

Assessment of Health Risks Associated with Sediments and Water in Bear Creek off Sparrows Point

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What do we mean by “risk”?

- Risk is the likelihood of an adverse effect or outcome.
- For human health we consider
 - Potential for systemic health effects (non-cancer)
 - Potential cancer risks

To evaluate risk, we need to consider both potential for effects (hazard) and exposure

Risk assessment for chemicals involves evaluating the likelihood that adverse effects may occur or are occurring as a result of exposure to one or more chemicals

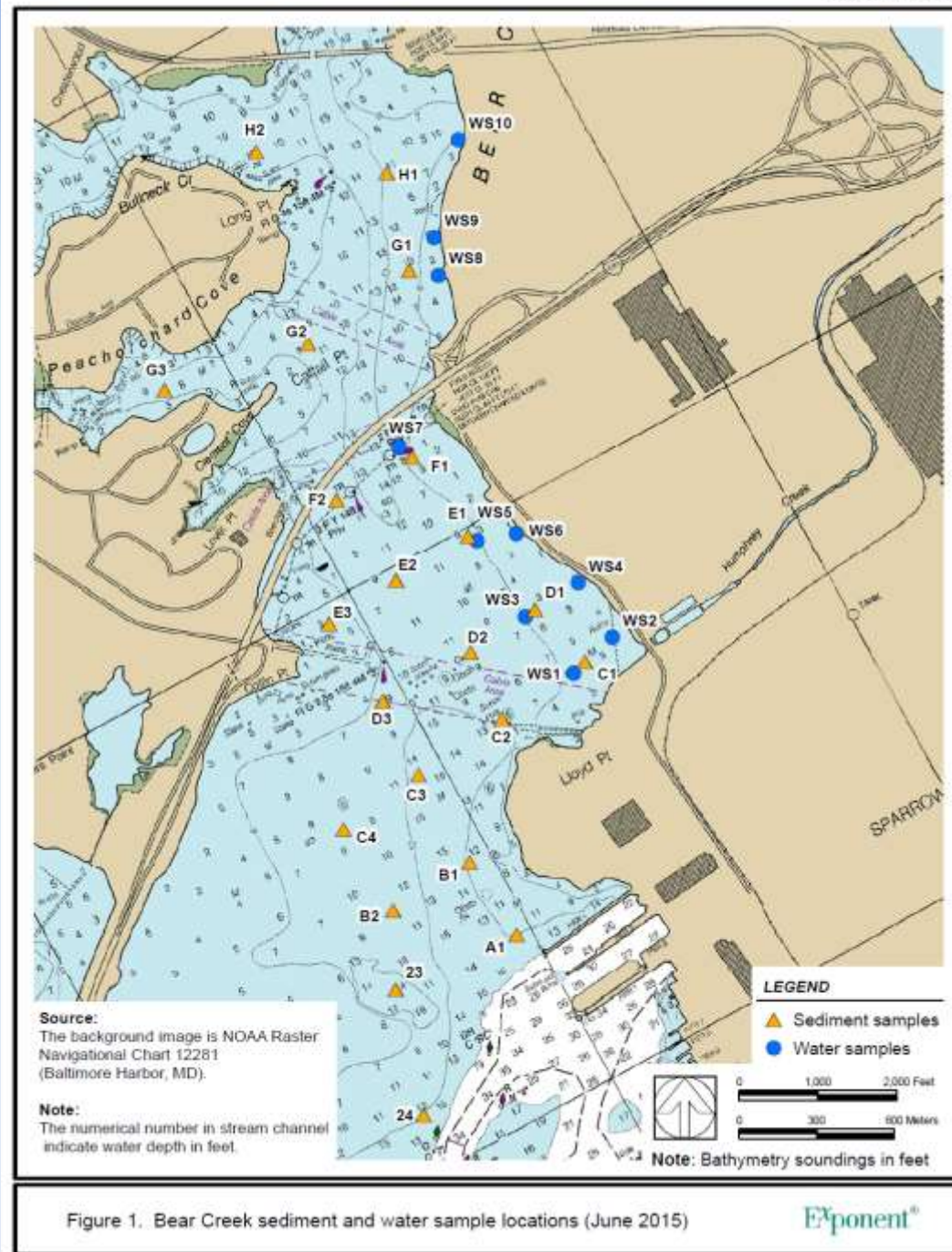
How did we assess risks associated with chemicals in sediments?

- For the exposure part:
 - We obtained data on the concentrations of metals such as zinc and chromium at 23 sediment sampling locations
 - We obtained data on organic chemicals such as PCBs and PAHs at 10 sampling locations
- For the potential hazard part
 - We compiled risk-based “screening levels” for these chemicals

How did we assess risks associated with chemicals in sediments?

- We then compared the measured concentrations to the screening levels
- If a concentration exceeded a screening level, then that occurrence was considered indicative of a potential for risk;
 - however, we need also consider the likelihood of contact
- Also evaluated the concentrations in light of what we know about concentrations that may generate regulatory remedial actions with respect to human health concerns

Where samples were collected for CBF in June 2015



Screening levels included

- **Regional Screening Levels from U.S. EPA.** These values reflect the concentration of a chemical in environmental media that would be associated with an excess theoretical cancer risk of one in a million (10^{-6}), or a hazard index of 0.1 for non-cancer endpoints of toxicity.
- **Site-Specific Screening Levels.** Two sets of site-specific screening values were used:
 - Site-specific screening levels calculated in the “Phase I Area, Sparrows Point Offshore Investigation,”
 - Site-specific screening values derived from the risk assessment performed by EA Engineering for Coke Point
 - *Differences included exposure of children under age 6 and amount of skin for watermen*

An example of a table that compares concentrations to screening values.

Table 5a. Comparison of metal results in sediment to Sparrow's Point and Coke Point cancer screening levels (mg/kg) for dermal exposure in adults

Sample ID		Adult screening levels		U.S. EPA RSLs		A1	B1	B2	C1*	C1* dup	C2	C3	C4	D1*	D1* dup
		Sparrows Pt	Coke Pt	Residential	Industrial										
Moisture	wet/dry					2.7	2.8	2.3	2.0	2.0	3.0	2.5	2.1	2.5	2.5
Arsenic	ug/g dry wt	248	153	0.68	3.0	30.3	44.7	55.6	26.5	24.3	33.6	27.3	62.1	50.8	50.7
Cadmium	ug/g dry wt	NA	NA	NA	NA	4.9	13.2	2.5	5.2	4.9	6.9	5.3	4.8	9.2	9.4
Chromium	ug/g dry wt	NA	NA	NA	NA	601.2	1720.9	856.7	3649.9	2742.2	1240.3	720.3	799.8	2414.2	2957.1
Copper	ug/g dry wt	NA	NA	NA	NA	144.3	343.4	114.0	224.7	201.2	176.6	139.6	186.7	208.7	248.6
Lead	ug/g dry wt	NA	NA	NA	NA	146.5	383.7	259.4	96.8	95.4	188.8	175.4	485.0	187.4	262.5
Nickel	ug/g dry wt	NA	NA	NA	NA	62.4	69.2	37.1	134.7	120.7	76.1	59.3	43.5	115.8	120.7
Vanadium	ug/g dry wt	--	NA	NA	NA	188.0	241.0	246.9	538.3	501.9	239.1	191.9	225.5	245.0	289.7
Zinc	ug/g dry wt	NA	NA	NA	NA	705.8	2000.9	986.2	1328.1	1503.8	1655.3	983.3	1378.7	2088.6	2501.2

What did we learn for metals?

- Exposures can result mainly from direct contact with sediments. The frequency of contact would also be important.
- The metals concentrations in sediments reflect an area that has been affected by metals deposition. These sediments have metal concentrations that are higher than ambient conditions reported in prior evaluations.
- Arsenic is most noteworthy as sediment concentrations exceed the EPA screening level values for all exposure groups. However, the concentrations of arsenic do not exceed the site-specific screening levels developed for Sparrow Point or Coke Point.
- A few other metals exceeded their respective screening levels.

What did we learn for Polycyclic Aromatic Hydrocarbons (PAHs)?

- Exposures could occur as a result of direct contact and/or ingestion of surface water and sediments.
- For surface water there were very few exceedances of screening values and these were only slight and did not seem to correspond to the site.
- For sediments, there were four individual chemicals that exceeded EPA residential screening level values for cancer endpoints, but do not exceed either EPA's screening levels for industrial land use nor the site-specific screening values developed for Sparrows Point or Coke.

What did we learn for PCBs?

- Exposures could result from direct contact and eating fish that have accumulated PCBs.
- Because the health-based screening levels for PCBs are low, all locations exceeded the level.
- PCB concentrations were present in all sediments but were generally less than 1 part per million (ppm), a value that usually does not usually trigger a sediment remediation but may trigger an evaluation of sources to sediments.
- The highest PCB concentration – 1.09 mg/kg – was located at nearshore location D1.
- A fish consumption advisory is in place for PCBs in all of Baltimore Harbor.

Summary

- The concentrations in sediments do indicate an area where contamination has deposited
- Human health risk screening levels related to direct contact are exceeded for some metals and organic compounds
- In general these exceedances are low and presume the occurrence of regular direct contact of sediments by people
- Arsenic is notable among the metals
- PCBs exceed health screening levels but the concentrations are generally less than 1 ppm (mg/kg); a health advisory is currently place for all Baltimore Harbor/Patapsco River with respect to fish consumption.