

Focused Testing to Resolve Causes of Sediment Toxicity for Ecological Risk Assessment at a Complex Urban Waterway V ANCHOR QEA ::::

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Newtown Creek

- Urban waterway
- Tidal tributary to East River with five deadend branch tributaries
- No natural freshwater flow
- Freshwater flow contributed by CSOs, stormwater and industrial outfalls, and groundwater





BERA-Related Sediment Toxicity Testing

- Survival, growth, and reproduction of amphipods in Study Area and reference areas
- Bulk sediment chemistry analyses
- Direct measures of bioavailability
 - Porewater
 - Metals, PAHs, pesticides, PCBs
 - Bulk sediment
 - AVS and SEM
- Toxicity in some locations not well correlated with bioavailable fraction of chemicals in porewater



28-Day Survival Tests: High Toxicity and Low Porewater Exposure Station Locations





Focused Study – Surface Sediment Sampling Stations





Focused Tests to Investigate Causes of Toxicity

- 10-day sediment bioassays—two amphipod species having different sensitivities to different stressors
 - Ampelisca abdita
 - Leptocheirus plumulosus
- Run bioassays with and without pre-treatment
- Include analyses of factors potentially causing low survival of benthic invertebrates near CSOs/MS4s
 - Porewater measurements
 - Ammonia and sulfide
 - PAHs and metals
 - Pharmaceuticals and personal care products
 - Observations of physical fouling of test organisms



Bioassay Observations – % Survival After 10 Days

	Bulk Sediment (10-Day)					
	Ampeliso	Ampelisca abdita		Leptocheirus plumulosus		
Location	Without Pre- Treatment	With Pre- Treatment	Without Pre- Treatment	With Pre- Treatment		
Lab Control	85	81	98	86		
EK	0	0	0	0		
EB	0	7	20	43		
DK	0	12	26	53		
MC	1	17	32	53		
NC	10	54	65	81		

- Summary of basic observations
 - Species: Lp exhibits greater survival than Aa
 - Treatments: survival greater in tests with pre-treatment compared to without pre-treatment
 - Locations: NC survival greater than MC, DK, EB, which are greater than EK



Concentrations and Toxic Units for Key Sediment and Porewater Chemicals by Location

Sample Type	Location	TPAH (34)	C19-C36 Aliphatics Unadjusted	SEM/AVS Ratio
Sediment (mg/kg)	EK059SG	2,700	3,800	0.12
	EB036SG	290	1,200	0.059
	DK040SG	180	650	0.040
	MC017SG	1,100	3,000	0.051
	NC065SG	110	660	0.049

Sample Type	Location	TPAH (34)	Bisphenol-A	Nonylphenol	4-tert- Octylphenol	Sum SEM TU
Porewater (TUs)	EK059SG	18	210	560	68	8.9
	EB036SG	1.2	6.1	11	1.1	4.2
	DK040SG	1.1	4.9	5.2	0.41	1.2
	MC017SG	1.5	17	170	4.3	6.7
	NC065SG	0.96	3.5	1.2	0.40	5.6



Bulk Sediment Tests and Selected Analytes

10-Day Survival





Comparison of Porewater Ammonia and Sulfide in *Ampelisca abdita* With and Without Pre-Treatment







Comparison of Porewater Ammonia and Sulfide in *Leptocheirus plumulosus* With and Without Pre-Treatment







Fouling Observations

- Fouling observations conducted during tests with and without pre-treatment
- Replicates sacrificed on days 1, 2, and 4 to observe and photograph fouling of organisms
- Fouling categorized as
 - Body plate fouling
 - Gill fouling
 - Antennae fouling
 - Dark spots/blackened
- Fouling metric developed for preliminary analysis:

 $\frac{Max(all fouling observations)}{No. burrowing + no. on surface on that day}$





Newtown Creek Sediment Toxicity Tests: Day 1 Fouling of Leptocheirus plumulosus and Ampelisca abdita at Station EK059



Observations – Fouling Metric



- Fouling correlated with C19-C36 aliphatics
- Maximum and minimum fouling associated with minimum and maximum survival



Conclusions

- For samples collected close to CSOs and MS4s, stressors other than CERCLA hazardous substances contribute to toxicity
- Other possible stressors
 - High TOC leading to porewater sulfide concentrations above threshold
 - Porewater pharmaceutical and personal care product concentrations above thresholds
 - Bisphenol-A, Nonylphenol, 4-tert-Octylphenol
 - Elevated unresolved complex hydrocarbon mixtures leading to physical fouling



Questions/Discussion

