

Contaminant Assessment and Reduction Project (CARP)

Litten, S., New York State Department of Environmental Conservation, Albany, NY

Fowler, B., Axys Analytical, Sidney, BC.

ABSTRACT

The NY State Department of Environmental Conservation has been investigating sources and ambient f polychlorinated dioxins, furans, and biphenyls (PCDDs, PCDFs) and PCBs in New York Harbor. DEC uses a sampling system (OPS) capable of extracting suspended solids and aqueous phase large volumes of water. Laboatory analysis of filter-captured particulates and es recovered from XAD resin used EPA Method 1613b for the dioxins and furans, a 613 for all 209 PCB congeners, and another modification of 1613 for the pesticides. The sampling and analytical system achieved sub-femtogram/L detection limits and routinely measured all target analytes. Application of toxic equivalency factors (TEFs) allows summation of 17 dioxin and furan congeners. Source fingerprints are discernable by examination of relative abundances of the TEF adjusted concentrations of the congeners. Usually dioxins account for more of the TEQ than furans. Unusually dioxin-rich signatures occur in Newark Bay. However, most, but not all, urban wastewater sources are more affected by PCDFs. The Hudson River is also a strong PCDF source and a major source of TEQ loading. PCBs occur throughout the system as well in both the particulate and dissolved phases with the greatest concentrations occurring in the Hudson River. Non-Aroclor congeners are readily apparent. TEFs are available for 13 PCB congeners and would, if used, often be responsible for much of the total TEQ.

CARP Sample Sites

Abbreviation	Site Name	Sample type
26WSTP BBSTP BIGHT BIGHT-D BRBG BRBZ CISTP CWNY GOWC HPSTP HRHAV HRKP HRMM HRMT HRPOU HRSHAR HRTZHA HRWA JAMB JASTP LER LISE LISJ LOWB MORCO NAK NEWB NRSTP NTSTP OBSTP OHSTP PBLF PRMB PRMS PRMT PRSTP PBLF PRMB PRMS PRMT PRSTP PVSC RARB RENSTP ROCSTP ROCSTP SMR	26th Ward WPCF Bowery Bay WPCF New York Bight, Trawl Site, December 1998 River at Botanical Garden Bronx River below Zoo Cony Island WPCF Clean Waters of New York Gowanus Canal (Carroll St). Hunts Point WPCF Hudson River, Haverstraw Bay, Trawl Site Mid-Hudson Trawl Site Hackensack River, Mouth, Trawl Site Hackensack River, Mouth, Trawl Site Hackensack River, Mouth, Trawl Site Hudson River at Poughkeepsie Hudson River at Poughkeepsie Hudson River, Tappen Zee to Harlem R., Trawl Site Hudson River, Tappen Zee to Harlem R., Trawl Site Hudson River, Waterford Jamaica Bay, Trawl Site Jamaica WPCF Lower East River, Trawl Site Long Island Sound, Eaton's Neck to Stamford, Trawl Site Long Island Sound, Port Jefferson, Trawl Site Long Island Sound, Port Jefferson, Trawl Site Nothern Arthur Kill, Trawl Site Northern Arthur Kill, Surface, Trawl Site Passaic River, Mouth, Sutface, Trawl Site Passaic River, Mouth, Sutface, Trawl Site Passaic River, Mid-Tidal Port Richmond, WPCF Passaic River, Mid-Tidal Port Richmond, WPCF Red Hook WPCF Red Hook WPCF Rockaway WPCF Saw Mill River, Yonkers	Water Polution Control Fa Water Polution Control Fa Ambient Tributary Tributary Water Polution Control Fa Industrial Effluent Tributary Water Polution Control Fa Ambient Ambient Ambient Ambient Ambient Tributary Ambient Water Polution Control Fa Ambient
TISTP UER UPB WALLR WISTP	Tallman Island, WPCF Upper East River, Trawl Site Upper NY Harbor, trawl Site Wallkill River at New Paltz Wards Island WPCF	Water Polution Control Fa Ambient Ambient Tributary Water Polution Control Fa

Please see the CARP Methods poster for locations of each of these sites



Polychlorinated dioxins (PCDDs) and furans (PCDFs) having chlorine substitutions at the **2**, **3**, **7**, and **8** positions;

New Jersey advises against consuming any fish, crustacea, or shellfish caught in the tidal Passaic River; also prohibits sale or consumption of several species throughout Newark Bay Complex due to dioxin contamination. Levels in tissues of at least eight edible species ometimes exceed the New York State advisory level in other areas of the Harbor. Levels in sediments in portions of the Newark Bay Complex limit options for disposal of contaminate dredged materials. Levels in sediments exceed New York State sediment quality guidance values at sampling sites throughout the Harbor.

New York State Water Quality Standard: 6 E-10 µg/L (0.6 fg/L) as TEQ

The NYSWQS is the sum of the products of the concentrations of seven PCDDs and ten PCDFs and their Toxic Equivalency Factors (TEFs). This approach recognizes that the 17 chemicals exert a similar toxicity but at very different potencies.

Analysis: USEPA Method 1613B

Component Dioxin and Furan Congeners

Dioxins and furans	NATO TEF
2,3,7,8-TCDD	1
1,2,3,7,8-PeCDD	0.5
1,2,3,4,7,8-HxCDD	0.1
1,2,3,6,7,8-HxCDD	0.1
1,2,3,7,8,9-HxCDD	0.1
1,2,3,4,6,7,8-HpCDD	0.01
OCDD	0.001
2,3,7,8-TCDF	0.1

Polychlorinated Biphenyls (PCBs)

Advisories for PCBs exist on the consumption of roughly 16 edible species in the Harbor and/or Bight, and a commercial fishing ban is in place on striped bass. Levels in sedime exceed the NOAA Effects Range - Median Value at sites throughout the Harbor; exceed by this level by five times or more at sampling sites in Newark Bay, Passaic River, Arthur Kil and Raritan Bay; exceed New York State sediment quality guidance values. Levels in v in tributaries to the Harbor have been found to exceed the water quality standard for protection of human health by roughly 1,000 times.

New York State Water Quality Standard: 0.000001 µg/L or 1 pg/L

Analysis: Draft NYSDEC Method HRMS - 1 (Analytical Procedures For PCB Congeners By Isotope Dilution HRGC/HRMS)

All 209 congeners were measured among 159 domains. Of the 159 domains only one (3,4,5-TriCB) has yet to be detected.

Some PCB congeners exert a toxicity similar to that of the dioxins and furans. These are the so-called "toxic" or "co-planer PCBs". The NYSWQS does not take this theory into account but there are published Toxic Equivalency Factors (TEFs) which when multiplied by their concentrations of appropriate allow those PCB congeners to be quantitated as though they were 2,3,7,8-TCDD. The 15 co-planer PCB congeners are usually rare but in some environments, they contribute a significant fraction of the total dioxin-type toxicity.

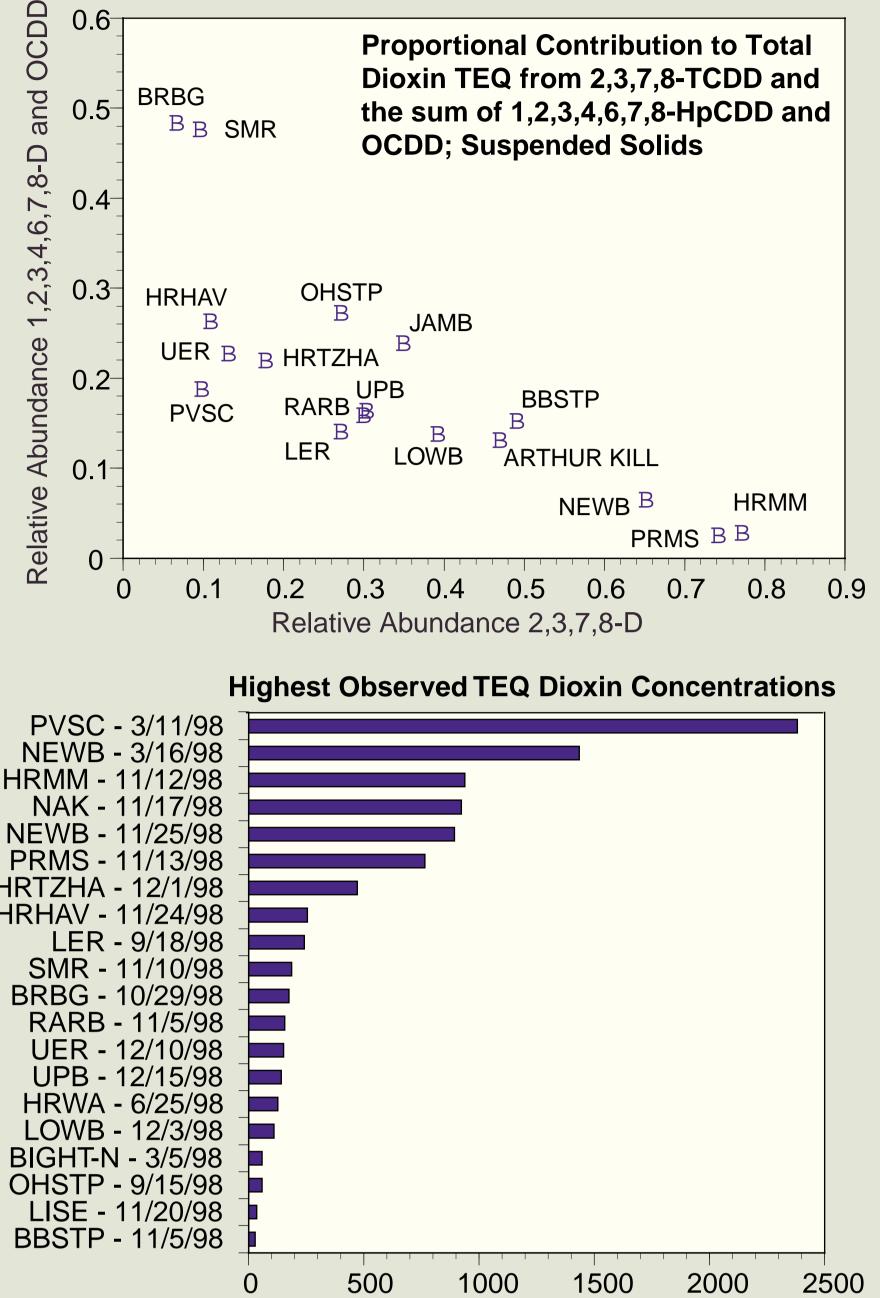
Toxic Equivalency Factors (TEFs) used for calculating PCB TEQs.

IUPAC	TEF
77	1.0E-04
81	1.0E-04
105	1.0E-04
114	5.0E-04
118	1.0E-04
123	1.0E-04
126	1.0E-01
156	5.0E-04
157	5.0E-04
167	1.0E-05
169	1.0E-02
170	1.0E-04
180	1.0E-05
189	1.0E-04
190	1.0E-04
	77 81 105 114 118 123 126 156 157 167 167 169 170 180 189

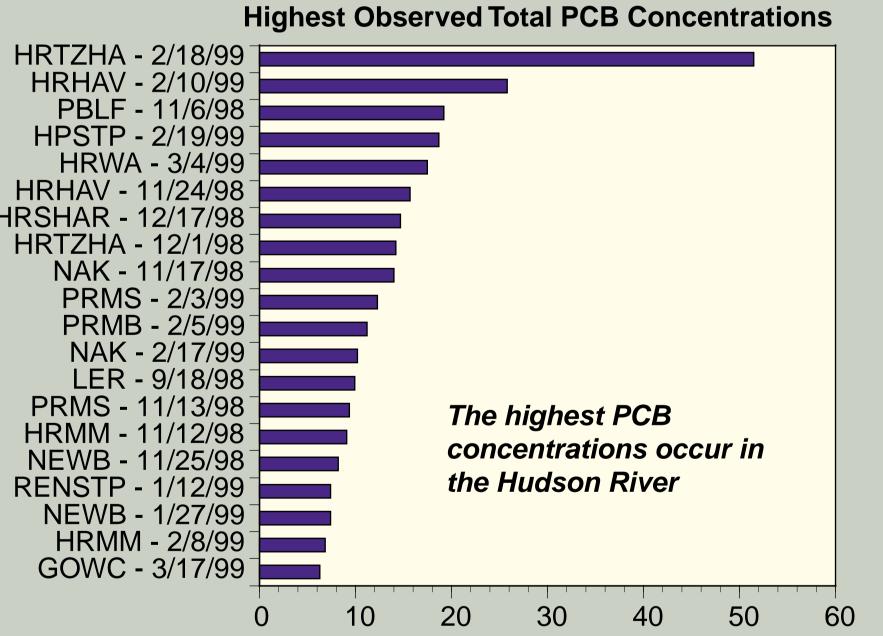
Kill Van Kull

Bayonne Bridge

geners.		
i	Dioxins and furans	NATO TEFs
	1,2,3,7,8-PeCDF	0.05
	2,3,4,7,8-PeCDF	0.5
	1,2,3,4,7,8-HxCDF	0.1
	1,2,3,6,7,8-HxCDF	0.1
	1,2,3,7,8,9-HxCDF	0.1
	2,3,4,6,7,8-HxCDF	0.1
	1,2,3,4,6,7,8-HpCDF	0.01
	1,2,3,4,7,8,9-HpCDF	0.01
	OCDF	0.001

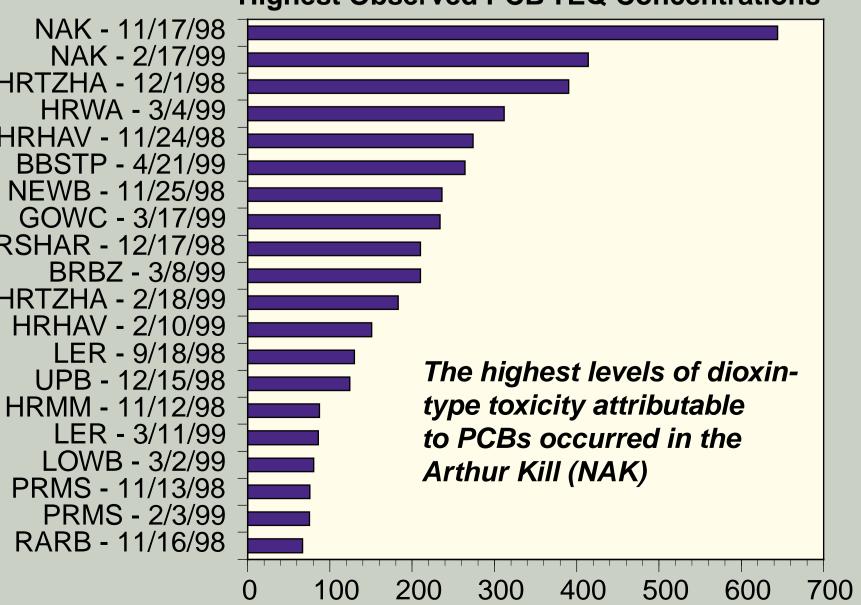


TEQ Dioxin, fg/L, suspended solids

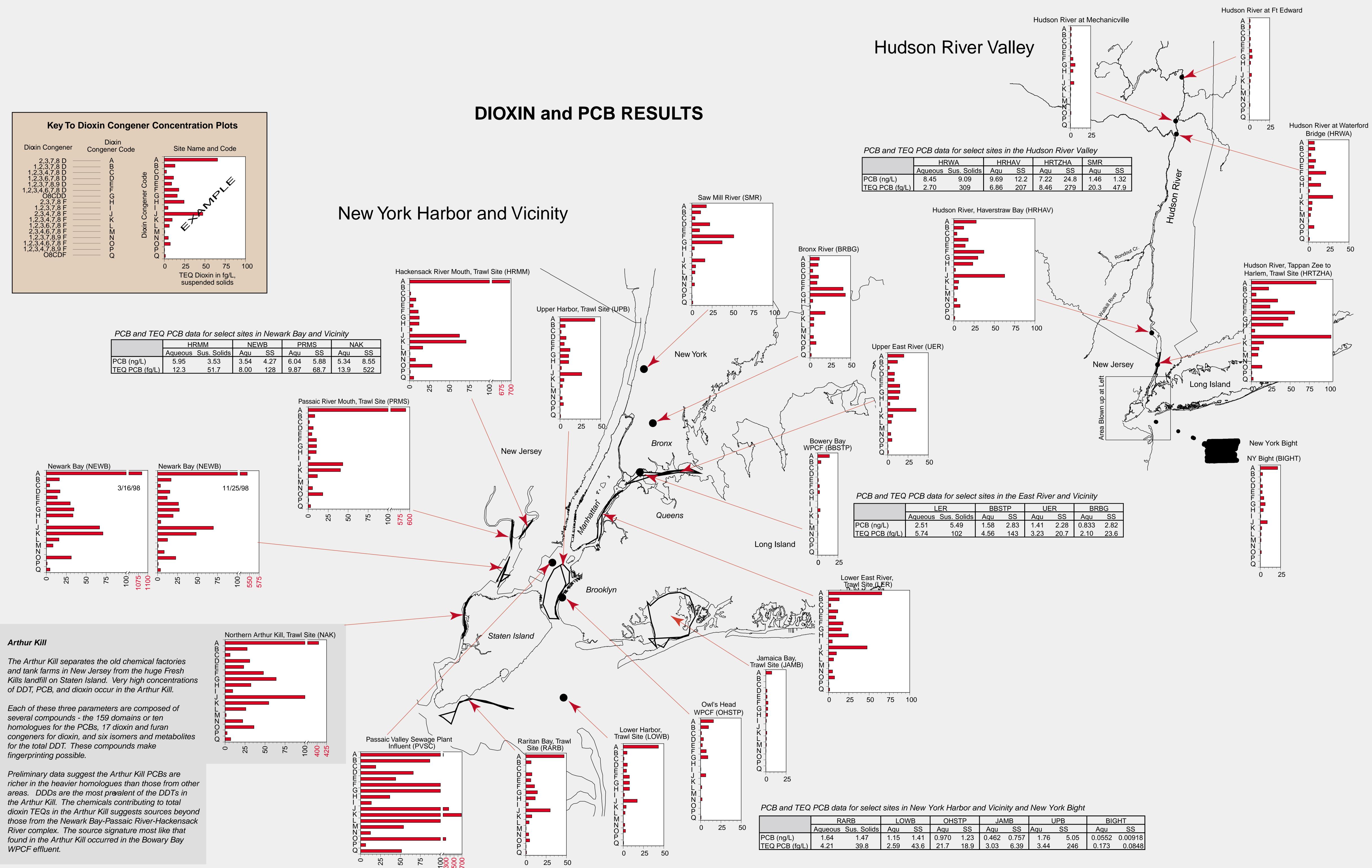


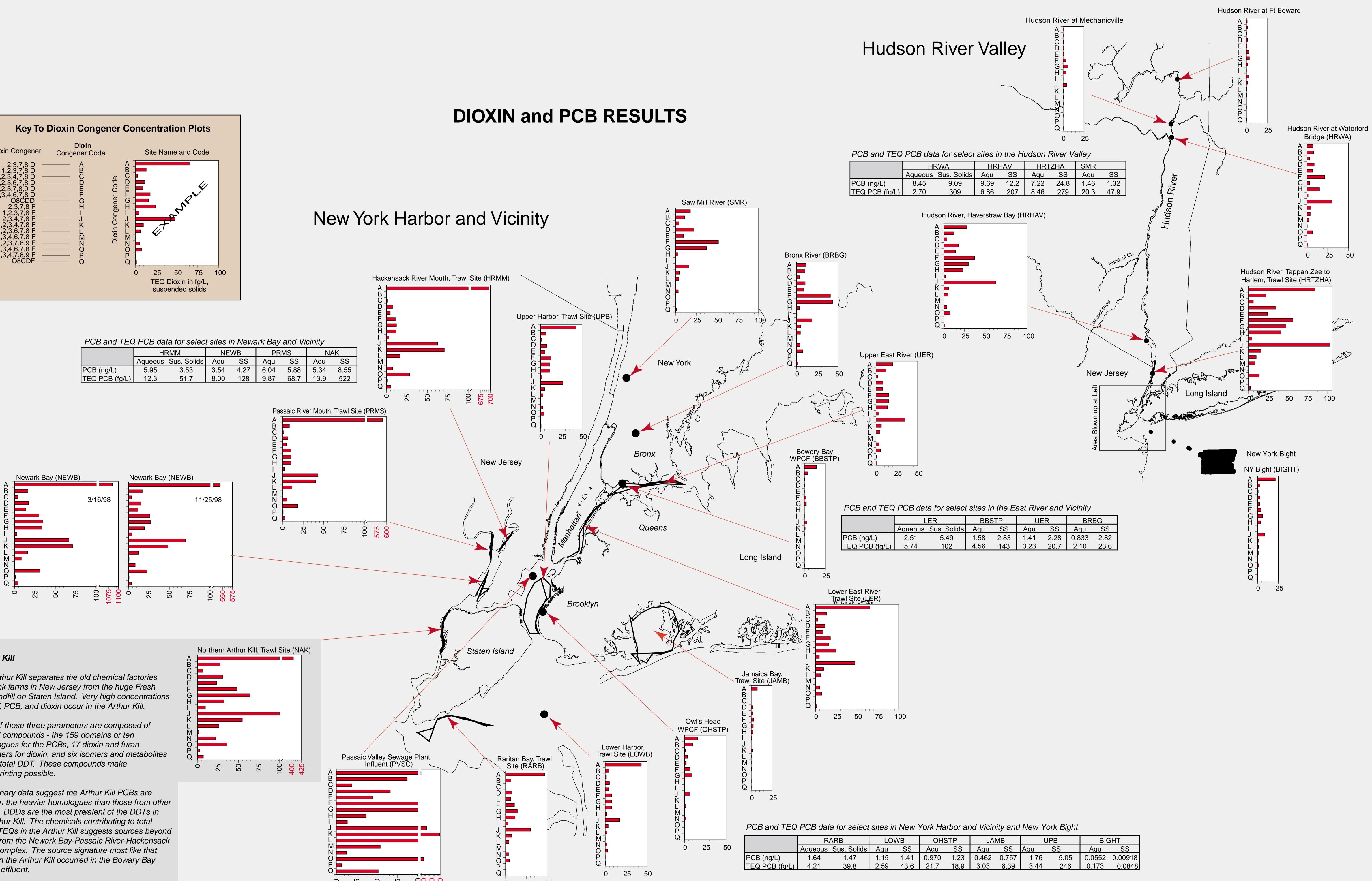
Total PCB in ng/L, suspended solids and aqueous

Highest Observed PCB TEQ Concentrations



PCB TEQ in fg/L, suspended solids and aqueous





fingerprinting possible.

WPCF effluent.

Toxic Chemicals in New York Harbor and Vicinity - Sources and Ambient Concentrations of Dioxins and PCBs From Large Volume Water Column Sampling.

	RARB		LOWB		OHSTP		JAMB		UPB		BIGHT	
	Aqueous	Sus. Solids	Aqu	SS	Aqu	SS	Aqu	SS	Aqu	SS	Aqu	SS
PCB (ng/L)	1.64	1.47	1.15	1.41	0.970	1.23	0.462	0.757	1.76	5.05	0.0552	0.00918
TEQ PCB (fg/L)	4.21	39.8	2.59	43.6	21.7	18.9	3.03	6.39	3.44	246	0.173	0.0848