Derivation of Preliminary Remediation Goals (PRGs)

1) Newtown Creek contains contaminated sediments that are related to unacceptable risks to invertebrates, fish, birds and mammals, including humans
2) Newtown Creek sediments qualify for federal regulatory action to reduce or eliminate the unacceptable risk and hazards
3) Non-aqueous phase liquids are present that serve as an additional source of contamination to Newtown Creek

Does everyone agree with this basic premise?

PRESENTATION TO COMMUNITY ADVISORY GROUP

SEPTEMBER 27, 2023

ABBY DEBOFSKY AND CHUCK NACE, USEPA REGION 2

Typical Sediment Remedial Technologies

Technologies

Dredge sediments, dewater, ship off site

Cap contaminated sediments with clean(er) fill, reactive barrier, etc. – mechanical or natural

Solidify sediments in place

Combination of above

All work well, all are valid – site-specific attributes may impact selection

There are pros and cons with everything

Remedial Area Identified by Remediation Goals

Bank to bank – RG identification of footprint less relevant because all is treated

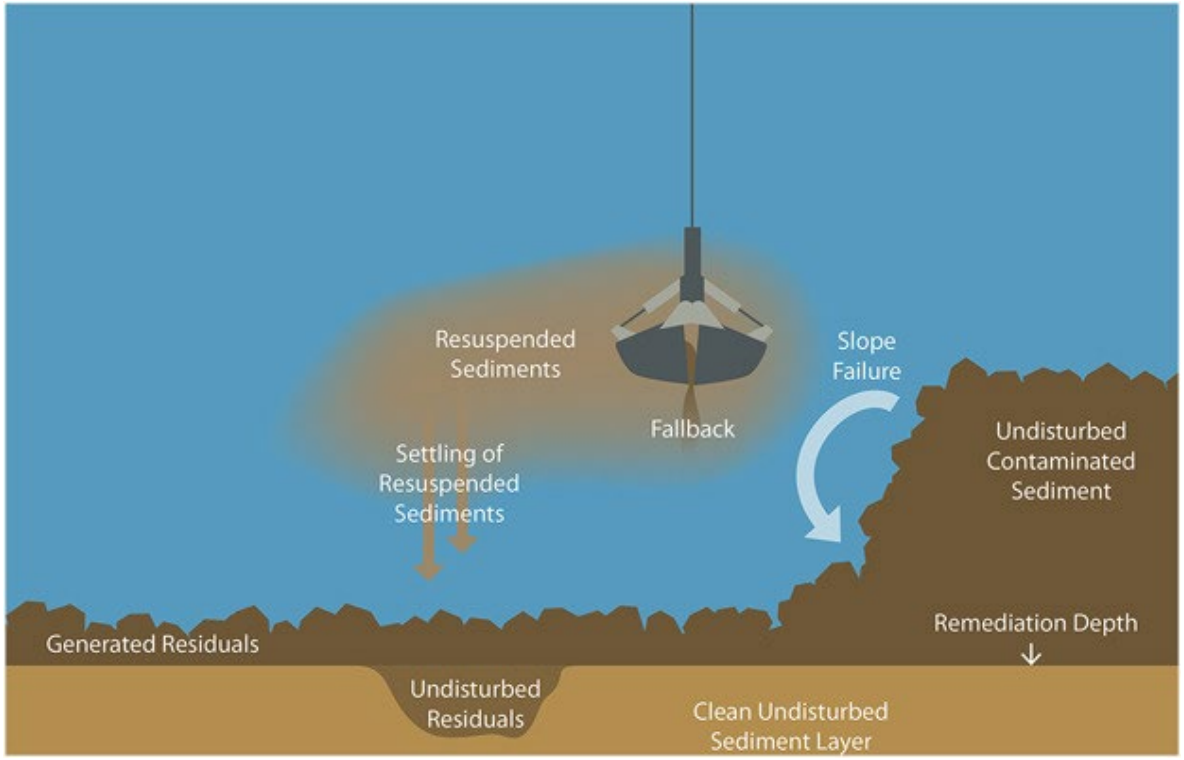
Hot spot – RG identification of footprint less relevant because concentrations are orders of magnitude greater

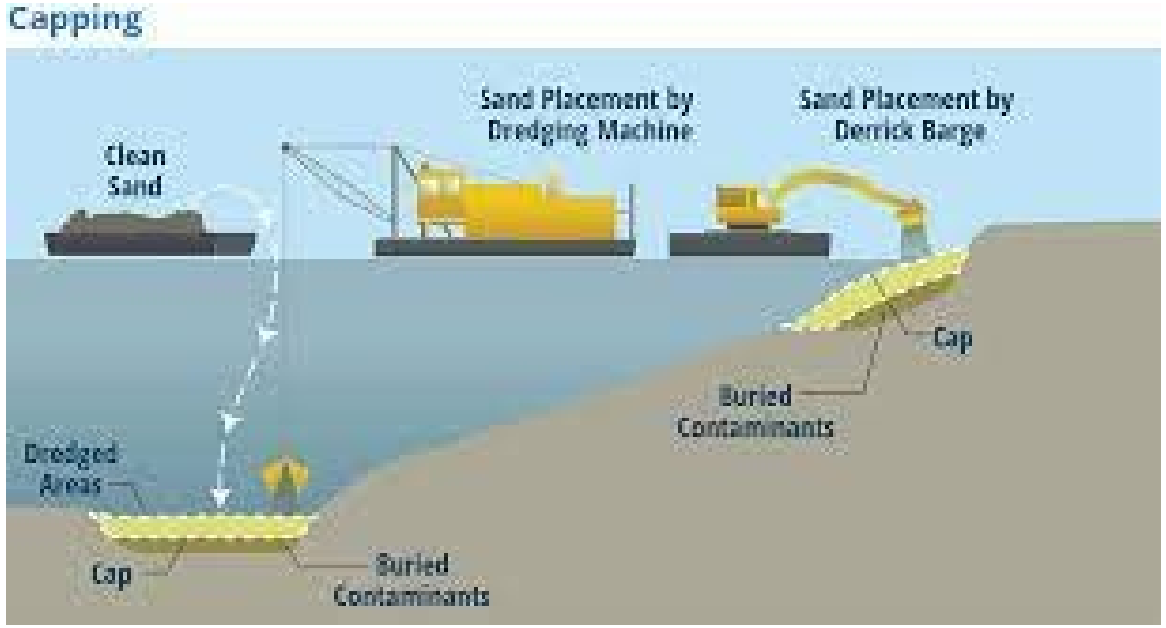
Depositional Areas – RG identification of footprint less relevant because area defined by physical attribute, not concentration

Source Areas – RG identification of footprint less relevant because sources are much higher than other areas

Surgical dredging – RG identification of footprint relevant because small areas are being addressed in a focused action

Typical Sediment Remedial Technologies





Note graphics are generic depictions of sediment dredging and capping

Three Types of PRGS

Risk-Based – values derived based on EPA acceptable risk/hazard values

- Human health – cancer risk of 10^{-6} to 10^{-4} or non-cancer hazard index of 1
- Ecological – hazard index of 1, site-derived toxicity value, other measurement endpoint methods

Regulatory – values derived on a variety of methods (e.g., risk, regulations). Derivation not always transparent. Typically promulgated through State governmental process – known as To be Considered (TBC) and Applicable or Relevant and Appropriate Requirements (ARARs)

Background – values calculated using a statistical method to estimate the concentration of compounds with limited or without influence from the contaminated site.

All three type of PRGs are usually identified in the Feasibility Study phase of the Superfund process and evaluated alongside the potential remedial alternatives to determine the most appropriate value to use

Selected PRGs are discussed in the Proposed Plan, which presents the EPA preferred remedy for the site, and are sometimes called RGs at this time

PRGs become Remediation Goals (RG) during the development of the Record of Decision (ROD)

Remediation goals are memorialized as cleanup goals when the ROD is signed

All numbers have variability

Rounding

- Significant figures – generally EPA rounds to one significant figure, but not always
- Example 145 would be 100; 165 would be 200
- Computer plotting software
  - Programming may vary output of formulas due to internal settings
- Medical science often uses similar approach 10, 20, 50 mg/kg, not 12, 22, or 48 mg/kg for medicinal doses

Precision/Accuracy

- Large underwater area being moved or covered using a backhoe bucket to achieve a certain footprint
- Grid or transect approach assumes homogeneity
- Footprints mapped out in feet or inches, dredge bucket is larger
- +/- errors in footprint
- Measurement of residuals will vary due to variability in analytical methods
- Averages across areas

Factors Impacting Site-Specificity

Site conditions, such as bioavailability, organic carbon, pH, sediment type

Regulatory authority – federal, state, county

Risk assessment results – receptor populations and compounds identified as being of concern

Example – Speed Limits

Highways in US have speed limits ranging from 50 mph up to 80 mph – all are deemed safe for the particular area

Road geometry (curves, straights, hills, population centers) is important – posted limit not transparent to this process

Local, State and Federal jurisdiction may dictate different values for areas that seem similar

Most are rounded to fives/tens

Human Health Risk Assessment Conclusions

Contaminants contributing the most to human health risks include polychlorinated biphenyls (PCBs) and dioxins due to the consumption of fish and blue crabs from Newtown Creek. Regional Maximum Exposure (RME) fish and blue crab consumption result in a lifetime excess cancer risk that exceeds the U.S. EPA acceptable excess cancer risk range of 10^{-4} to 10^{-6}. Noncancer hazards above the U.S. EPA threshold (HI of 1) were also associated with consuming fish and blue crabs from Newtown Creek.

For all other recreational receptors, the cancer risks are below or within U.S. EPA's acceptable risk range and noncancer hazards are below the hazard threshold. The general construction worker was the only occupational receptor with noncancer hazards above the hazard threshold. Cancer risks for the general construction worker were within U.S. EPA's acceptable risk range.

Unacceptable cancer risks and non-cancer hazards provides regulatory ability to pursue a remedial action

Baseline Ecological Risk Assessment (BERA) Conclusions

Locations: Turning Basin, English Kills, Maspeth Creek, East Branch, Dutch Kills are primary areas of elevated risk, with less impact in Creek Miles 0-2

Compounds: Primarily PAHs and PCBs, with additional contributions of copper, lead and dioxin (2,3,7,8-TCDD)

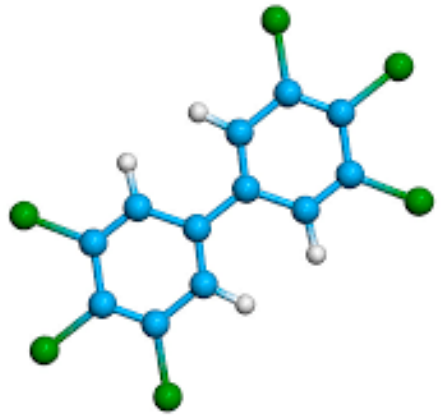
Next Steps: Results of BERA, HHRA and RI will be used to develop the Feasibility Study, which will identify remedial alternatives to address risk associated with areas and compounds listed above.

Preliminary Risk-Based Remediation Goals (PRGs)

Contaminant of Concern	Risk-Based PRGs	Receptor(s) with Unacceptable Risk	Pathway Driving Risk	Most Sensitive Pathway
PCBs	0.30 mg/kg	Humans Birds	Fish/crab consumption	Crab consumption
Dioxin/Furan	18 ng/kg	Humans	Fish/crab consumption	Crab consumption
Copper	490 mg/kg	Mummichog – spotted sandpiper	Diet – fish	Mummichog
Lead	340 mg/kg	Spotted sandpiper	Diet – bird	Spotted sandpiper
TPAH(34)	100 mg/kg	Benthic fish and macroinvertebrates	Sediment toxicity – macroinvertebrates	Benthic macroinvertebrates
C19-C36 aliphatic hydrocarbons	200 mg/kg	Benthic fish and macroinvertebrates	Sediment toxicity – macroinvertebrates	Benthic macroinvertebrates

*Applicable or Relevant and Appropriate (ARAR), To Be Considered (TBCs) and background values are not included at this time in the process.

PCBs and Dioxin Risk-Based PRG



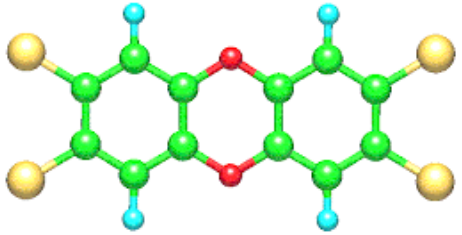
PCBs: 0.3 mg/kg

Based on human health risk assessment (blue crab consumption most sensitive endpoint)

Exposure point concentration of sediment is 5.9 mg/kg = hazard quotient of 20 (1 is acceptable)

5.9 mg/kg divided by 20 = 0.295 mg/kg, rounded to 0.3 mg/kg

Mathematical formula based on toxicological information and rounded to one significant figure



Dioxin: 18 ng/kg

Based on human health risk assessment (blue crab consumption most sensitive endpoint)

Exposure point concentration in sediment is 140 ng/kg = hazard quotient of 8 (1 is acceptable)

140 ng/kg divided by 8 = 17.5 ng/kg, rounded to 18 ng/kg

Mathematical formula based on toxicological information and rounded to one significant figure

Other PRGs for PCBs/Dioxin

Newtown Creek value is **0.30 mg/kg**

Passaic River 8-mile – **0.05 mg/kg** based on fish consumption – difference in fish consumption rate 26 g/day vs. 34.6 g/day; **0.46 mg/kg** based on background

Passaic River Upper 9-mile - **0.46 mg/kg** based on background

Gowanus Canal – **0.48 mg/kg** for fish/crab ingestion

Newtown Creek value is **18 ng/kg**

Passaic River 8-mile **– 8.3 ng/kg** – difference in fish consumption rate 26 g/day vs. 34.6 g/day

Passaic River Upper 9-mile – **85 ng/kg** SWAC

Copper and Lead Risk-Based PRG

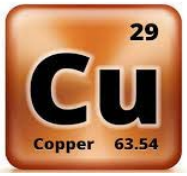
Copper: 490 mg/kg

Based on ecological risk assessment (mummichog exposure most sensitive endpoint)

Used the same dietary formulas in the BERA to back-calculate sediment concentration associated with a hazard index of 1

Similar to human health but more complicated; known maximum copper value in mummichog tissue and acceptable hazard index of 1

- Back calculated a sediment value that when paired with polychaete ingestion rate provides a value of 1
- Resulted in 490 mg/kg, no rounding performed



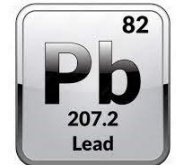
Lead: 340 mg/kg

Based on ecological risk assessment (spotted sandpiper exposure most sensitive endpoint)

Used the same dietary formulas in the BERA to back-calculate sediment concentration associated with a hazard index of 1

Similar to human health but more complicated; known maximum lead values in polychaetes and acceptable hazard index of 1

- Back calculated a sediment value that when paired with polychaete ingestion rate provides a value of 1
- Resulted in 336 mg/kg rounded to 340 mg/kg



Copper PRGs from EPA Sediment Sites

Site Note Newtown is 490 mg/kg	Copper PRG
Callahan Mining Corp (R1)	790 ppm (sediment)
Newport Naval Education/Training Center (R1)	0.053 ppm (porewater)
Gowanus Canal (R2)	80 ppm (sediment) – maximum non-toxic reference*
American Brass, Inc. (R4)	220 ppm (sediment)
Copper Basin Mining District (R4)	640 ppm (sediment)
Silver Bow Creek/Butte Area (R8)	1000 ppm (sediment) – ESD revision to 31.6 ppm
Commencement Bay - ASARCO (R10)	390 ppm (sediment)
Commencement Bay – Sitcum Waterway (R10)	1100 ppm (action level) – 390 ppm (cleanup level)
Commencement Bay – Middle Waterway (R10)	470 ppm (action level) – 390 ppm (cleanup level)
Harbor Island (R10)	390 ppm (action and cleanup level)
Harbor Island – Todd Shipyard (R10)	390 ppm (action and cleanup level)
Lockheed West (R10)	114 ppm (sediment)
Old Navy Dump (R10)	390 ppm (sediment)

Lead

Newtown Creek value is **340 mg/kg**

Gowanus – **94 mg/kg**, based on maximum non-toxic reference samples – from ROD, lead value will not be enforced unless additional information indicates it is toxic – *ROD states: Based on measured concentrations in sediment, copper and lead were identified as the metals most likely associated with adverse effects. However, geochemical analyses (i.e., SEM/AVS) indicate that these metals currently are minimally bioavailable and should not cause toxicity. However, metals may become bioavailable in the future if geochemical conditions in the canal change and do not favor the formation of insoluble sulfides. Therefore, PRGs for copper and lead are necessary in the event that metals become bioavailable and toxic in the future. The maximum Gowanus Bay and Upper New York Bay concentrations for the reference stations that showed no toxicity were selected as the PRGs for copper and lead

NL Industries – **500 mg/kg**, based on modeling for belted kingfisher, recalculated as part of a five-year review provided a range of 92-565 mg/kg as protective for spotted sandpiper (NOAEL-LOAEL) and concluded that the value of 500 mg/kg would be protective for spotted sandpipers too since it fell with calculated range.

18-Mile Creek – **400 mg/kg**, based on human health

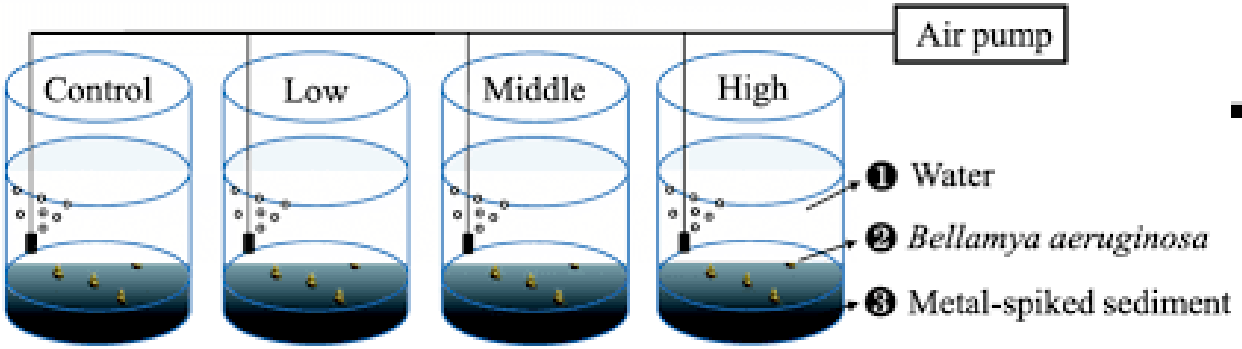
Toxicity Testing Result Evaluation

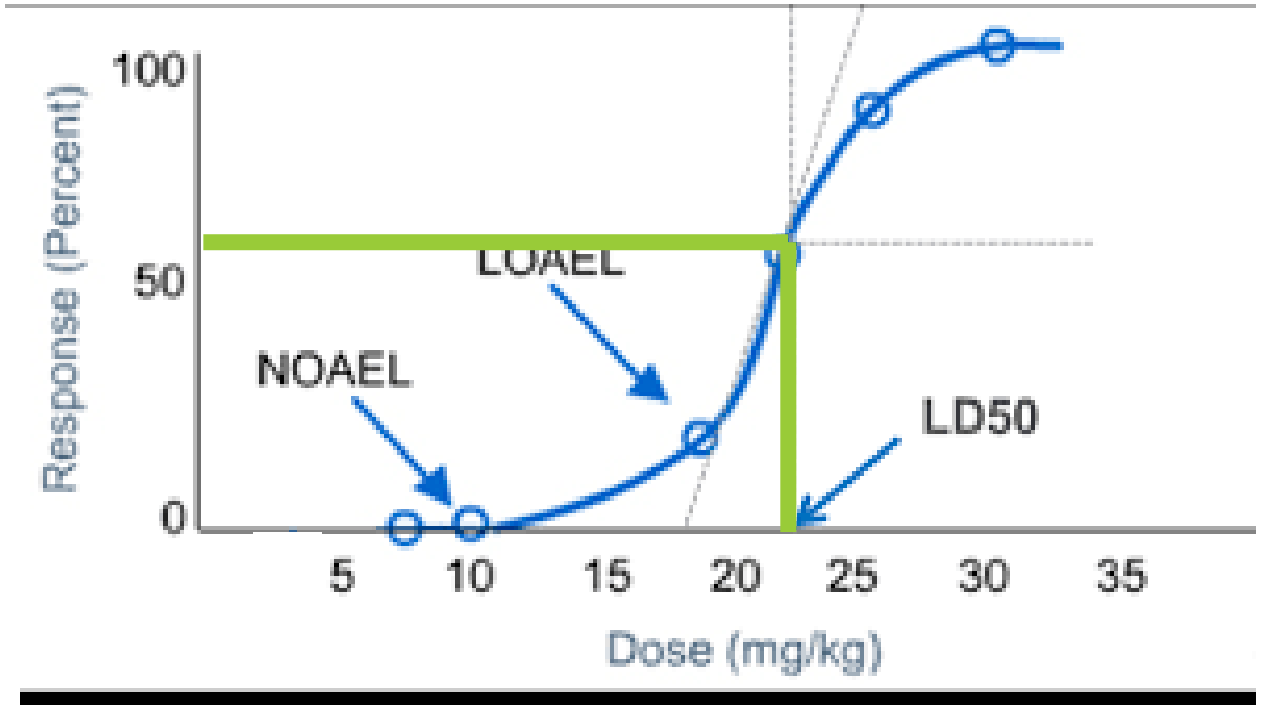
Expose test subjects to various concentrations of contaminant – site sediment provides variability

Measure response (growth, reproduction, survival)

Plot response versus concentration

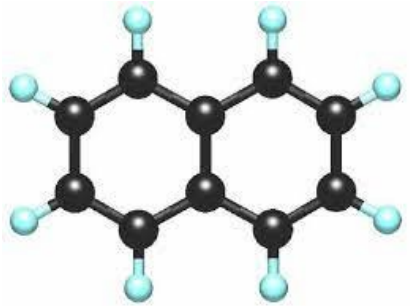
Chose acceptable response rate, draw horizontal line, then draw vertical line where horizontal line crosses the curve

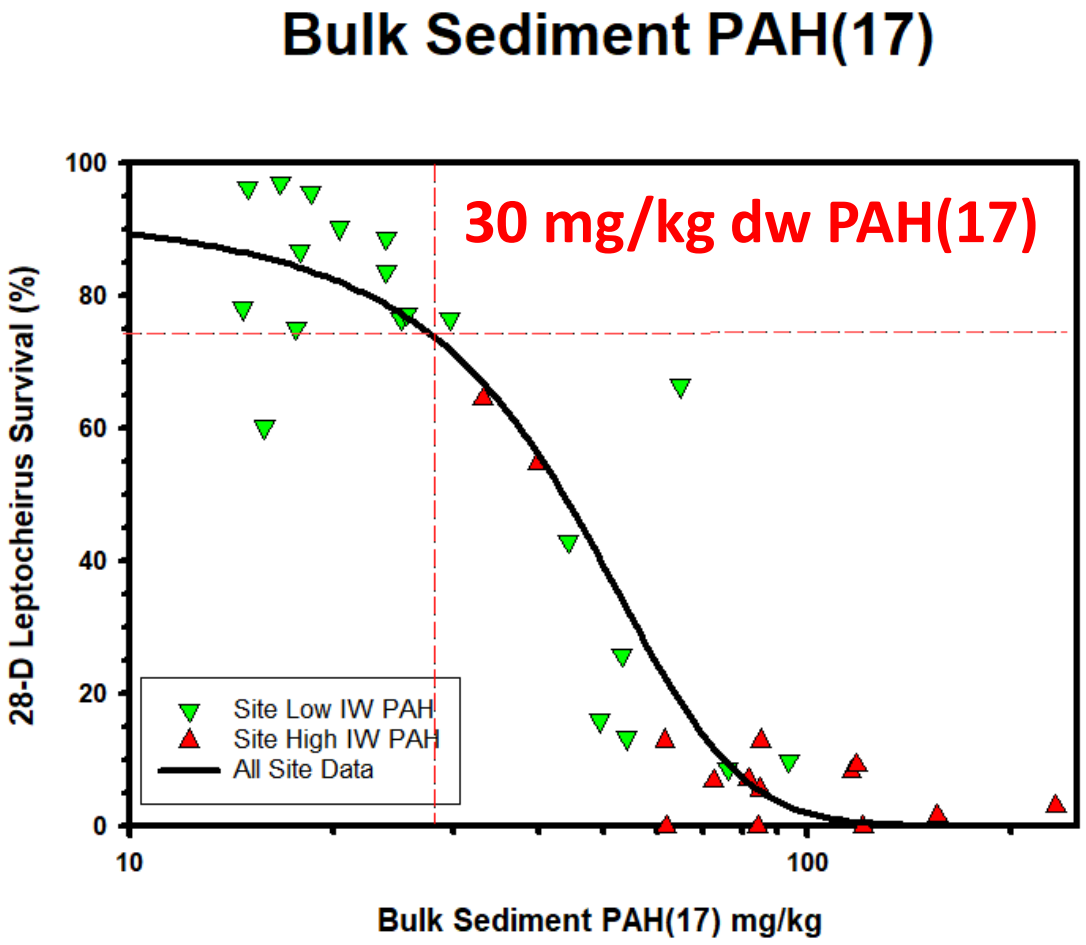


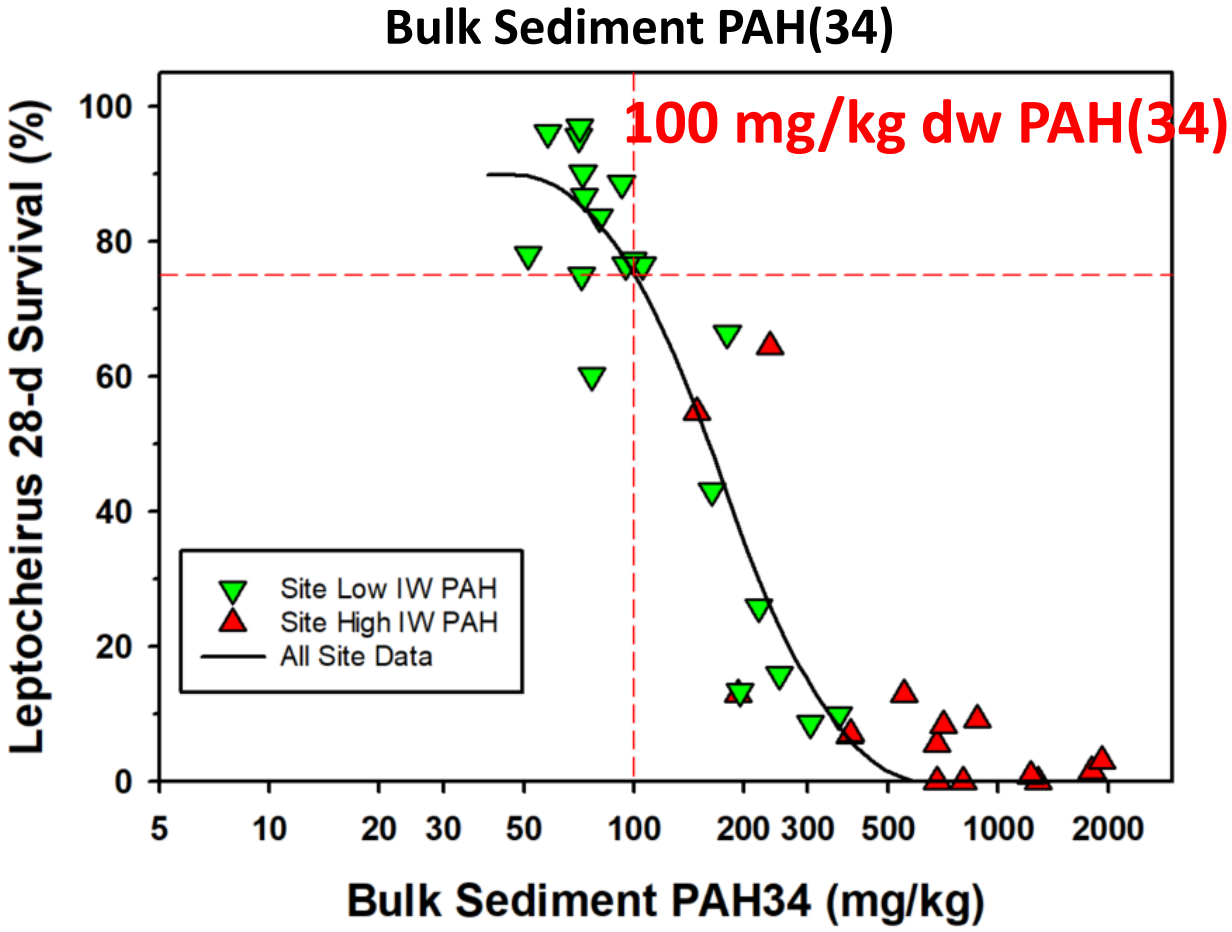


NOAEL – No observed adverse effect level
LOAEL – Lowest observed adverse effect level
LD50 – Lethal Dose for 50% of population

PAH Risk-Based PRG

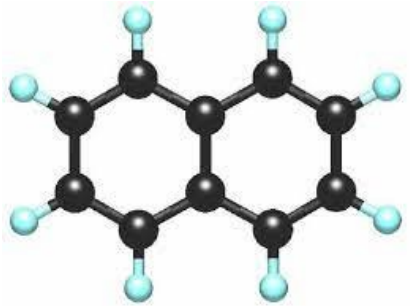


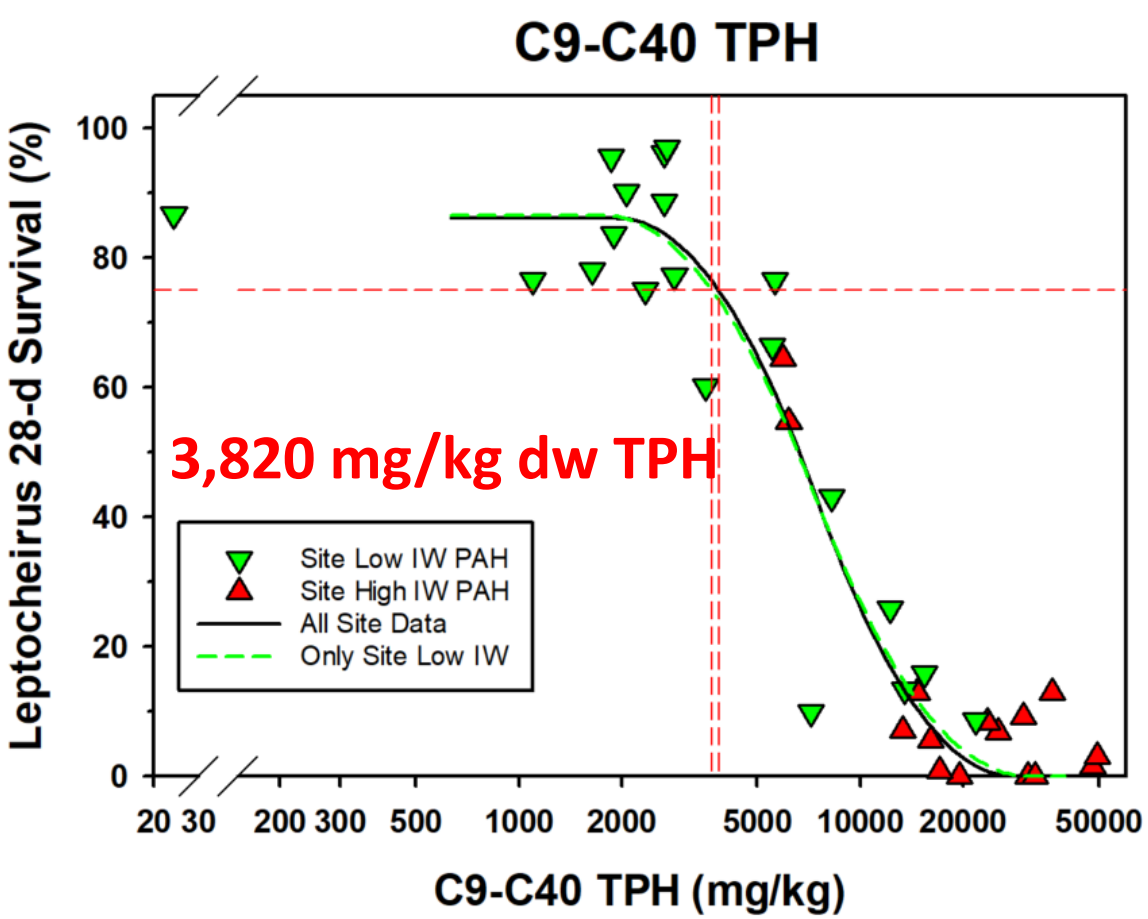


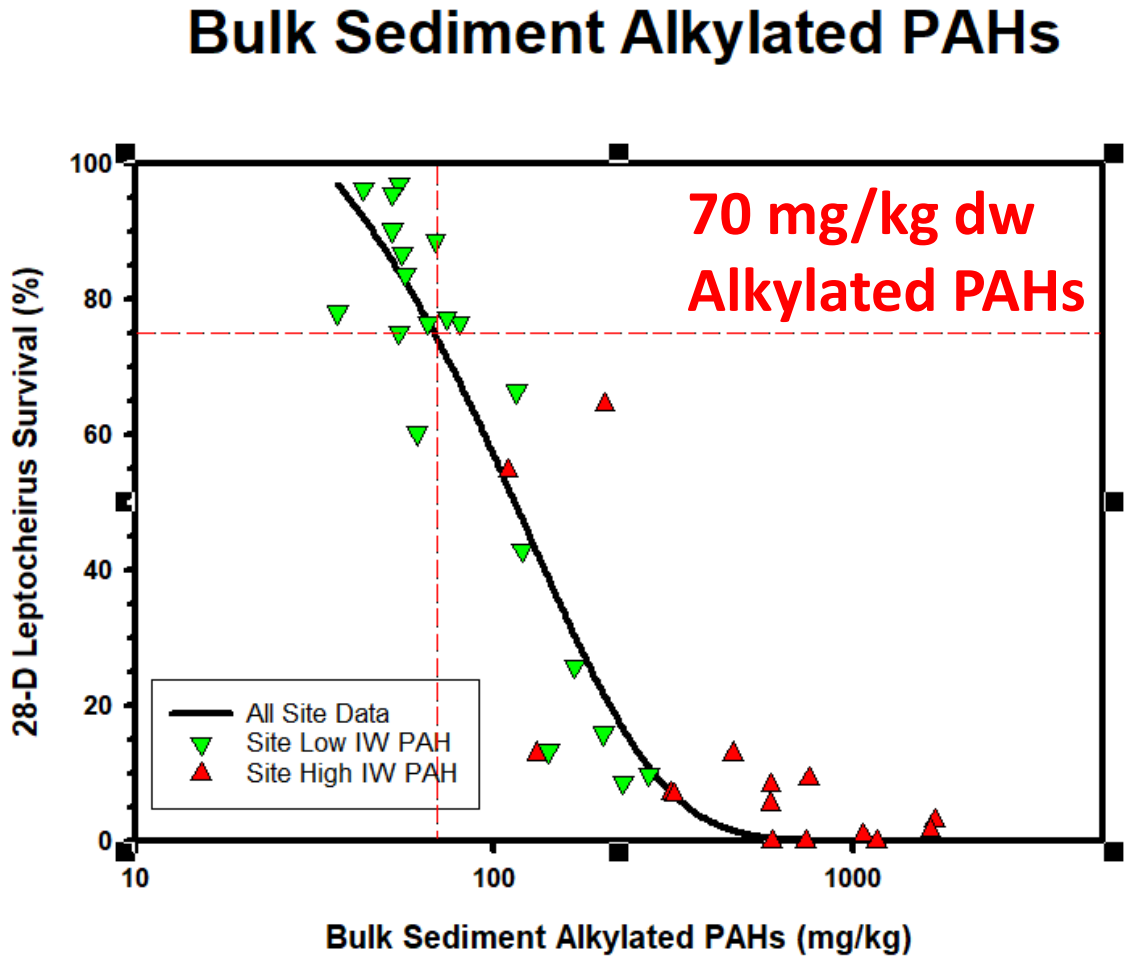


Concentration associated with 75% Survival Rate, rounded to one significant figure

PAH Risk-Based PRG

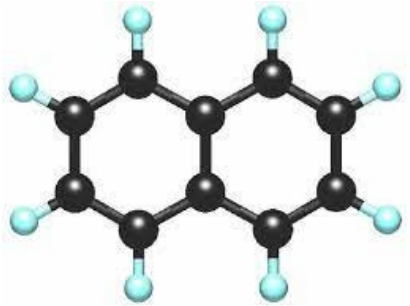


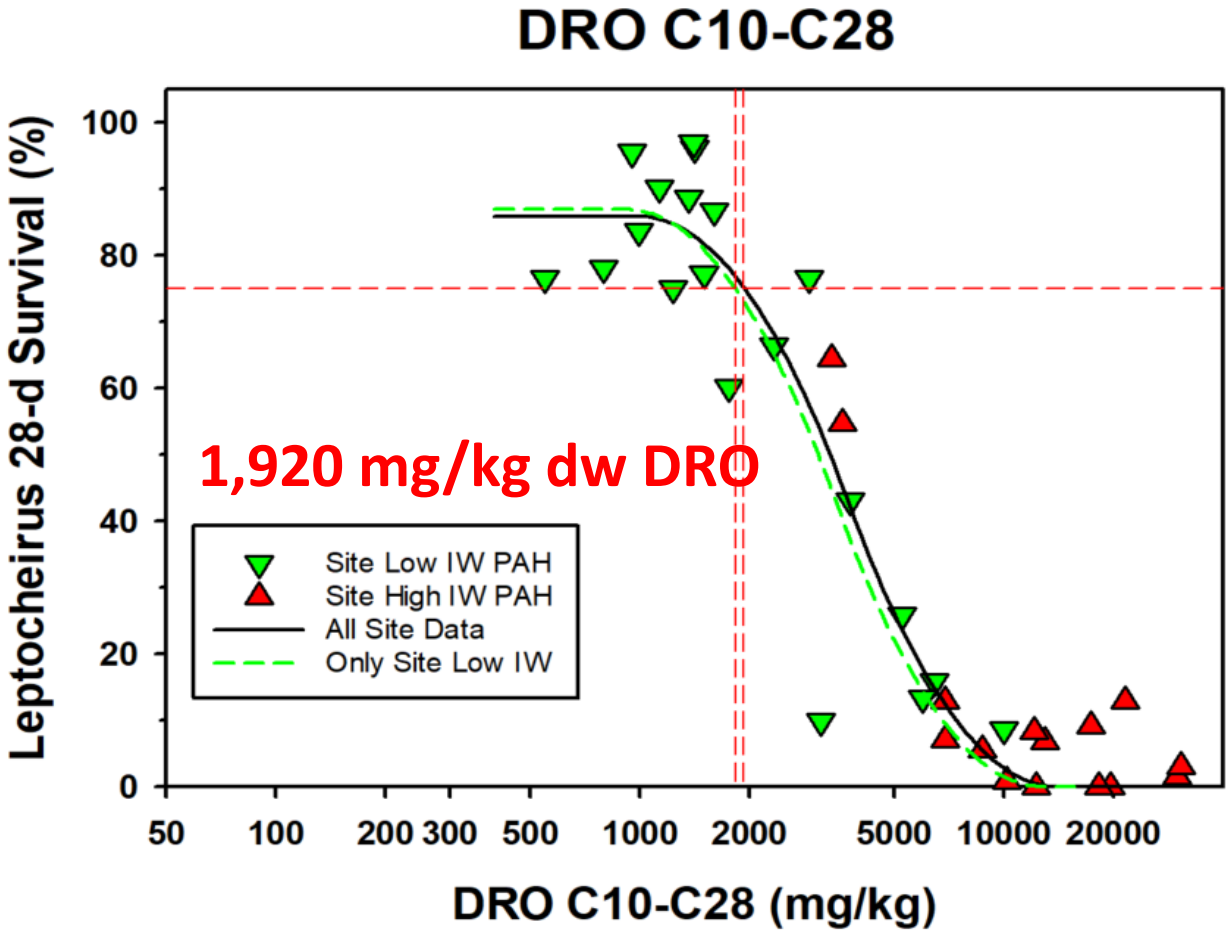


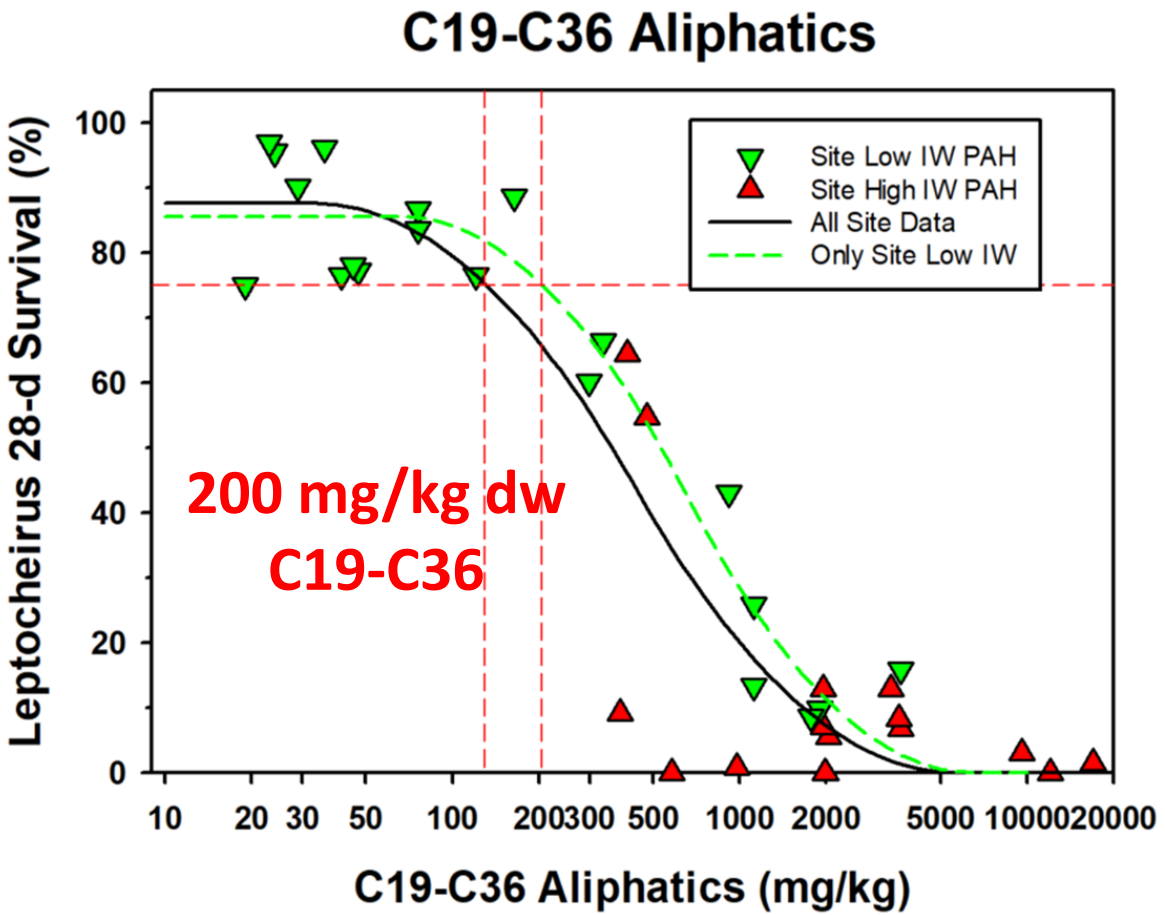


Concentration associated with 75% Survival Rate, rounded to three or one significant figure

PAH Risk-Based PRG







Concentration associated with 75% Survival Rate, rounded to three or one significant figure

Summary Hydrocarbon PRGs

Bulk sediment hydrocarbon concentrations correlated better with toxicity than did OC-normalized bulk sediment or porewater concentrations:

C9-C40 TPH Interim PRG= 3,820 mg/kg

C10-C28 DRO Interim PRG= 1,920 mg/kg

C19-C36 Interim PRG= 200 mg/kg

PAH(34) Interim PRG= 100 mg/kg

PAH(17) Interim PRG= 30 mg/kg *(compared to NCG value of 76 mg/kg)*

Alkylated PAHs Interim PRG = 70 mg/kg

Other PRGs for PAHs

Newtown Creek PAH(17) value is **30 mg/kg**

Gowanus – total PAHs, measured as PAH(17), **20 mg/kg**; derived from sediment toxicity studies using geometric mean of NOAEL and LOAEL values – 24 mg/kg, rounded down to 20 mg/kg

- Newtown Creek (28 mg/kg rounded up to **30 mg/kg**) basically equal to Gowanus in cleanup terms

Quanta – total PAHs, measured as PAH(17), **72 mg/kg**; derived from serial dilution sediment toxicity studies

Questions?