Remediation and Redevelopment Program

Issues & Trends 2017

October 4, 2017

12:00 p.m.

Dial: 1-855-947-8255

Passcode: 6612 745#

New RCL Alternative

Polycyclic Aromatic Hydrocarbon (PAH)
Cumulative Assessment for
Non-Industrial, Direct Contact Risk

Paul Grittner
Paul.Grittner@wisconsin.gov

David Swimm
David.Swimm@wisconsin.gov

Questions will be taken during the presentation.
You may also submit questions to DNRRRComments@wisconsin.gov

What is the modified RCL Spreadsheet:

- It's a method for completing a risk assessment (per NR 722.11(1)) to develop alternative soil standards to RCLs to evaluate direct contact risk posed by PAHs at non-industrial sites

- Will demonstrate that certain concentrations of PAHs will not pose a significant risk, even if individual compounds are present at concentrations greater than their RCL

- Should not be considered for samples where compounds other than PAHs exceed a direct contact RCL

Basis:

DHS Reassessment

- PAHs found as mixtures, not as independent compounds
- PAHs have similar human health and toxicology effects, so can be effectively evaluated together

Applicable PAHs - Seven Carcinogenic Compounds(cPAHs):

- Benzo[a]pyrene
- Benz[a]anthracene
- Benzo[b]fluoranthene
- Benzo[k]fluoranthene
- Chrysene
- Dibenz[a,h]anthracene
- Indeno[1,2,3-cd]pyrene.

The modified spreadsheet changes assessment for 7 cPAHs by:

from

Threshold RCL concentrations (mg/kg)
for individual compounds

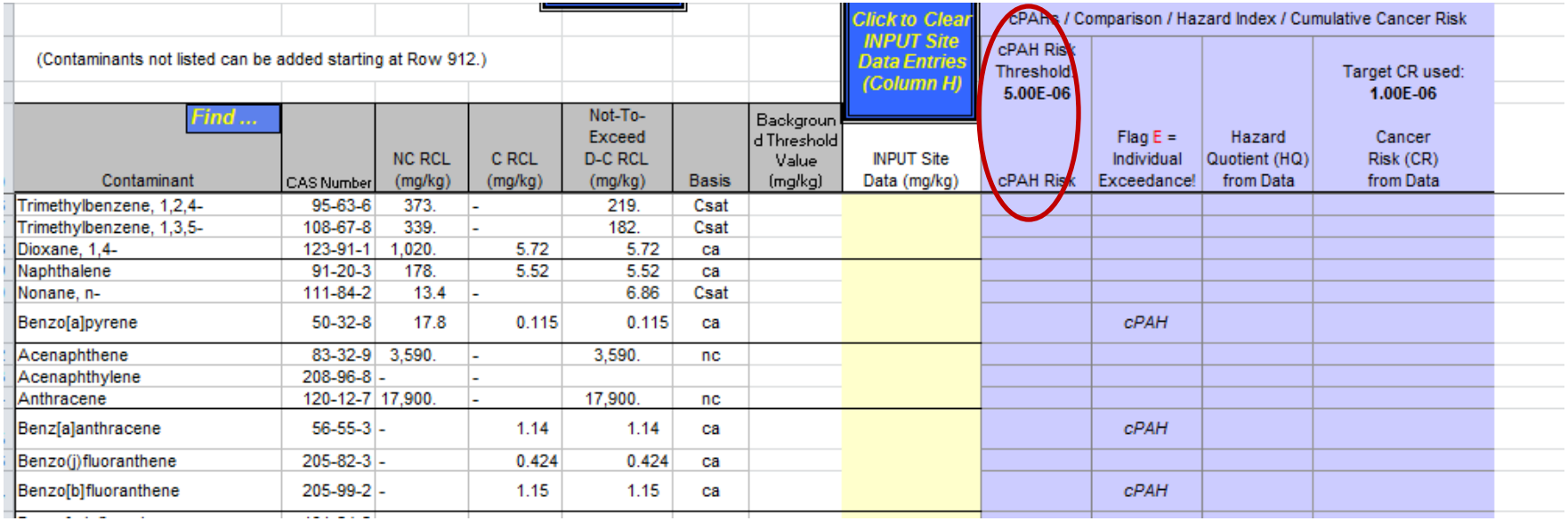
to

Cumulative Threshold excess cancer risk value
(1/200,000 or 5×10^{-6})
for summation of all 7 compounds

This is accomplished by:

1) Not comparing concentrations of 7 cPAHs to a compound specific RCL in the calculator.

2) Adding a new column in the spreadsheet to tabulate total cancer risk posed by the 7 cPAHs.



(Contaminants not listed can be added starting at Row 912.)

Click to Clear INPUT Site Data Entries (Column H)

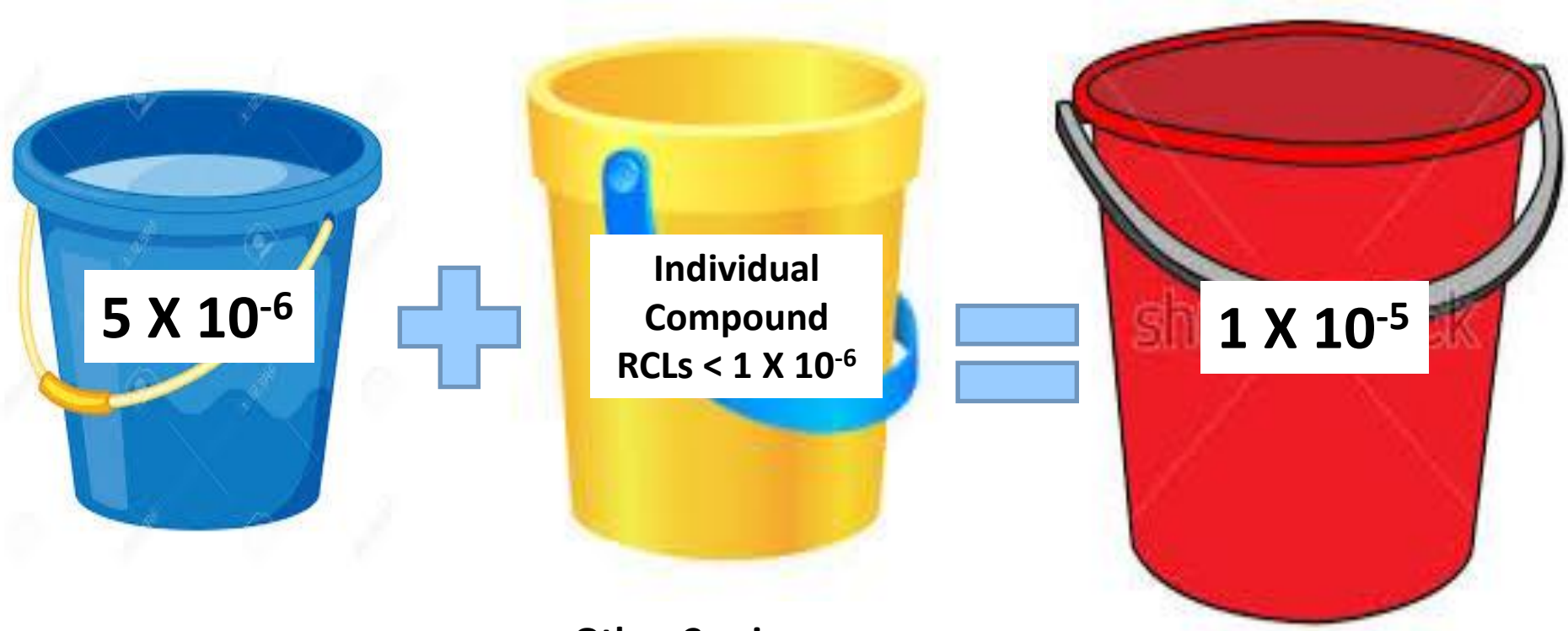
cPAHs / Comparison / Hazard Index / Cumulative Cancer Risk

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)	cPAH Risk Threshold 5.00E-06 cPAH Risk	Flag E = Individual Exceedance!	Hazard Quotient (HQ) from Data	Target CR used: 1.00E-06 Cancer Risk (CR) from Data
Trimethylbenzene, 1,2,4-	95-63-6	373.	-	219.	Csat						
Trimethylbenzene, 1,3,5-	108-67-8	339.	-	182.	Csat						
Dioxane, 1,4-	123-91-1	1,020.	5.72	5.72	ca						
Naphthalene	91-20-3	178.	5.52	5.52	ca						
Nonane, n-	111-84-2	13.4	-	6.86	Csat						
Benzo[a]pyrene	50-32-8	17.8	0.115	0.115	ca				*cPAH*		
Acenaphthene	83-32-9	3,590.	-	3,590.	nc						
Acenaphthylene	208-96-8	-	-								
Anthracene	120-12-7	17,900.	-	17,900.	nc						
Benz[a]anthracene	56-55-3	-	1.14	1.14	ca				*cPAH*		
Benzo(j)fluoranthene	205-82-3	-	0.424	0.424	ca						
Benzo[b]fluoranthene	205-99-2	-	1.15	1.15	ca				*cPAH*		

Review:

1 cPAH at respective RCL (mg/kg)	⟷	**1 X 10^{-6}** ECR
5 cPAHs at their respective RCLs	⟷	**5 X 10^{-6}**
1 cPAHs at 5X RCL concentration	⟷	**5 X 10^{-6}**
Threshold for all carcinogenic compounds (VOCs, PAHs, etc.)	⟷	**1 X 10^{-5}**
NEW – Threshold for 7 cPAHs	⟷	**5 X 10^{-6}**

Risk Thresholds (excess cancer risk):



7 cPAHs

Other Carcinogens:

- Other cPAHs
- Metals, VOCs, others

Total Carcinogens

The modified RCL spreadsheet only calculates alternative soil standards to non-industrial direct contact RCLs

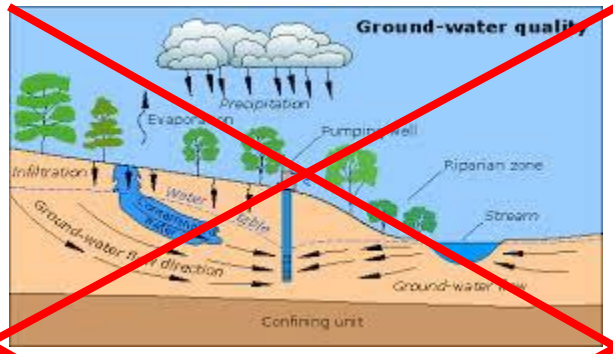
The modified spreadsheet does not change the way:

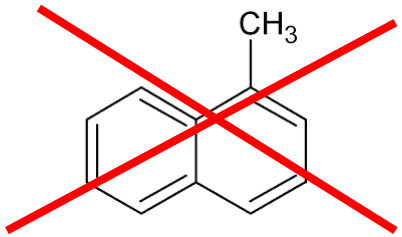
1) Groundwater RCLs are assessed

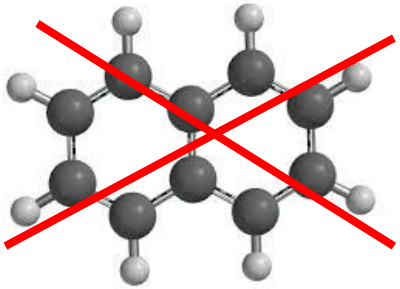
2) Industrial direct contact RCLs are assessed

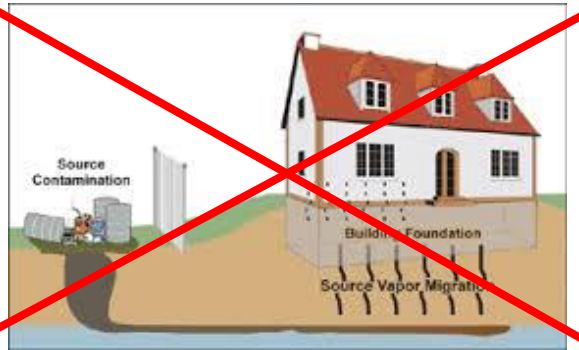
3) Vapor and other pathways require consideration

4) Naphthalene or 1-methylnaphthalene are assessed









Using the modified RCL spreadsheet requires pre-approval from the DNR

RP must request approval to prepare a risk assessment to determine alternative soil standards per NR 722.11.

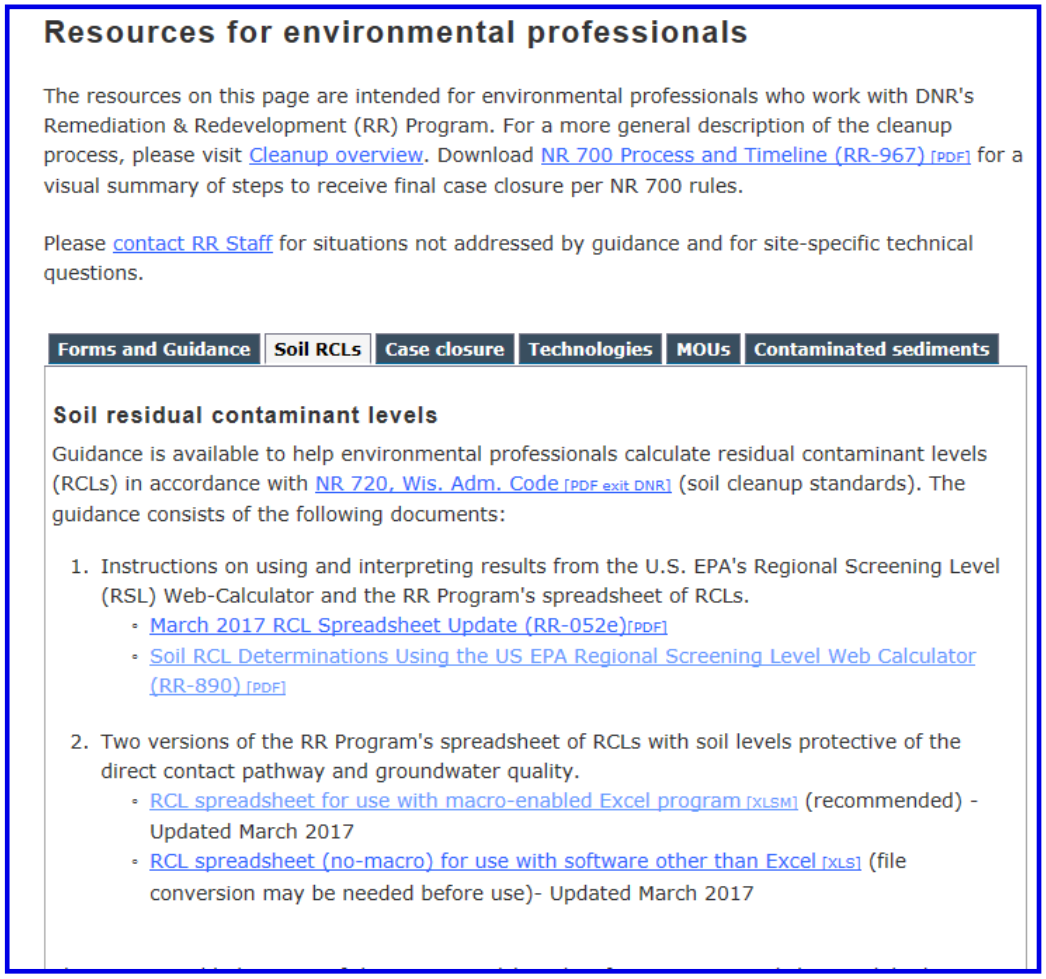
- The modified RCL spreadsheet is a means to conduct the assessment.

- The modified spreadsheet provides standard exposure assumptions.

DNR will approve, modify, or deny the request.

Using the modified RCL spreadsheet

1) Open the spreadsheet – found on DNR's website (search for Soil RCLs)



Resources for environmental professionals

The resources on this page are intended for environmental professionals who work with DNR's Remediation & Redevelopment (RR) Program. For a more general description of the cleanup process, please visit Cleanup overview. Download NR 700 Process and Timeline (RR-967) [PDF] for a visual summary of steps to receive final case closure per NR 700 rules.

Please contact RR Staff for situations not addressed by guidance and for site-specific technical questions.

Forms and Guidance | Soil RCLs | Case closure | Technologies | MOUs | Contaminated sediments

Soil residual contaminant levels

Guidance is available to help environmental professionals calculate residual contaminant levels (RCLs) in accordance with NR 720, Wis. Adm. Code [PDF exit DNR] (soil cleanup standards). The guidance consists of the following documents:

1. Instructions on using and interpreting results from the U.S. EPA's Regional Screening Level (RSL) Web-Calculator and the RR Program's spreadsheet of RCLs.
   - March 2017 RCL Spreadsheet Update (RR-052e)[PDF]
   - Soil RCL Determinations Using the US EPA Regional Screening Level Web Calculator (RR-890) [PDF]

2. Two versions of the RR Program's spreadsheet of RCLs with soil levels protective of the direct contact pathway and groundwater quality.
   - RCL spreadsheet for use with macro-enabled Excel program [XLSM] (recommended) - Updated March 2017
   - RCL spreadsheet (no-macro) for use with software other than Excel [XLS] (file conversion may be needed before use)- Updated March 2017

Using the modified RCL spreadsheet

2) Enter the data, remembering to

- enter all compounds analyzed for in the sample
- enter the detection limit if 'non-detected'
- enter 'J' flag values
- enter highest value for compounds analyzed more than once
- enter all PAHs analyzed

- Compounds not analyzed at a site aren't entered in the table
- Groups of compounds not expected at a site aren't entered in the table

Typical Lab Report Results: (ug/kg)	
Acenaphthene	<18
Acenaphthylene	32 "J"
Anthracene	45
Benzo(a)anthracene	46
Benzo(a)pyrene	53
Benzo(b)fluoranthene	51
Benzo(g,h,i)perylene	37
Benzo(k)fluoranthene	57
Chrysene	62
Dibenzo(ah)anthracene	<18
Fluoanthene	115
Fluorene	22 "J"
Indeno(123cd)pyrene	34
1-Methylnapthalene	<18.
2-Methylnapthalene	22 "J"
Naphthalene	21 "J"
Phenanthrene	44
Pyrene	93

Converted to mg/kg and changing NDs to MDLs:	
Acenaphthene	0.018
Acenaphthylene	0.032
Anthracene	0.045
Benzo(a)anthracene	0.046
Benzo(a)pyrene	0.053
Benzo(b)fluoranthene	0.051
Benzo(g,h,i)perylene	0.037
Benzo(k)fluoranthene	0.057
Chrysene	0.062
Dibenzo(ah)anthracene	0.018
Fluoanthene	0.115
Fluorene	0.022
Indeno(123cd)pyrene	0.034
1-Methylnapthalene	0.018
2-Methylnapthalene	0.022
Naphthalene	0.021
Phenanthrene	0.044
Pyrene	0.093

Using the modified RCL spreadsheet

Methods to Enter Data:

- Type it in.
- Reorder the data in excel, copy and paste into RCL spreadsheet.

Typical Lab Report Results: (ug/kg)	
Acenaphthene	<18.8
Acenaphthylene	52.2
Anthracene	150
Benzo(a)anthracene	462
Benzo(a)pyrene	531
Benzo(b)fluoranthene	509
Benzo(g,h,i)perylene	376
Benzo(k)fluoranthene	573
Chrysene	625
Dibenzo(ah)anthracene	125
Fluoanthene	1150
Fluorene	22.4
Indeno(123cd)pyrene	341
1-Methylnapthalene	<18.8
2-Methylnapthalene	20.2
Naphthalene	21.8
Phenanthrene	444
Pyrene	926

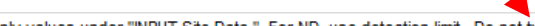
Converted to mg/kg and changing NDs to MDLs:	
Acenaphthene	0.0188
Acenaphthylene	0.0522
Anthracene	0.15
Benzo(a)anthracene	0.462
Benzo(a)pyrene	0.531
Benzo(b)fluoranthene	0.509
Benzo(g,h,i)perylene	0.376
Benzo(k)fluoranthene	0.573
Chrysene	0.625
Dibenzo(ah)anthracene	0.125
Fluoanthene	1.15
Fluorene	0.0224
Indeno(123cd)pyrene	0.341
1-Methylnapthalene	0.0188
2-Methylnapthalene	0.0202
Naphthalene	0.0218
Phenanthrene	0.444
Pyrene	0.926

Reordered analytes to match NR722 calculator (for ease of data entry):	
Naphthalene	0.0218
Benzo(a)pyrene	0.531
Acenaphthene	0.0188
Acenaphthylene	0.0522
Anthracene	0.15
Benzo(a)anthracene	0.462
Benzo(b)fluoranthene	0.509
Benzo(g,h,i)perylene	0.376
Benzo(k)fluoranthene	0.573
Chrysene	0.625
Dibenzo(ah)anthracene	0.125
Fluoanthene	1.15
Fluorene	0.0224
Indeno(123cd)pyrene	0.341
1-Methylnapthalene	0.0188
2-Methylnapthalene	0.0202

- Others methods can be developed.

Using the modified RCL spreadsheet

Data is now entered



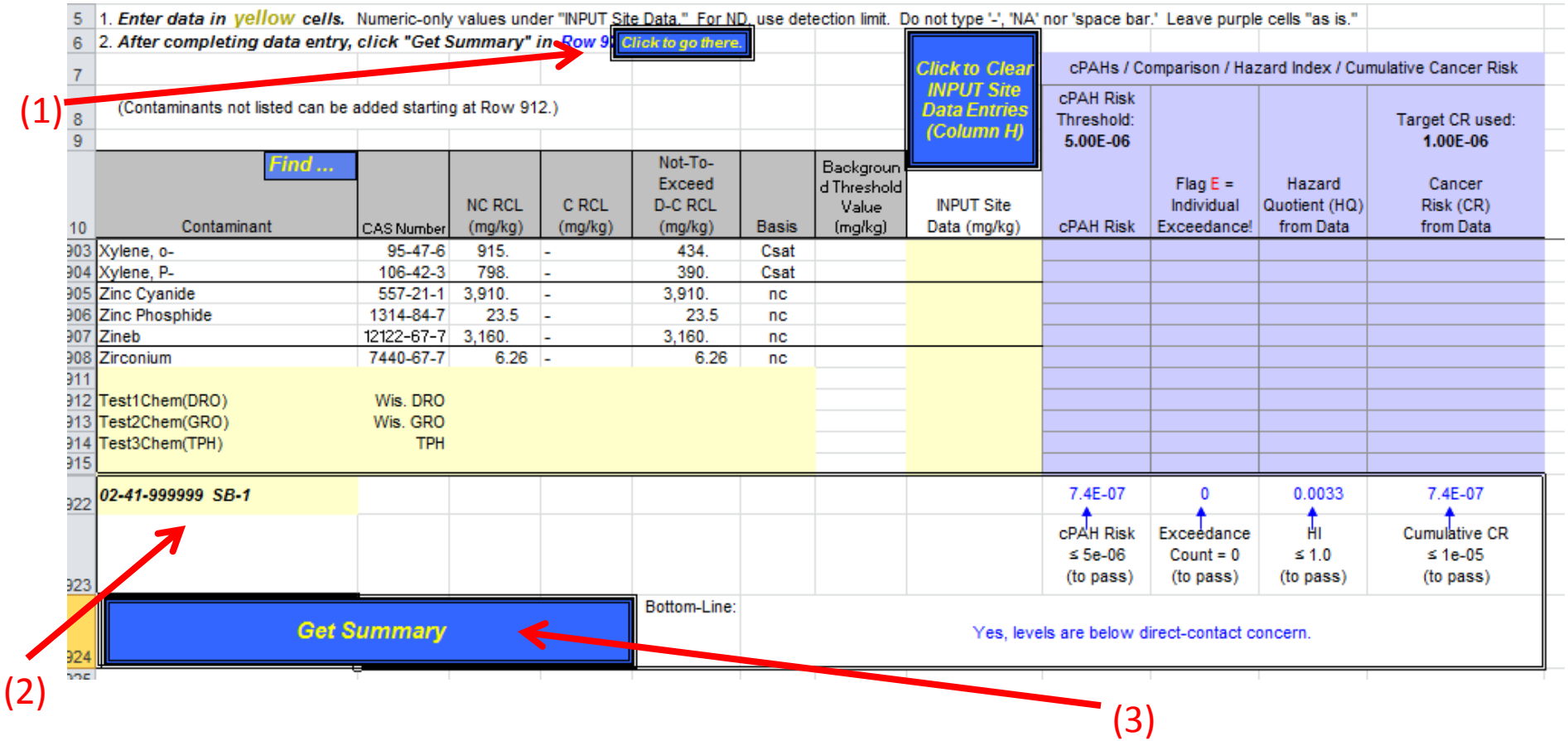
1. ***Enter data in yellow cells.*** Numeric-only values under "INPUT Site Data." For ND, use detection limit. Do not type '-', 'NA' nor 'space bar.' Leave purple cells "as is."
2. ***After completing data entry, click "Get Summary" in*** Row 9 — Click to go there.

(Contaminants not listed can be added starting at Row 912.)

Click to Clear INPUT Site Data Entries (Column H)

	Find ...							cPAHs / Comparison / Hazard Index / Cumulative Cancer Risk			
								cPAH Risk Threshold: **5.00E-06**			Target CR used: **1.00E-06**
10	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)	cPAH Risk	Flag E = Individual Exceedance!	Hazard Quotient (HQ) from Data	Cancer Risk (CR) from Data
26	Trimethylbenzene, 1,2,4-	95-63-6	373.	-	219.	Csat						
27	Trimethylbenzene, 1,3,5-	108-67-8	339.	-	182.	Csat						
28	Dioxane, 1,4-	123-91-1	1,020.	5.72	5.72	ca						
29	Naphthalene	91-20-3	178.	5.52	5.52	ca		0.021			0.0001	3.8E-09
30	Nonane, n-	111-84-2	13.4	-	6.86	Csat						
31	Benzo[a]pyrene	50-32-8	17.8	0.115	0.115	ca		0.053	4.6E-07	*cPAH*	0.003	4.6E-07
32	Acenaphthene	83-32-9	3,590.	-	3,590.	nc		0.018			0.	
33	Acenaphthylene	208-96-8	-	-				0.032				
34	Anthracene	120-12-7	17,900.	-	17,900.	nc		0.045			0.	
35	Benz[a]anthracene	56-55-3	-	1.14	1.14	ca		0.046	4.0E-08	*cPAH*		4.0E-08
36	Benzo(j)fluoranthene	205-82-3	-	0.424	0.424	ca						
37	Benzo[b]fluoranthene	205-99-2	-	1.15	1.15	ca		0.051	4.4E-08	*cPAH*		4.4E-08
38	Benzo[g,h,i]perylene	191-24-2	-	-				0.037				
39	Benzo[k]fluoranthene	207-08-9	-	11.5	11.5	ca		0.057	5.0E-09	*cPAH*		5.0E-09
40	Chrysene	218-01-9	-	115.	115.	ca		0.062	5.4E-10	*cPAH*		5.4E-10
41	Dibenz[a,h]anthracene	53-70-3	-	0.115	0.115	ca		0.018	1.6E-07	*cPAH*		1.6E-07
42	Dibenzo(a,e)pyrene	192-65-4	-	0.042	0.042	ca						
43	Dimethylbenz(a)anthracene, 7,12-	57-97-6	-	4.59E-04	4.59E-04	ca						
44	Fluoranthene	206-44-0	2,390.	-	2,390.	nc		0.115			0.	
45	Fluorene	86-73-7	2,390.	-	2,390.	nc		0.022			0.	
46	Indeno[1,2,3-cd]pyrene	193-39-5	-	1.15	1.15	ca		0.034	3.0E-08	*cPAH*		3.0E-08
47	Methylnaphthalene, 1-	90-12-0	4,180.	17.6	17.6	ca		0.018			0.	1.0E-09
48	Methylnaphthalene, 2-	91-57-6	239.	-	239.	nc		0.022			0.0001	
49	Nitropyrene, 4-	57835-92-4	-	0.424	0.424	ca						
50	Perylene	198-55-0	-	-								
51	Phenanthrene	85-01-8	-	-				0.044				
52	Pyrene	129-00-0	1,790.	-	1,790.	nc		0.093			0.0001	

Using the modified RCL spreadsheet



3) Once all data is entered, push the 'Get Summary' to generate a compilation of all data

Using the modified RCL spreadsheet

BRRTS # :
02-41-999999 SB-1

# of Soil-Concentration Entries: 18

(Cumulative) cPAH Cancer Risk	Number of Individual Exceedance	(Cumulative) Hazard Index	(Cumulative) Cancer Risk
7.4E-07	0	0.0033	7.4E-07

Bottom-Line: Yes, levels are below direct-contact concern.

Date of Entry: 9/27/2017.
Date of Worksheet Used: 03/14/2017.

List below only has contaminants with data.

Contaminant	CAS Number	NC RCL (mg/kg)	C RCL (mg/kg)	Not-To-Exceed D-C RCL (mg/kg)	Basis	BTV (mg/kg)	INPUTTED Site Data (mg/kg)	cPAH Cancer Risk from Data	Flag E = Individual Exceedance!	Hazard Quotient (HQ) from Data	Cancer Risk (CR) from Data
Naphthalene	91-20-3	178.	5.52	5.52	ca		0.021			0.0001	3.8E-09
Benzo[a]pyrene	50-32-8	17.8	0.115	0.115	ca		0.053	4.61E-07	cPAH	0.003	4.6E-07
Acenaphthene	83-32-9	3,590.	-	3,590.	nc		0.018			0.	
Acenaphthylene	208-96-8	-	-				0.032				
Anthracene	120-12-7	17,900.	-	17,900.	nc		0.045			0.	
Benz[a]anthracene	56-55-3	-	1.14	1.14	ca		0.046	4.04E-08	cPAH		4.0E-08
Benzo[b]fluoranthene	205-99-2	-	1.15	1.15	ca		0.051	4.43E-08	cPAH		4.4E-08
Benzo[g,h,i]perylene	191-24-2	-	-				0.037				
Benzo[k]fluoranthene	207-08-9	-	11.5	11.5	ca		0.057	4.96E-09	cPAH		5.0E-09
Chrysene	218-01-9	-	115.	115.	ca		0.062	5.39E-10	cPAH		5.4E-10
Dibenz[a,h]anthracene	53-70-3	-	0.115	0.115	ca		0.018	1.57E-07	cPAH		1.6E-07
Fluoranthene	206-44-0	2,390.	-	2,390.	nc		0.115			0.	
Fluorene	86-73-7	2,390.	-	2,390.	nc		0.022			0.	
Indeno[1,2,3-cd]pyrene	193-39-5	-	1.15	1.15	ca		0.034	2.96E-08	cPAH		3.0E-08
Methylnaphthalene, 1-	90-12-0	4,180.	17.6	17.6	ca		0.018			0.	1.0E-09
Methylnaphthalene, 2-	91-57-6	239.	-	239.	nc		0.022			0.0001	
Phenanthrene	85-01-8	-	-				0.044				
Pyrene	129-00-0	1,790.	-	1,790.	nc		0.093			0.0001	

New

Original

Illustrative Example (as modified from RR-087):

Results:	Sample #1	Sample #2
# compounds > RCLs (DC)	2	2
cumulative HI	0.0165	0.0218
cumulative cancer risk	5.00E-06	5.70E-06

Original RCL Spreadsheet Summary:

	Sample #1 (mg/kg)	Sample #2 (mg/kg)	non-industrial DC (RCL)	Soil to GW (RCL)
Acenaphthene	0.230	0.630	3,590	NS
Acenaphthylene	0.240	0.360	NS	NS
Anthracene	0.350	0.150	17,900	NS
Benz[a]anthracene	0.320	0.340	1.14	NS
Benzo[a]pyrene	**0.245**	**0.230**	0.115	470
Benzo[b]fluoranthene	0.240	0.340	1.15	480
Benzo[g,h,i]perylene	0.260	0.240	NS	NS
Benzo[k]fluoranthene	0.240	0.290	11.5	NS
Chrysene	0.240	0.360	115	145
Dibenz[a,h]anthracene	**0.240**	**0.280**	0.115	NS
Fluoranthene	0.250	0.270	2,390	NS
Fluorene	0.360	0.290	2,390	14,815
Indeno[1,2,3-cd]pyrene	0.240	0.260	1.15	NS
Methylnaphthalene, 1-	0.360	0.340	17.6	658
Methylnaphthalene, 2-	0.350	0.120	239	NS
Naphthalene	0.120	0.380	5.52	54,473
Phenanthrene	0.270	0.270	NS	NS
Pyrene	0.280	0.280	1,790	NS

Illustrative Example (as modified from RR-087):

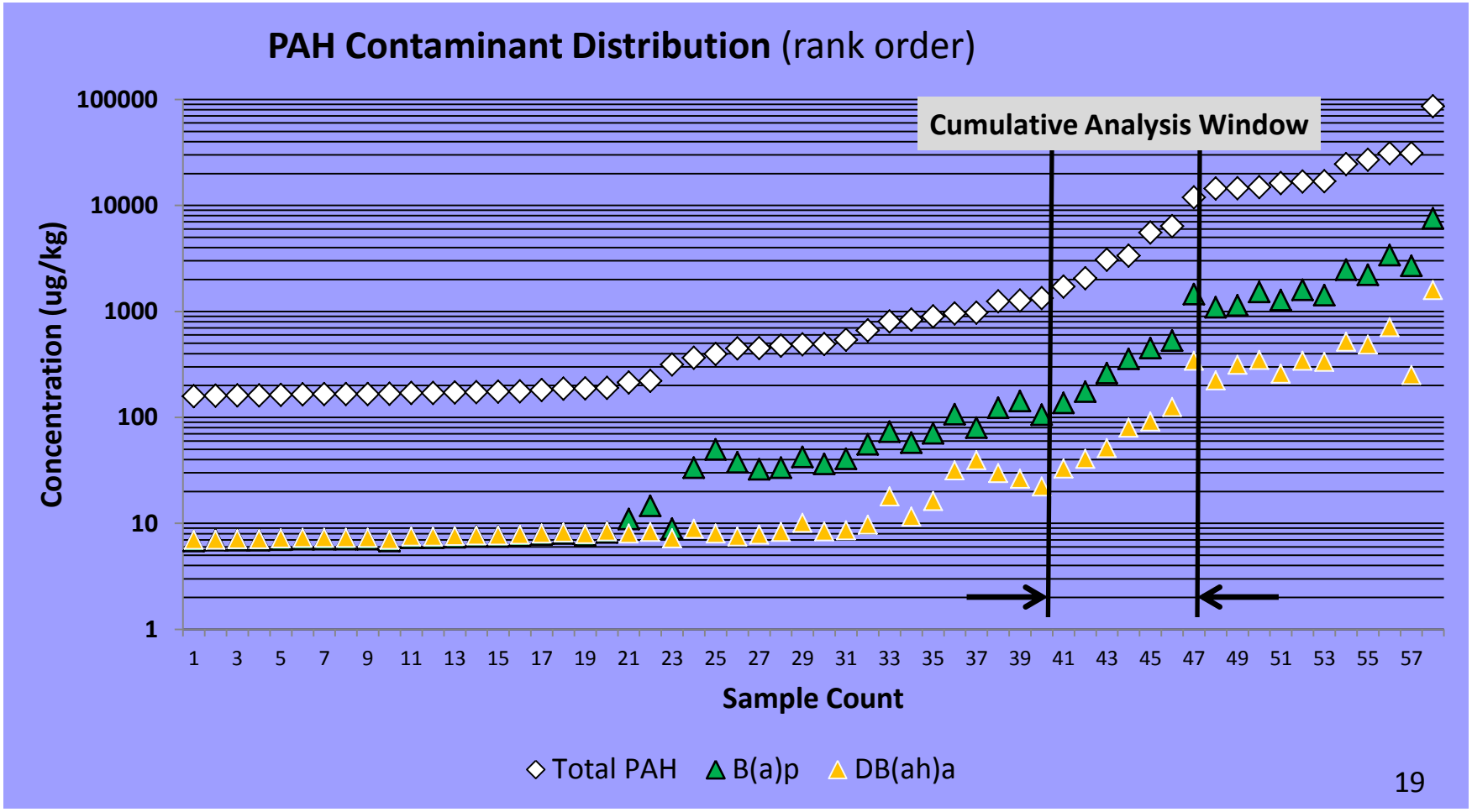
Results:	Sample #1	Sample #2
cumulative cPAHs ECR (DC)	4.90E-06	5.30E-06
# compounds > RCLs (DC)	0	0
cumulative hazard index	0.0168	0.0218
cumulative cancer risk	5.00E-06	5.70E-06

Modified RCL Spreadsheet Summary:

	Sample #1 (mg/kg)	Sample #2 (mg/kg)	non-industrial DC (RCL)	Soil to GW (RCL)
Acenaphthene	0.230	0.630	3,590	NS
Acenaphthylene	0.240	0.360	NS	NS
Anthracene	0.350	0.150	17,900	NS
Benz[a]anthracene	0.320	0.340	cPAH	NS
Benzo[a]pyrene	**0.245**	**0.230**	cPAH	470
Benzo[b]fluoranthene	0.240	0.340	cPAH	480
Benzo[g,h,i]perylene	0.260	0.240	NS	NS
Benzo[k]fluoranthene	0.240	0.290	cPAH	NS
Chrysene	0.240	0.360	cPAH	145
Dibenz[a,h]anthracene	**0.240**	**0.280**	cPAH	NS
Fluoranthene	0.250	0.270	2,390	NS
Fluorene	0.360	0.290	2,390	14,815
Indeno[1,2,3-cd]pyrene	0.240	0.260	cPAH	NS
Methylnaphthalene, 1-	0.360	0.340	17.6	658
Methylnaphthalene, 2-	0.350	0.120	239	NS
Naphthalene	0.120	0.380	5.52	54,473
Phenanthrene	0.270	0.270	NS	NS
Pyrene	0.280	0.280	1,790	NS

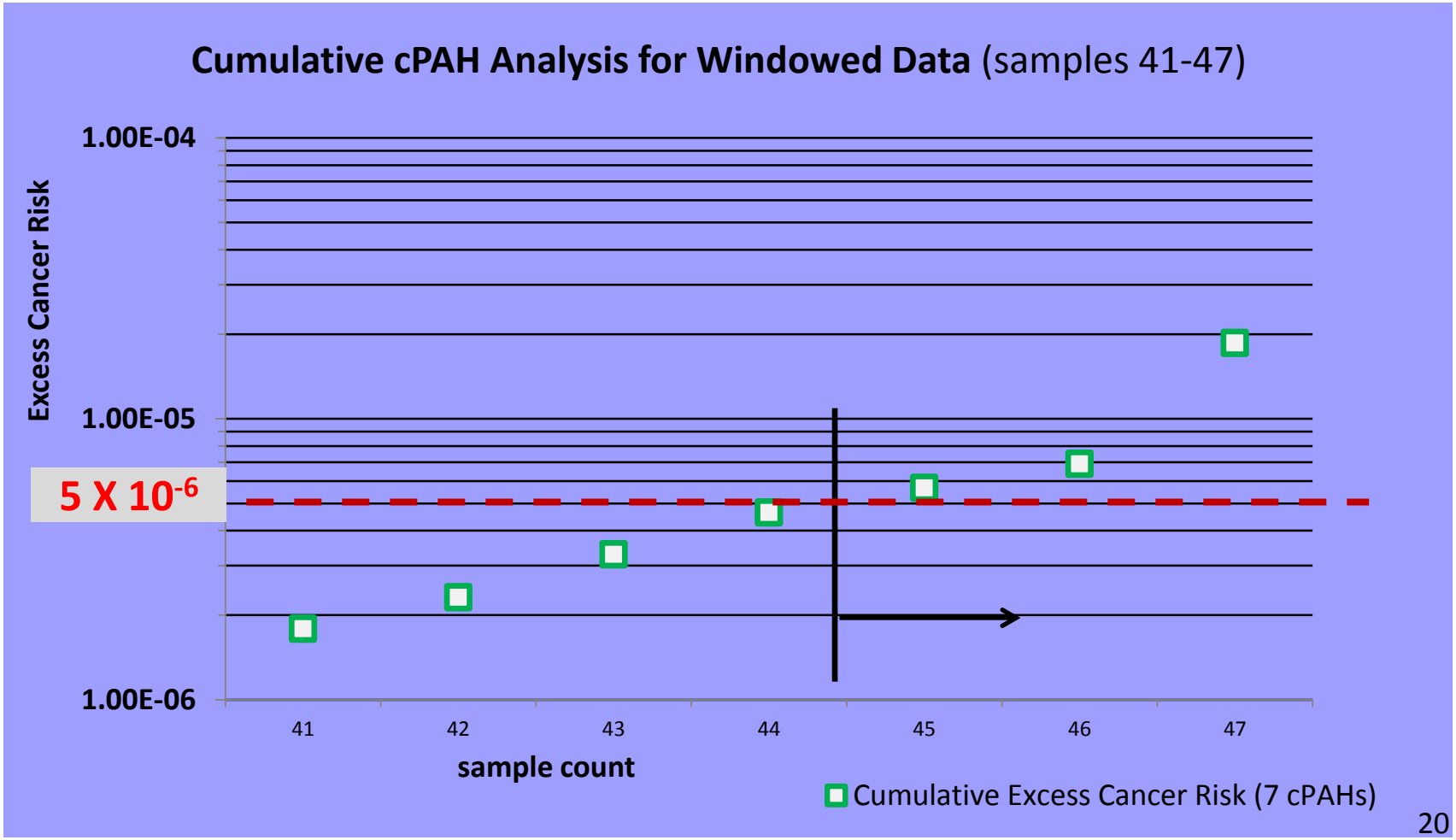
Assessing Large Data Sets (only PAH contamination)

Step 1:



Assessing Large Data Sets (only PAH contamination)

Step 2:



Using the modified RCL spreadsheet requires pre-approval from the DNR

Request approval in writing through a technical assistance request or incorporate the request into any other **fee**-based submittal*.

Request must demonstrate that PAH concentrations exceed direct contact RCLs, and that obtaining compliance with them is not 'practicable.'

The following items should be provided to support the request to conduct a risk assessment:

- Tabulated data compared to individual compound specific RCLs
- Statement confirming that meeting these RCLs is not practicable

* Requests for approval for PECFA, VPLE, and DOT projects are managed similarly to other review requests within these programs

Using the modified RCL spreadsheet requires pre-approval from the DNR

After the DNR grants approval, the RP may use the modified calculator to assess non-industrial direct contact risk. Provide the following items to demonstrate the use of the modified calculator as part of a site investigation report, a remedial action completion report, or other submittal provided to the DNR.

- Tabulated data compared to cumulative PAH threshold risk value
- Copies of modified RCL spreadsheet summaries
- Any charts and tables used to define a 'breakpoint' for large data sets

DNR will not accept results of the risk assessment if the spreadsheet has unauthorized modifications or if all applicable sample data was not entered.

Using the modified RCL spreadsheet requires pre-approval from the DNR

DNR will review request and approve, modify, or disapprove

- Approval is expected to be the typical response – risk assessment based on chemical properties, not site conditions.
- Meeting non-industrial RCLs for PAHs listed in the unmodified spreadsheet is generally considered to be impracticable.

Questions

- DNR Guidance Documents are available:
  - RR-079, “Risk Assessment Approach for Calculating cPAH Non-Industrial Direct Contact RCLs - Wis. Admin. § NR 722.11 (1)”
  - RR-087, “Calculating Soil RCLs for PAHs Wis. Admin. Code § NR 722.11 (1)”
  - RR-890, “Soil RCL Determinations Using the US EPA Regional Screening Level Web Calculator”
- DNR Contact Information:
  - Paul Grittner, paul.grittner@wisconsin.gov, (608) 266-0941
  - Resty Pelayo, aristeo.pelayo@wisconsin.gov, (608) 267-3539
  - David Swimm, david.swimm@wisconsin.gov, (608) 264-8766

Issues & Trends 2017

November 1, 2017
12:00 p.m.

TBA

Look for information soon on the *NEW* RR Report web site:
rr-report.blogs.govdelivery.com

Audio and information from today's presentation and future *Issues & Trends Series* events can be found on the RR Program Training Webpage at:
Http://dnr.wi.gov/topic/Brownfields/Training.html

Questions/Comments/Suggestions regarding the Issues & Trends Series can be submitted to:
DNRRRComments@wisconsin.gov

WISCONSIN DEPT. OF NATURAL RESOURCES

Environment · Cleanup · Redevelopment · Partnership
Remediation and Redevelopment