02-73-007107*
SITE NAME:	*Leysamarte Inn*
SITE ADDRESS:	*Leysamarte, WI*

BORING #	B-1	B-1	B-2		B-3		B-4	...			
Date Collected	11/11/13	11/11/13	11/11/13	11/11/13	11/11/13	11/11/13	11/11/13				
DEPTH (ft BGS)	2.5 - 4.5	5 - 7	2.5 - 4.5	5 - 7	0 - 4	6 - 8	2 - 4	Soil RCLs (mg/kg)			
								Calculated 06/2014		Background	Lab
	Soil Concentrations in mg/kg (or ppm)							Non-Industrial Direct Contact	Soil to GW	Surficial BTV	Detection Limit (mg/kg)
Benzene	0.75	< 0.005	2.	0.5	1.	1.	1.	1.49	0.005	-	0.005
Ethylbenzene	5.6	< 0.005	8.	2.	< 0.005	1.	1.	7.47	1.57	-	0.005
Toluene	800.	0.05	10.	2.	< 0.005	2.	2.	818.	1.107	-	0.005
Xylene	250.	3.	10.	4.	< 0.005	50.	50.	258.	3.94	-	0.005
PCE	2.	< 0.005	2.	0.5	< 0.005	7.	7.	30.7	0.005	-	0.005
Naphthalene	1.	< 0.005	2.	3.	< 0.005	3.	3.	5.15	0.659	-	0.005
Benzo[a]pyrene	< 0.01	< 0.01	0.1	0.5	0.4	0.3	0.3	0.015	0.47	-	0.01
Arsenic	5.	< 0.5	10.	5.	< 0.5	8.	8.	0.613	0.584	8.	0.5
Lead	240.	25.	100.	50.	< 1	50.	50.	400.	27.	52.	1

Overview | Non-Industrial DC RCLs | Industrial DC RCLs | Summary Soil DC Data | GW RCLs

Soil Data Summary Table

BRRTS #: *02-73-007107*
SITE NAME: *Leysamarte Inn*
SITE ADDRESS: *Leysamarte, WI*

BORING #	*B-1*	B-1	B-2		B-3		B-4	...			
DEPTH to Water Table (ft BGS)	6		7		6		8				
Date Collected	11/11/13	11/11/13	11/11/13	11/11/13	11/11/13	11/11/13	11/11/13				
DEPTH (ft BGS)	2.5 - 4.5	5 - 7	2.5 - 4.5	5 - 7	0 - 4	6 - 8	2 - 4	Soil RCLs (mg/kg)			
SOIL TYPE	clay	peat	clay	silty clay	soil fill	waste fill	sandy silt	Calculated 06/2014		Background	Lab
								Non-Industrial Direct Contact	Soil to GW	Surficial BTV	Detection Limit (mg/kg)
Soil Concentrations in mg/kg (or ppm)											
Benzene	0.75	< 0.005	2.	*0.5*	1.	*1.*	1.	1.49	0.005	-	0.005
Ethylbenzene	5.6	< 0.005	8.	*2.*	< 0.005	1.	1.	7.47	1.57	-	0.005
Toluene	800.	0.05	10.	*2.*	< 0.005	*2.*	2.	818.	1.107	-	0.005
Xylene	250.	3.	10.	*4.*	< 0.005	*50.*	50.	258.	3.94	-	0.005
PCE	2.	*< 0.005*	2.	*0.5*	< 0.005	*7.*	7.	30.7	0.005	-	0.005
Naphthalene	1.	< 0.005	2.	*3.*	< 0.005	*3.*	3.	5.15	0.659	-	0.005
Benzo[a]pyrene	< 0.01	< 0.01	0.1	*0.5*	0.4	0.3	0.3	0.015	0.47	-	0.01
Arsenic	5.	< 0.5	10.	*5.*	< 0.5	*8.*	8.	0.613	0.584	8.	0.5
Lead	240.	25.	100.	*50.*	< 1	*50.*	50.	400.	27.	52.	1
No. of Individual Exceedances (DC)	0		4		1		1				
Cumulative Hazard Index (DC)	1.063		0.603		0.009		0.143	} HI and CCR are from the DC_RCL Worksheet			
Cumulative Cancer Risk (DC)	2.19E-06		2.59E-05		2.77E-05		2.19E-05				

Exceedance Highlights:

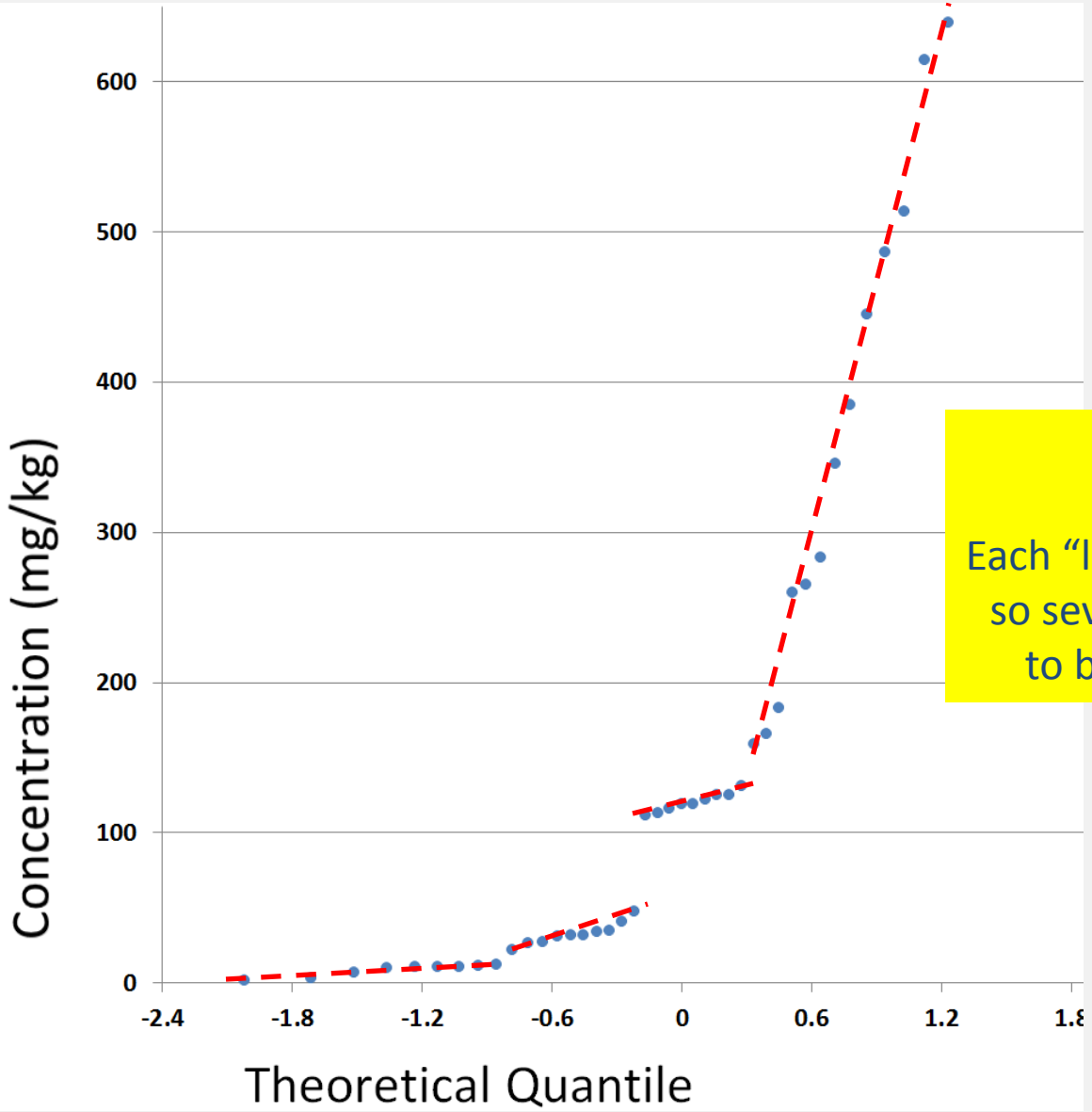
“Soil” Terms

- ~~RCL – Cleanup level in soil (mostly calculated)~~
- ~~RSL – Has algorithm for RCL calculation~~
- ~~BTV – Background that may become RCL~~
- UCL – (Statistics)

UCL

- Upper 95% Confidence Limit for the Mean
- Applies to a single population
  - adequate no. of sample
  - hotspots
- Can be compared to DC-RCL

Multiple Populations?



Yes.

Each “line” has its UCL, so several UCLs need to be calculated.

UCL – DC-RCL Comparison

Data for Contaminant **X**
(RCL for X is **10** mg/kg.)
Red font indicates RCL exceedance.

Sample#	Soil-**X** (mg/kg)
1	8.5
2	9.7
3	10.
4	9.
5	8.
6	10.
7	9.1
8	10.5
9	11.
10	10.2
11	9.4
12	9.6
13	9.4

Soil-X (mg/kg)

General Statistics

Total Number of Observations	13	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	8	Mean	9.569
Maximum	11	Median	9.6
SD	0.812	Std. Error of Mean	0.225
Coefficient of Variation	0.0848	Skewness	-0.227

Normal GOF Test

Shapiro Wilk Test Statistic	0.99	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.11	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.246	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	9.971	95% Adjusted-CLT UCL (Chen-1995)	9.924
		95% Modified-t UCL (Johnson-1978)	9.968

Suggested UCL to Use

95% Student's-t UCL	9.971

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Summary of Key Points

- RCL – Residual Contaminant Level
- RSL – Regional Screening Level
- BTV – Background Threshold Values
- UCL – Upper 95% Confidence Limit

Questions & Contacts

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WISCONSIN DEPT. OF NATURAL RESOURCES

Thank you for attending Consultants' Day

Environment Remediation and Redevelopment Cleanup Redevelopment