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ASSOCIATIONS OF POLYCYCLIC AROMATIC **HYDROCARBONS (PAHS) WITH SIZE** FRACTIONATED SEDIMENT PARTICLES

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Sediment Sample Collection and Analyses

- Sampling Location 1: Cribbs Mill Creek
- Major Contributing Source Areas: Residential Area ٠
- Samples were collected at the end of a concrete channel



Introduction

- Non-point sources are major contributors of PAHs to the environment (US EPA 2000)
- PAHs predominantly associate with solids (low solubility and are hydrophobic)
- Adsorption on particulate matter is the main transport and fate mechanism of PAHs in the environment
- Understanding the distribution of contaminants with particle sizes is needed for effective and economical treatment of PAHs in runoff
- · Contributing source areas affect the magnitude of PAH concentrations with particles (USGS 2003)

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Sediment Sample Collection and Analyses

- Sampling Location 2: Hunter Creek
- Major Contributing Source Areas: Commercial (especially, Auto Service Area next to the sampling location), Road Runoff, Residential Trailer Park Areas



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Sediment Sample Collection and Analyses

- Sampling Location 3: Carroll's Creek
- Major Contributing Source Areas: Residential and Commercial areas
- Had past history of sanitary sewage contamination from SSOs



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• For all cases, the particles in the size range of 180 to 355 µm were dominant in the sediments. Overall, most of the particles were distributed in the size range of 90 to 710 µm.



Sediment Sample Collection and Analyses Different particle sizes (< 45µm to >2800µm) of each creek sediment sample were analyzed separately for PAH contamination

- Large Organic Material (LOM) were separated from >2800 um size fraction for separate analyses
- All size fractions were analyzed for Material Composition and Chemical Oxygen Demand (COD)
- Sediments were analyzed for PAHs by Thermal Desorption (TD) extraction followed by Gas Chromotoraphy – Mass Spectroscopy (GC-MS) detection



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Chemical Oxygen Demand

- For all cases, sediment CODs showed similar distribution
- The COD values of the >2800µm (LOM only) was 1.3 to 1.6E09 mg/kg
- Median particle size based on COD was about 355µm for three creeks



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Effects of	Particle Siz	zes and I	Location of	on PAH Concentrations	,
One-Way ANOVA o	f PAH Conce	ntrations b	y Particles	Cluster Analyses	
РАН	Cribbs Mill Creek	Hunter Creek	Carroll's Creek	Cluster analyses of analyte concentrations showed that >	
Naphthalene	0.324	0.000	0.000	2800µm (LOM only) fractions	
Fluorene	0.000	0.000	0.000	were separated as a single group distinct from the other	
Phenanthrene	0.000	0.000	0.000	size categories at the 75th	PAF
Anthracene	0.000	0.000	0.000	percent similarity level for	RTIC
Fluoranthrene	0.000	0.000	0.000	most PAH compounds for	LES
Pyrene	0.000	0.000	0.000	most sites	
Benzo(a)anthracene	0.000	0.000	0.000	Benzo(a)anthracene	
Chrysene	0.000	0.001	0.000	2 54.12-	
Benzo(b)flouranthrene	0.000	0.011	0.000	5 5 5 706-	
Benzo(a)pyrene	0.039	0.060	0.000		
Indeno(1,2,3-cd)pyrene	0.002	0.437	0.000	100.00	
Dibenz(a,h)anthracene	0.024	0.010	0.000	Observations	
Benzo(ghi)perylene	0.004	0.118	0.565		

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DALL	P Value			
PAH	Size	Location	Size*Location	
Naphthalene	0	0.088	0.116	
Fluorene	0	0.721	0.481	
Phenanthrene	0	0.389	0.043	
Anthracene	0	0.032	0.821	
Fluranthene	0	0	0	
Pyrene	0	0	0	
Benzo(a)anthracene	0	0.005	0.002	
Chrysene	0	0.004	0	
Benzo(b)flouranthrene	0	0.002	0.254	
Benzo(a)pyrene	0.004	0.032	0.022	
Indeno(1,2,3-cd)pyrene	0	0.284	0.25	
Dibenz(a,h)anthracene	0	0.019	0.002	
Benzo(ghi)perylene	0	0.041	Geosynte 0.493 consulta	



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Effect of Land Use on PAH Pollution

Probability Plots and One-Way ANOVA were used to compare the PAH concentrations at all three sites

Size Range (µm)	Cribbs Mill Creek	Hunter Creek	Carroll's Creek
< 45	Phenathrene (Low), Benzo(ghi)perylene (High)	Fluoranthrene (High), Pyrene (High) Benzo(a)anthracene (High), Chrysene (High), Benzo(a)pyrene (High),	Pyrene (Low), Benzo(a)anthracene (Low), Benzo(b)flouranthrene (Low),
45 - 90	Phenathrene (Low)	Fluorene (High), Fluoranthrene (High), Pyrene (High), Benzo(a)anthracene (High), Chrysene (High), Benzo(b)flouranthrene (High)	Benzo(a)anthracene (Low),
90-180	None	Naphthalene (Low), Fluoranthrene (High), Pyrene (High)	Anthracene (Low), Fluoranthrene (Low)
180 - 355	None	Fluoranthrene (High)	None
355 - 710	None	Fluoranthrene (High)	None
710 - 1400	None	None	Fluoranthrene (Low)
1400 - 2800	None	None	Fluoranthrene (Low)
> 2800 (w/o LOM)	None	None	None
> 2800 (LOM only)	None	None	None

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Conclusions

•The highest PAH concentrations were associated with stream sediment samples that had the highest organic content

•Most of the mass of the PAHs were associated with the intermediate particle sizes $(90 - 710\mu m)$ in the stream sediments which were in the greatest abundance, even though their PAH concentrations were the lowest

•The site with the highest concentrations of most of the PAHs in the stream sediments was affected by obvious hydrocarbon contamination from adjacent commercial automobile service facilities

• The one year since the SSO contamination, and bed erosion material possibly diluting the sediments at Carroll's Creek, likely resulted in those samples being less contaminated compared to the other creek locations

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