

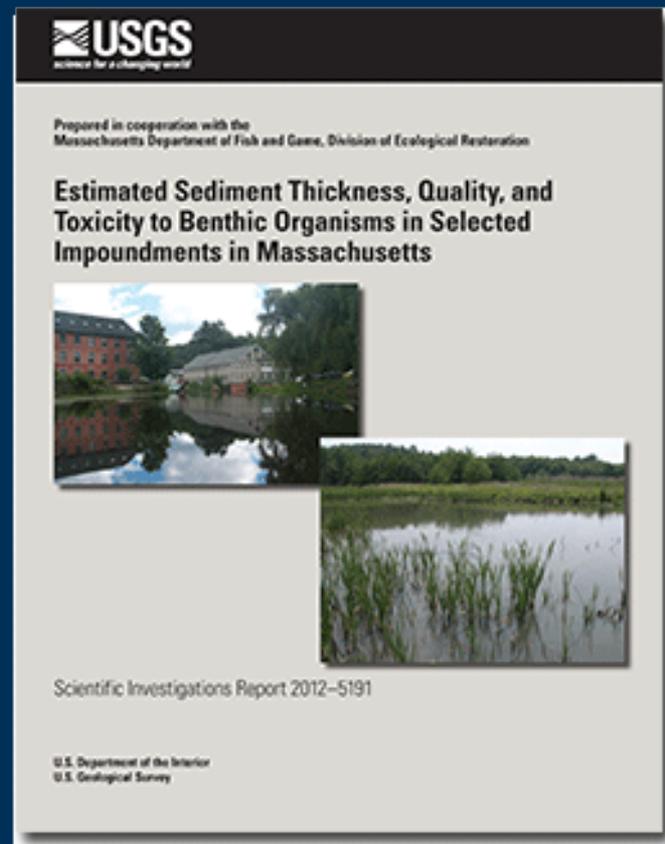
Sediment thickness, quality, and estimated toxicity in selected Massachusetts Impoundments

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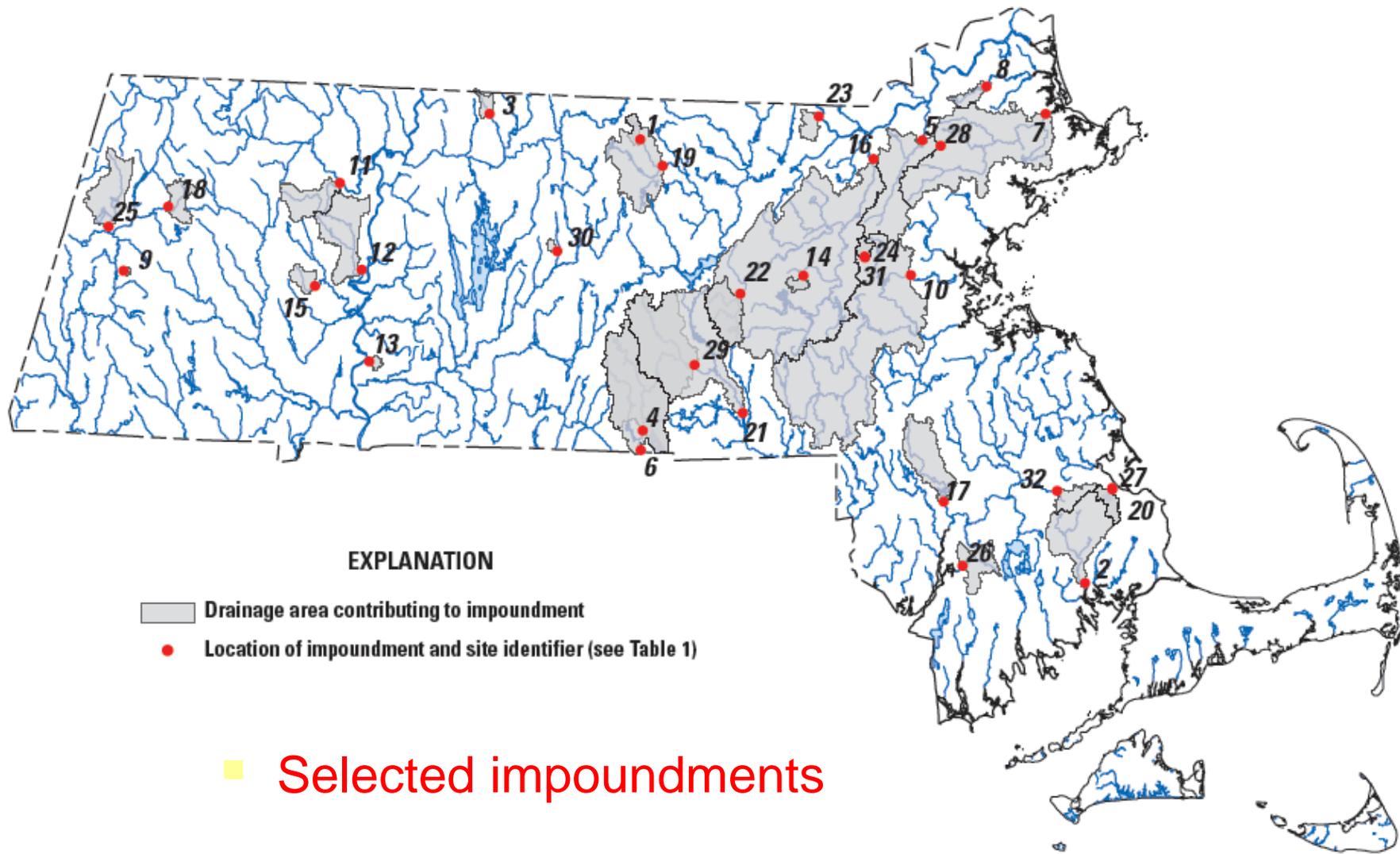
In cooperation with:

*Mass. Dept. of Fish & Game,
Division of Ecological Restoration*



Project Background, Objectives

- Removal of obsolete dams can have ecological, public-safety, and economic benefits. However, mobilization of impounded sediment contaminants may pose a risk to humans and biota.
- Objectives—
 - Characterize impounded sediment thickness, volume, and chemistry behind a selected set of 32 dams representing a range of MA land uses and geographic settings.
 - Relate bottom sediment chemistry and estimated toxicity to land-use variables, to assist in prioritization of future removal projects.



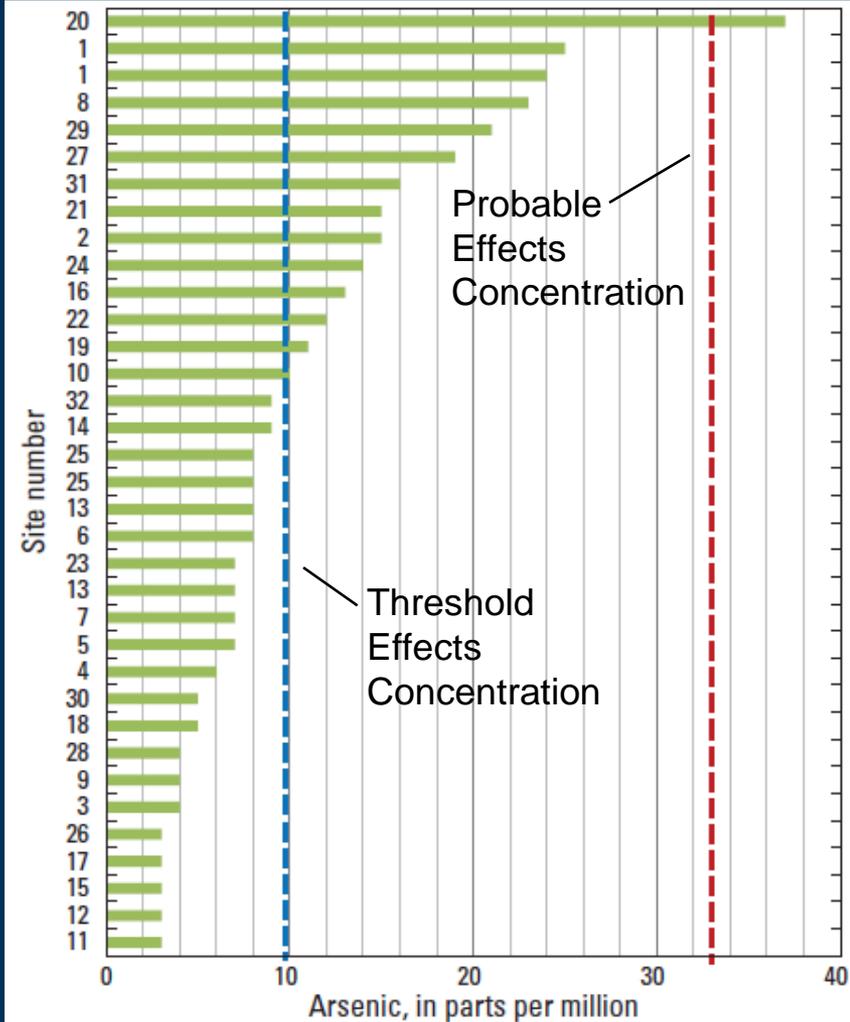
Base from U.S. Geological Survey digital data, 1:25:000, 1991
 Lambert conformal conic projection. NAD 83

Sediment thickness measurement and coring:

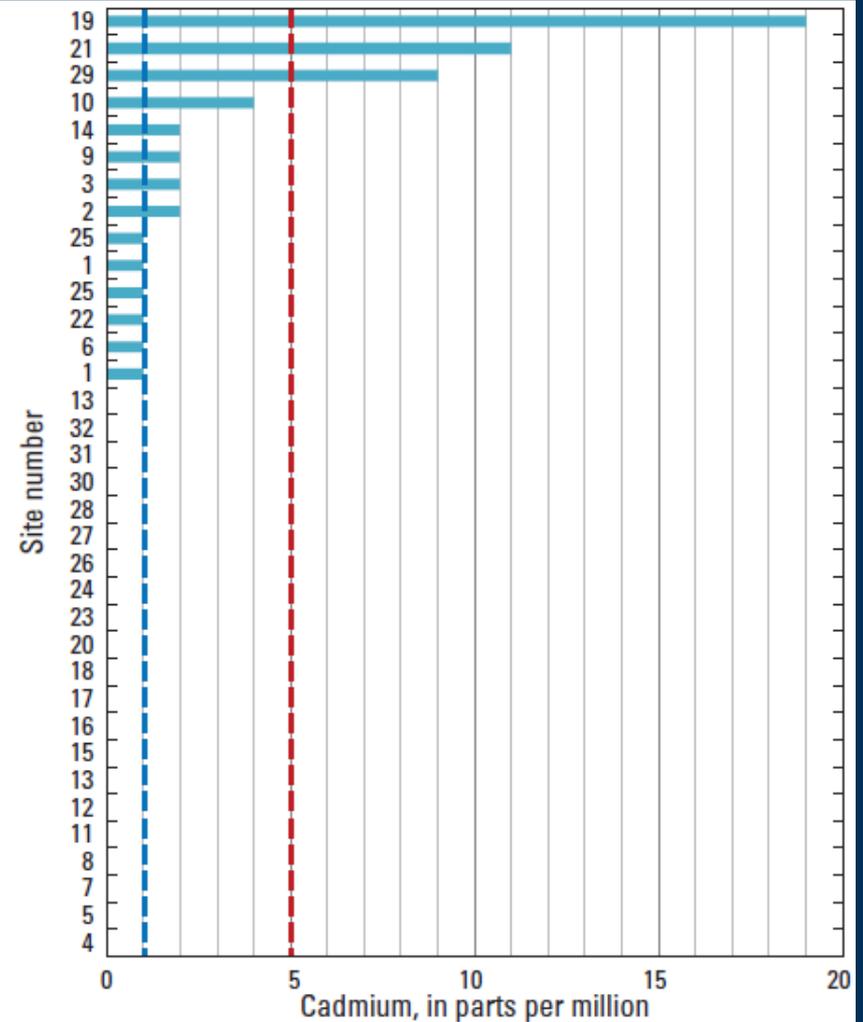


Inorganic element concentrations

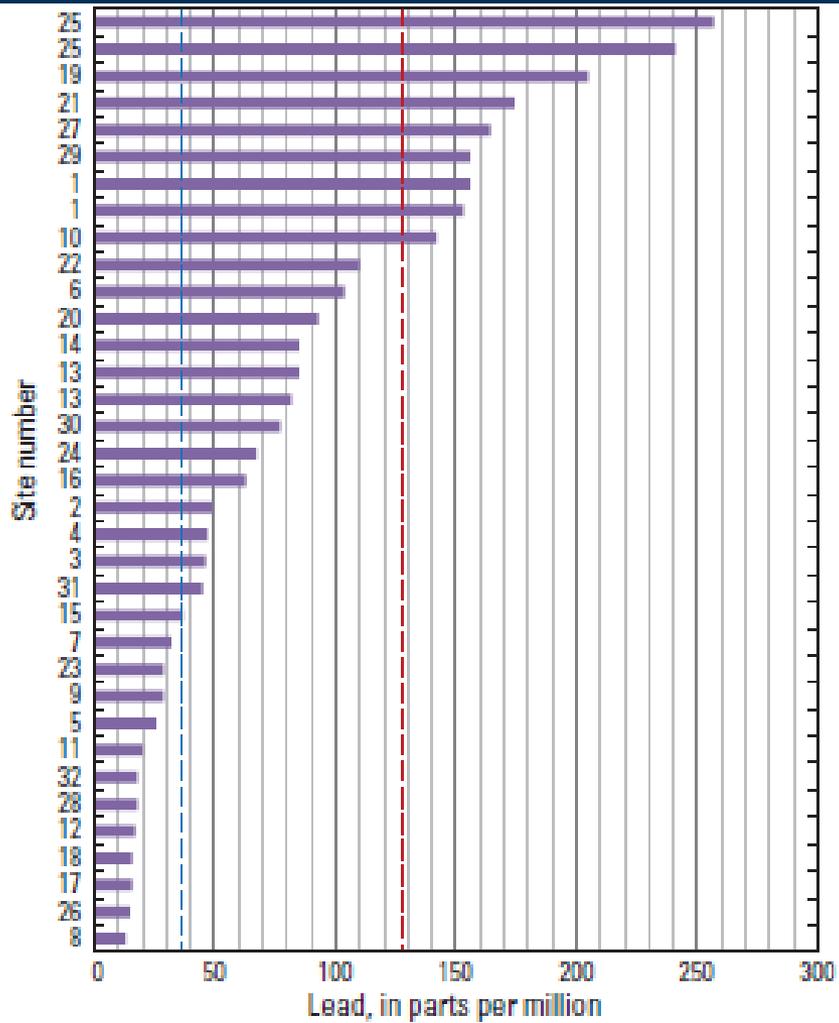
Arsenic



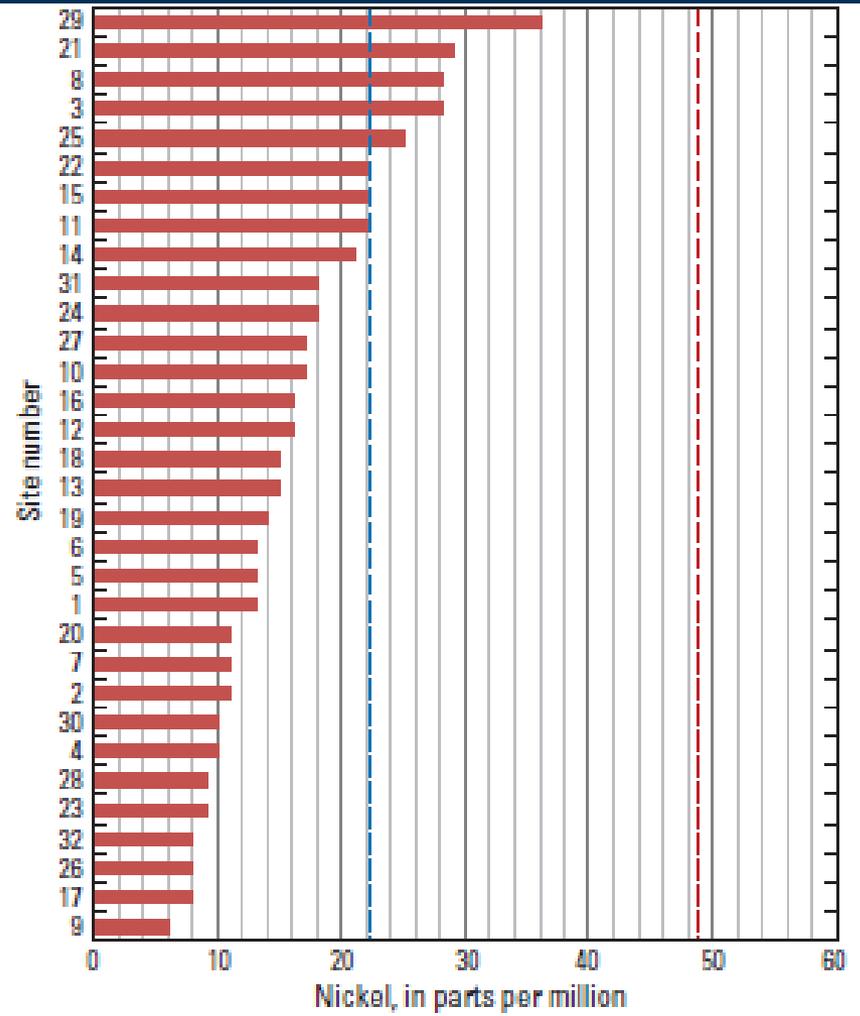
Cadmium



Lead



Nickel

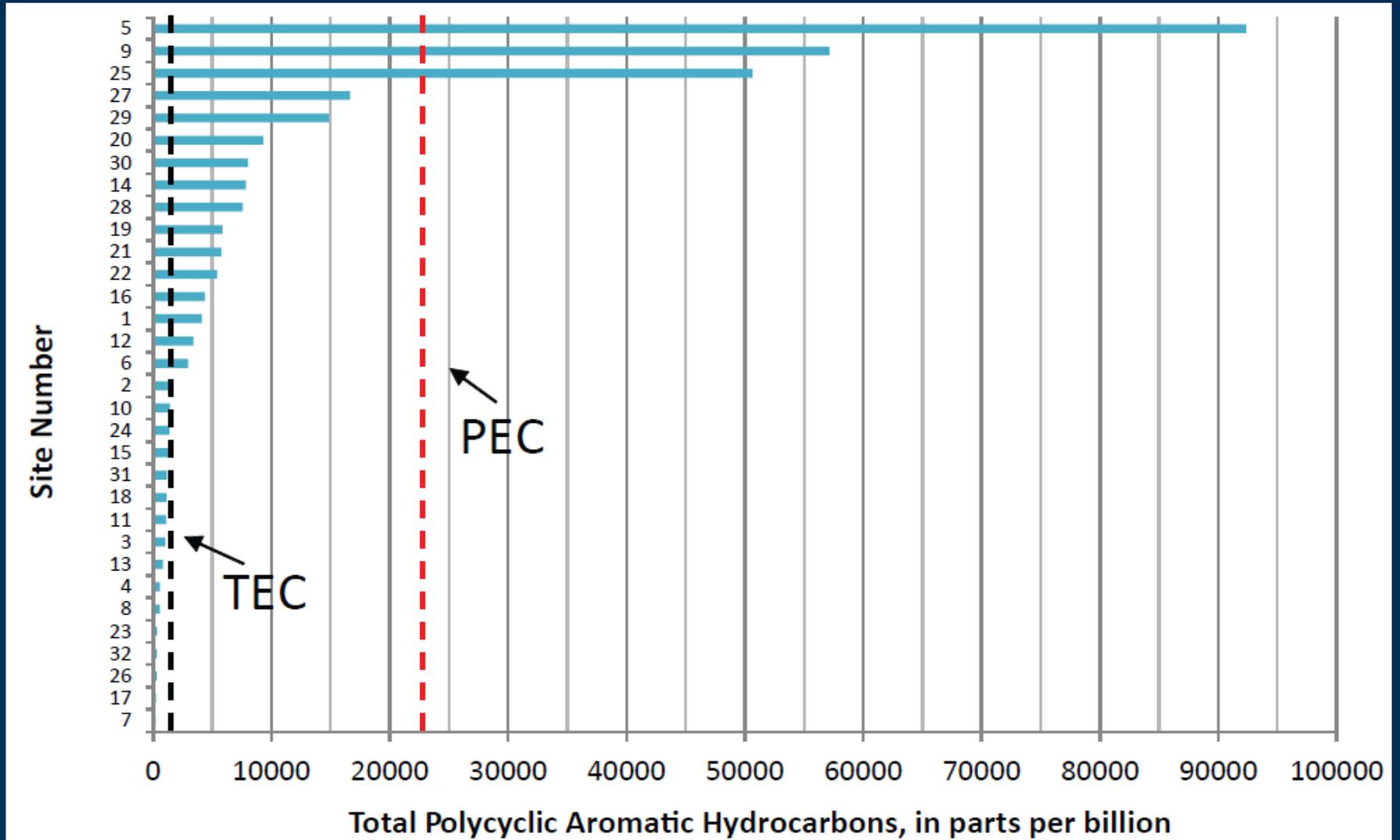


Among the inorganic elements:

- Lead exceeded Probable Effects Concentration (PEC) most frequently (28% of sites).
- Cadmium, chromium, and copper exceeded PEC at 13% of sites
- Arsenic exceeded PEC at 1 site; nickel and zinc at 0 sites.

Organic compound groups

Total PAHs



Among organic compound groups:

- Total PAHs exceeded PEC most frequently (9% of sites).
- Total PCBs exceeded PEC less frequently (6% of sites).
- Total DDTs did not exceed PEC at any sites.

Results: Statistical analysis

- Significant correlations ($p < 0.05$) found between some element concentrations (copper, nickel, zinc) and 1971 commercial + industrial land use; and between Total PAHs and number of factories in the 1830s.
- Relations generally had lower predictive power (r-squared values) than those found by Chalmers (2007) for post-1990 sediment.
- Results reflect the large variation in land-use in most impounded MA basins over the past 200 years. Hence, bulk concentration of impounded sediment in MA is difficult to predict from present-day land-use alone.

Conclusions:

- Sediment thickness in 32 impoundments ranged from 0 to >20 ft, and averaged 3.7 ft. Sediment volumes ranged from 100,000 to 81 million cubic ft.
- Contaminant concentrations varied greatly. Highest concentrations in impoundments of present or former industrial areas, e.g., Blackstone and North Nashua Rivers (elements) and Shawsheen River (organic compounds).
- Significant relations found between 1971 Commercial + Industrial + Transportation land-use and several elements; and between number of 1830s factories and total PAHs.
- Probability of benthic toxicity ranged from 8 to 70% among sites, and averaged 30%.



For report, go to: <http://pubs.usgs.gov/sir/2012/5191/>