Revisions to Direct Contact RCLs for PAH Compounds in Soil

Collaborative effort with the Wisconsin Department of Health Services (DHS)

Current PAH Assessment Criteria:

- Determine RCLs using the default assumptions in NR720.12(3), or alternative assumptions specifically approved under NR 720.12(2)
- NR720.12(1) target excess cancer risk thresholds:

  $1X10^{-6}$ for individual compounds, and
  $1X10^{-5}$ for cumulative risk

DHS Observations:

- PAHs occur in soils as complex mixtures of compounds, so direct contact exposure is always to the mixtures
- Carcinogenic PAH compounds (cPAHs) share similar human health effects (i.e., similar modes of carcinogenic action)
- PAH compounds do not bio accumulate

DHS Feedback:

- cPAHs exposure is to the mixture, rather than individual compounds thus assessment of cumulative risk only is more representative and acceptable
- Limited to cPAHs; other carcinogenic contaminants would continue to be assessed on an individual and cumulative risk basis

Coming Changes from EPA:

Re-assessment of Benzo(a)pyrene toxicity completed with anticipated changes:

- Reduced toxicity - results in a 7.7 X higher RSL
- Anticipated BaP RCL change from 15 to 115 ug/kg for 10^{-6} individual compound excess cancer risk
- Adds new non-cancer risk for BaP

EPA's RSL calculator is the basis for DNR's RCL calculator. Updates to the RSL calculator are not yet available.

DHS Additional Feedback:

- Update DNR RR-890 RCL calculator to reflect changes in EPA risk assumptions regarding adult body size and exposure duration

Default Exposure Assumptions

NR 720.12(3) default exposure assumptions are no longer consistent with the EPA calculator defaults

- **Exposure duration** (residential adult)
- **Surface area exposed** (child & adult residential & adult occupational)
- **Body weight** (adult residential and occupational)
- **Skin Adherence Factor** (adult occupational only)

DHS recommends adopting EPA's values.

Comparison of Default Residential Exposure Values:

	Abbr.	Units	NR 720	EPA Calculator Default
Hazard Quotient	HQ	unitless	1	1
Target Risk	TR	unitless	1×10^{-6}	1×10^{-6}
Exposure Frequency-resident child	EF_{res-c}	d/yr	350	350
Exposure Duration-resident child	ED_{res-c}	yr	6	6
Exposure Duration-resident adult	ED_{res-a}	yr	24	20
Soil Ingestion Rate-resident child	IRS_{res-c}	mg/d	200	200
Soil Ingestion Rate-resident adult	IRS_{res-a}	mg/d	100	100
Particulate Emission Factor	PEF	m^3/kg	1.43E+09	1.56E+09
Volatile Exposure Rate	VF	m^3/kg	Contaminant specific.	Contaminant specific.
Exposure Time- resident	ET_{res}	hours/day	24	24
Surface Area Exposed-resident child	SA_{res-c}	cm^2	2,800	2,373
Surface Area Exposed-resident adult	SA_{res-a}	cm^2	5,700	6,032
Skin Adherence Factor-resident child	AF_{res-c}	mg/cm^2	0.2	0.2
Skin Adherence Factor-resident adult	AF_{res-a}	mg/cm^2	0.07	0.07
Body Weight- resident child	BW_{res-c}	kg	15	15
Body Weight- resident adult	BW_{res-a}	kg	70	80
Lifetime	LT	yrs	70	70

Default Exposure Assumptions

- Modifying the default exposure assumptions results in an increase in the Direct Contact RCL of about 10%.
- For B(a)P, the Non Industrial Direct Contact Standard is currently 15 ug/kg (ppb).
- Modification to the exposure assumptions will result in an increase in the standard to 16 ug/kg.

Proposed Changes to the RCL calculator:

- ✓ Assess seven of nine currently regulated cPAHs *exclusively* using half (5 X 10^{-6}) cumulative excess cancer risk threshold
  - Use current relative potency factors (RPFs)
  - No longer assess as individual compounds
- ✓ Two exceptions: Naphthalene and 1-Methylnaphthalene
  - No RPF; toxicology factors independent of B(a)p
- ✓ Update exposure assumptions to be consistent with EPA

Proposed Later Changes:

- ✓ Update RCLs to reflect new B(a)p toxicity when revised EPA RSL calculator is available

PAH Specific modifications:

- Applicable to DC pathway for carcinogenic PAHs
- Does not impact GW pathway for soluble PAHs
- Does not *effectively* change Hazard Index assessments (other than modifying the relative bioavailability)
- Does not alter carcinogenic risk calculations for non PAH contaminants:
  - ✓ Carcinogenic PAHs will exclusively be assessed on a cumulative basis
  - ✓ All other contaminants will still be assessed using the individual compound 10^{-6} threshold

Why not implement full 1 x 10^{-5} cumulative excess cancer risk at this time?

<u>Anticipated Future Factors</u>:

Additional cPAHs - some more potent than B(a)P - when regulated in the future will act to decrease the effective B(a)p threshold values

- More compounds with risks greater than B(a)P will effectively reduce the relative significance associated with currently regulated cPAHs

Proposal:

Set cPAH cumulative risk threshold $5X10^{-6}$ as opposed to full $1X10^{-5}$ cumulative risk threshold

- Mitigate effects of any newly regulated cPAHs
- Use for future adjustments to the RCL calculator
- Continue to use full $1X10^{-5}$ threshold to assess overall cumulative Cancer Risk for all carcinogenic contaminants combined

Comparison to Background Threshold Value

- BTVs for PAHs not developed for Wisconsin at this time
- BTVs for PAHs in soil are primarily attributable to atmospheric deposition
- Background Threshold Values (BTVs) for cPAHs are anticipated to be less than standards with proposed RCL calculation methods

Relative Effects:

Updated exposure assumptions

<10% increase for individual compound B(a)p and Db(ah)a RCL thresholds

15ug/kg to 16 ug/kg

Exclusive 5 X 10^{-6} cumulative risk for seven cPAHs

Depending on relative PAH mixture, approx. 4 fold increase in effective B(a)p concentrations over the 1 X 10^{-6} individual B(a)p threshold

16 ug/kg to 65 ug/kg

Relative Effects:

<u>5 X 10^{-6} cumulative risk for cPAHs using **new RSLs**</u>

Depending on relative PAH mixture, approx. 6 fold increase in effective B(a)p concentrations over the 5 X 10^{-6} cumulative B(a)P threshold

65 ug/kg to 375 ug/kg

<u>1 X10^{-6} individual compound excess cancer risk threshold with New RSLs</u>

7 fold increase for individual compound B(a)p RCL threshold

15 ug/kg to 115 ug/kg

For sites with ***moderate levels*** of PAH contamination relative to direct contact risk (i.e., carcinogenic risk for individual compounds slightly > 10^{-6} excess cancer risk):

Suggested revisions result in significant change in remedial assessment/requirements

For sites with ***elevated levels*** of PAH contamination relative to direct contact risk (i.e., carcinogenic risk for individual compounds significantly > 10^{-6} excess cancer risk):

Suggested revisions result in only modest to slight changes to remedial assessment/requirements

Data Review Summary: DC/Non-Industrial, CR Only, Shallowest Soils

	NR 720 Soil Calculator (current)			
n		> 10-6 individual	% exceed	threshold B(a)p conc. (ug/kg)
16	Site 1	16	100%	15
13	Site 2	13	100%	15
20	Site 3	20	100%	15
41	Site 4	20	49%	15
58	Site 5	35	60%	15
53	Site 6	42	79%	15
41	Site 7	40	98%	15
49	Site 8	39	80%	15

Data Review Summary: DC/Non-Industrial, CR Only, Shallowest Soils

		With Updated EPA Assumptions & Exclusive Cumulative CR					
n		> 10-6 individual	% exceed	threshold B(a)p conc.(ug/kg)	Est. > 5 X 10-6 cumulative	% exceed	Est. eff. B(a)p conc. (ug/kg)
16	Site 1	16	100%	16	11	69%	110
13	Site 2	13	100%	16	8	62%	57
20	Site 3	20	100%	16	18	90%	66
41	Site 4	20	49%	16	4	10%	58
58	Site 5	35	60%	16	26	45%	58
53	Site 6	42	79%	16	24	45%	60
41	Site 7	40	98%	16	33	80%	58
49	Site 8	38	78%	16	31	63%	61

Data Review Summary: DC/Non-Industrial, CR Only, Shallowest Soils

		With New B(a)p Toxicity & Exclusive Cumulative CR					
n		> 10-6 individual	% exceed	threshold B(a)p conc.(ug/kg)	Est. > 5 X 10-6 cumulative	% exceed	Est. eff. B(a)p conc. (ug/kg)
16	Site 1	10	63%	115	4	25%	350
13	Site 2	4	31%	115	0	0%	402
20	Site 3	16	80%	115	7	35%	385
41	Site 4	1	2%	115	0	0%	350
58	Site 5	20	34%	115	14	24%	391
53	Site 6	11	21%	115	1	2%	334
41	Site 7	21	51%	115	12	29%	374
49	Site 8	27	55%	115	20	41%	391

Summary of Practical RCL Implications:

Change to *exclusive* $5X10^{-6}$ cumulative threshold for seven cPAHs:

- Immediate changes to RCL calculator will increase effective B(a)p values approximately 4 fold
- Together with anticipated EPA changes, will increase effective B(a)p values approximately 1.25 orders of magnitude
- Together will significantly reduce the number of samples exceeding PAH risk screening levels at sites with low/modest contamination
- Using only half the cumulative risk capacity at this time will retain the ability to effect future RCL adjusts (i.e., additional and/or more potent regulated compounds, or risk pathway re-assessments)

PAH Risk Assessment Short Form