

Contaminant Assessment and Reduction Project (CARP)

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ABSTRACT

The NY State Department of Environmental Conservation has been investigating sources ambient concentrations of pesticides, mercury, and cadmium to New York Harbor. The highest concentrations of pesticides occur in the Arthur Kill and in WPCF effluents. A survey for pesticide sources conducted in tributaries to the Hudson River revealed that the Wallkill River may be a particularly nt source. Trackdown studies in the Wallkill River located the pesticide source in an intensively farmed "black dirt" area. Dissolved and methyl mercury concentrations are highest in the WPCF treated effluents. Whole water concentrations (total mercur are greatest in the Hackensack and Passaic Rivers. Cadmium levels were highest in WPCF effluents but always at concentrations below the NYSWQS. FAHs were measured as dissolved and particle-bound compartments. The highest particle-bound PAH concentrations were found in surface waters.

| | Abbreviation | Site Name | Sample type |
|--------|--------------|---|----------------------------|
| | 26WSTP | 26th Ward WPCF | Water Polution Control Fac |
| | BBSTP | Bowery Bay WPCF | Water Polution Control Fac |
| | BIGHT | New York Bight, Trawl Site | Ambient |
| | BIGHT-D | New York Bight, Trawl Site, December 1998 | Ambient |
| | BRBG | River at Botanical Garden | Tributary |
| | BRBZ | Bronx River below Zoo | Tributary |
| | CISTP | Cony Island WPCF | Water Polution Control Fac |
| | CWNY | Clean Waters of New York | Industrial Effluent |
| | GOWC | Gowanus Canal (Carroll St). | Tributary |
| | HPSTP | Hunts Point WPCF | Water Polution Control Fac |
| | HRHAV | Hudson River, Haverstraw Bay, Trawl Site | Ambient |
| | HRKP | Mid-Hudson Trawl Site | Ambient |
| | HRMM | Hackensack River, Mouth, Trawl Site | Ambient |
| | HRMT | Hackensack River, Mid-Tidal | Ambient |
| | HRPOU | Hudson River at Poughkeepsie | Ambient |
| | HRSHAR | Hudson River below Harlem River, Trawl Site | Ambient |
| | HRTZHA | Hudson River, Tappen Zee to Harlem R., Trawl Site | Ambient |
| | HRWA | Hudson River, Waterford | Tributary |
|) | JAMB | Jamaica Bay, Trawl Site | Ambient |
| I | JASTP | Jamaica WPCF | Water Polution Control Fac |
| | LER | Lower East River, Trawl Site | Ambient |
| | LISE | Long Island Sound, Eaton's Neck to Stamford, Trawl Site | Ambient |
|) | LISJ | Long Island Sound, Port Jefferson, Trawl Site | Ambient |
|) | LOWB | Lower NY Harbor, Trawl Site | Ambient |
| | MORCO | Mohawk River, Cohoes | Tributary |
| 1 | NAK | Northern Arthur Kill, Trawl Site | Ambient |
| | NEWB | Newark Bay, Trawl Site | Ambient |
| | NRSTP | North River, WPCF | Water Polution Control Fac |
| | NTSTP | Newtown Creek, WPCF | Water Polution Control Fac |
| | OBSTP | Oakwood Beach, WPCF | Water Polution Control Fac |
| 1 | OHSTP | Owls Head WPCF | Water Polution Control Fac |
| r I | PBLF | Pelham Bay Landfill Holding Tank | Landfill |
| 1 | PRMB | Passaic River, Mouth, Bottom | Ambient |
| l | PRMS | Passaic River, Mouth, Surface, Trawl Site | Ambient |
|) | PRMT | Passaic River, Mid-Tidal | Ambient |
| | PRSTP | Port Richmond, WPCF | Water Polution Control Fac |
| | PVSC | Passaic Valley Sewage Authority | Influent - WPCF |
| | RARB | Raritan Bay, Trawl Site | Ambient |
| | RENSTP | Rensselaer WPCF | Water Polution Control Fac |
| | RHSTP | Red Hook WPCF | Water Polution Control Fac |
| | ROCSTP | Rockland County WPCF | Water Polution Control Fac |
| | ROSTP | Rockaway WPCF | Water Polution Control Fac |
| | SMR | Saw Mill River, Yonkers | Tributary |
| | TISTP | Tallman Island, WPCF | Water Polution Control Fac |
| | UER | Upper East River, Trawl Site | Ambient |
| | UPB | Upper NY Harbor, trawl Site | Ambient |
| | WALLR | Wallkill River at New Paltz | Tributary |
| | WISTP | Wards Island WPCF | Water Polution Control Fac |
| | | | |

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

Cadmium (total and dissolved)

Levels have caused New York State to advise limited consumption of 1) blue claw crabs caught in the Hudson River from Troy Dam, south to the Lower Bay, and 2) hepatopancreas ("tomalley") of lobsters caught throughout the

New York State Water Quality Standard Cd, dissolved - 2.7 μ g/L = 2,700 ng/L

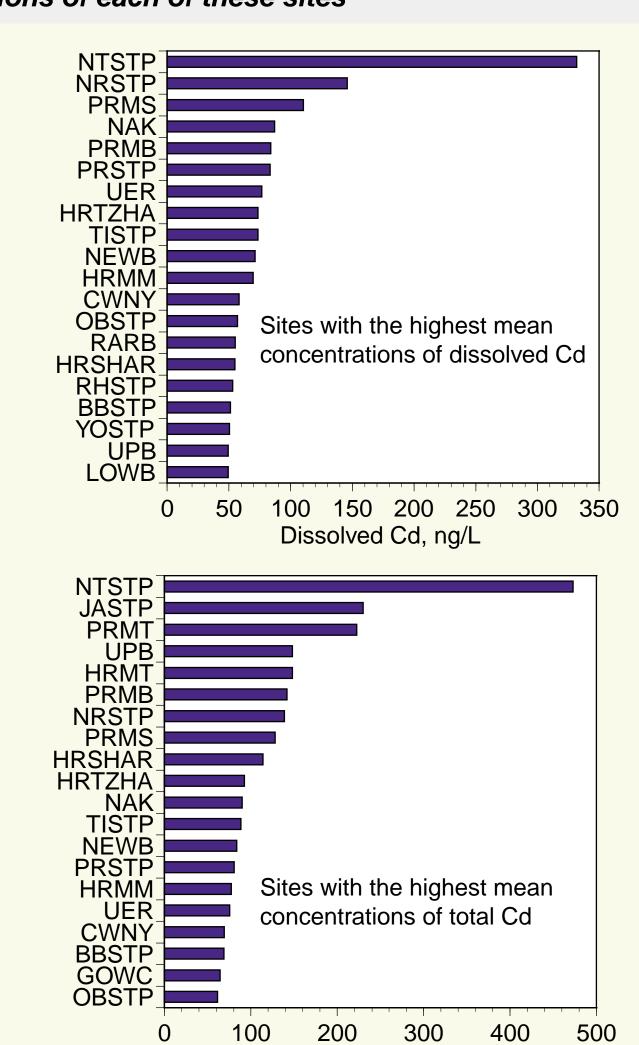
Analysis: USEPA 1638

No sample approached the NYSWQS.

The highest concentrations were seen in WPCF effluents.

Most of the cadmium is in the dissolved form.





Total Cd, ng/L

Mercury (total, dissolved, and dissolved methyl).

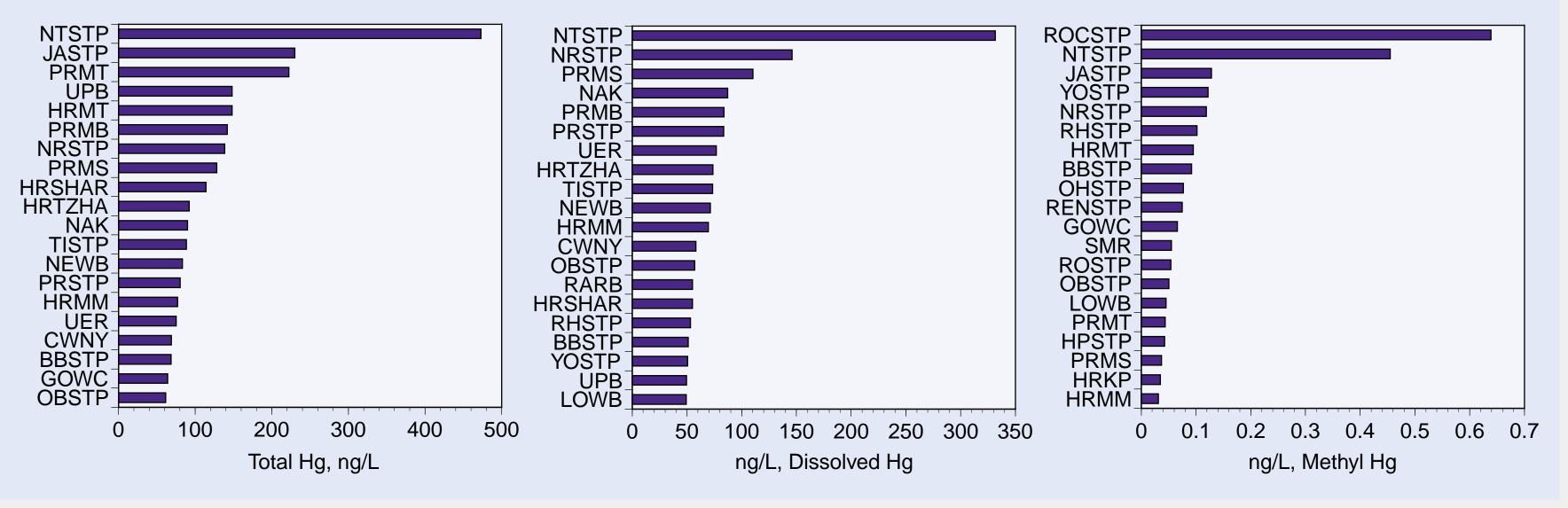
Mercury exceeds the water quality standard virtually Harbor-wide. Expected to exceed state advisory levels in fish tissue. Levels in sediments exceed the NOAA Effects Range - Median Value at sampling sites throughout the Harbor; and exceeds this level by ten times or more at sampling sites in the Hackensack River, Arthur Kill, and Newark Bay.

New York State Water Quality Standards are for the dissolved phase: 0.0007µg/L or 0.7 ng/L

The precautions to prevent field and laboratory contamination of metals samples are described in EPA Method 1669.

Most of the mercury is on particles and the highest concentrations occurred in the Hackensack and Passaic mouths.

Newtown Creek WPCFs.



Polynuclear Aromatic Hydrocarbons (PAHs)

Levels of total PAH and several individual PAHs at sediment sampling sites in many inner Harbor areas and tributaries exceed the NOAA Effects Range - Median Value, often by five to ten times or more; attibuted to discharges of petroleum and related materials. Recent NOAA studies found a moderate positive correlation among levels of PAHs in the Harbor/Bight sediments and toxic responses in a variety of laboratory test organisms. Levels of several PAHs in mussel tissue at several sampling sites throughout the Harbor sometimes exceed tissue concentrations on which USEPA water quality criteria for human health protection are based. Levels of four PAHs benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and benzo(k)fluoranthene - sometimes exceed water guality standards in Jamaica Bay.

Analysis: NYSDEC Method HRMS - 3 (Analytical Procedures For Polynuclear Aromatic Hydrocarbons By Isotope Dilution HRGC/MS)

New York State Water Quality Standards: enz(a)anthracene (H(WS)) 0.002 Benzofluoranthene (H(WS)) 0.002

PAHs were seen in surface waters (suspended solids).

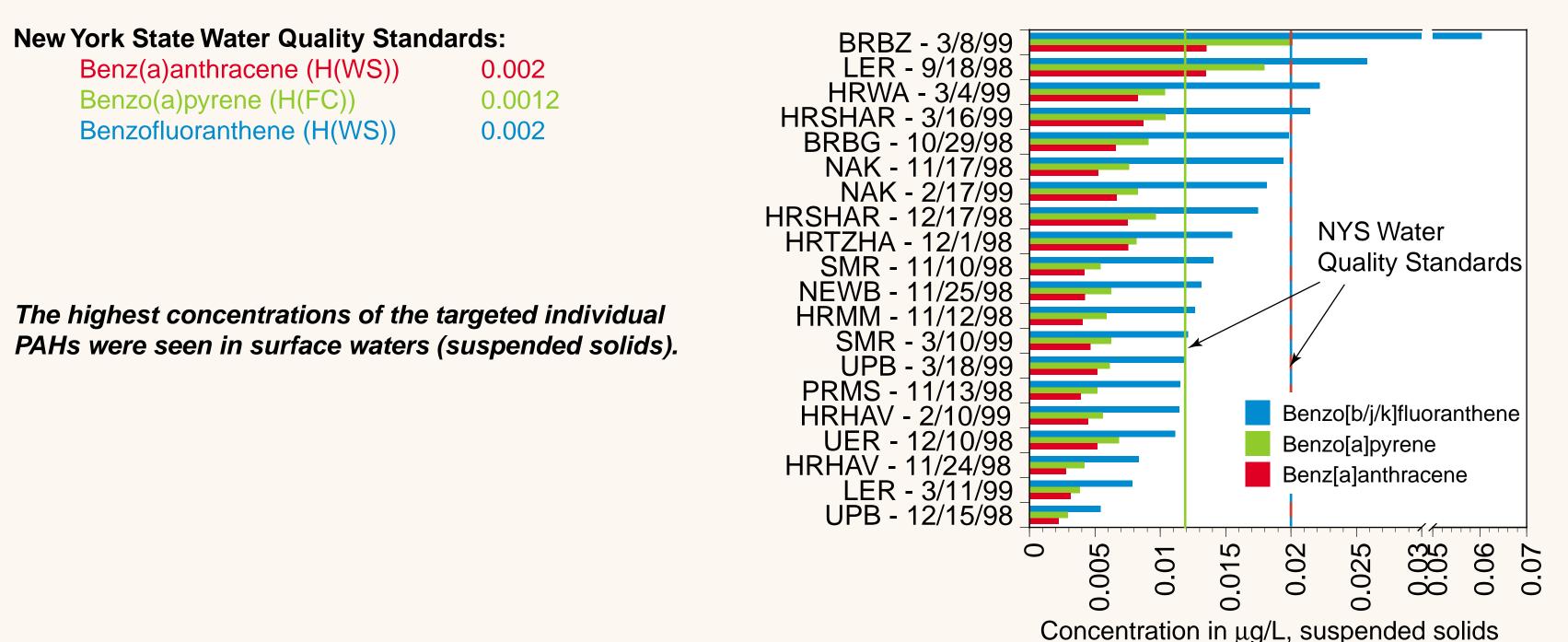
shown as molar summations.

The lighter naphthalenes (parent and methylated forms) account for a large proportion of the total PAH molar abundance. Unfortunately, XAD breaks down to produce naphthalenes that interfere with the detection of native PAHs. Therefore, in the CARP, we measure aqueous PAHs directly from grab samples without the benefit of field concentration. PAHs are also analyzed from the TOPS filter.

| PAHs and their molecular weights: | | | | | | | | |
|-----------------------------------|--------|------------------------------|--------|--|--|--|--|--|
| Naphthalene | 128.2 | Benzo[b/j/k]fluoranthenes | 252.3 | | | | | |
| Biphenyl | 154.2 | Benzo[e]pyrene | 228.3 | | | | | |
| Acenaphthylene | 152.2 | Benzo[a]pyrene | 252.3 | | | | | |
| Acenaphthene | 154.2 | Perylene | 252.32 | | | | | |
| Fluorene | 166.2 | Dibenz[ah]anthracene | 278.4 | | | | | |
| Phenanthrene | 178.2 | Indeno[1,2,3-cd]pyrene | 276.3 | | | | | |
| Anthracene | 178.2 | Benzo[ghi]perylene | 276 | | | | | |
| Fluoranthene | 202.3 | C1 Naphthalenes | 142.2 | | | | | |
| Pyrene | 202 | C2 Naphthalenes | 156.23 | | | | | |
| Benz[a]anthracene | 228.29 | C3 Naphthalenes | 170.26 | | | | | |
| Chrysene | 228.3 | C1 Phenanthrenes/Anthracenes | 192.26 | | | | | |

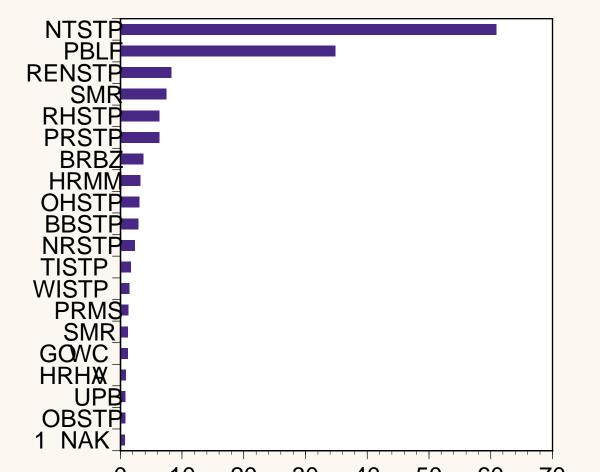
mpling in the Bronx

The highest dissolved concentrations were seen in WPCF effluents, particularly Rockland County Sewer District 1 and the



The toxic effect of PAHs on laboratory test organisms is thought to be due to molar abundance of all the PAHs and so, PAHs are also

The highest molar concentrations (from the aqueous phase) were seen in WPCF effluents and a landfill leachate.



0 10 20 30 40 50 60 70 PAHs, μmoles/L, aqueous

Pesticides

The final Comprehensive Conservation and Management Plan (CCMP) lists seven pesticides - DDT and metabolites, chlordane, dieldrin, heptachlor, heptachlor epoxide, hexachlorobenzene, and gamma-BHC. However, evidence presented in March, 1999 has led to the delisting of heptachlor, heptachlor epoxide, hexachlorobenzene, and gamma-BHC. In practice, however, the NYSDEC pesticides list includes these and many other substances. Of the pesticides the CCMP

> "In various edible species, tissue levels of all the listed pesticides . . . greatly exceed tissue concentrations on which USEPA water quality criteria for human health protection are based.

For chlordane:

"Levels in striped bass and American eel sometimes exceed FDA advisory levels at locations throughout the Harbor."

New York State Water Quality Standards are shown below for all target analytes. CARP targets are in bold

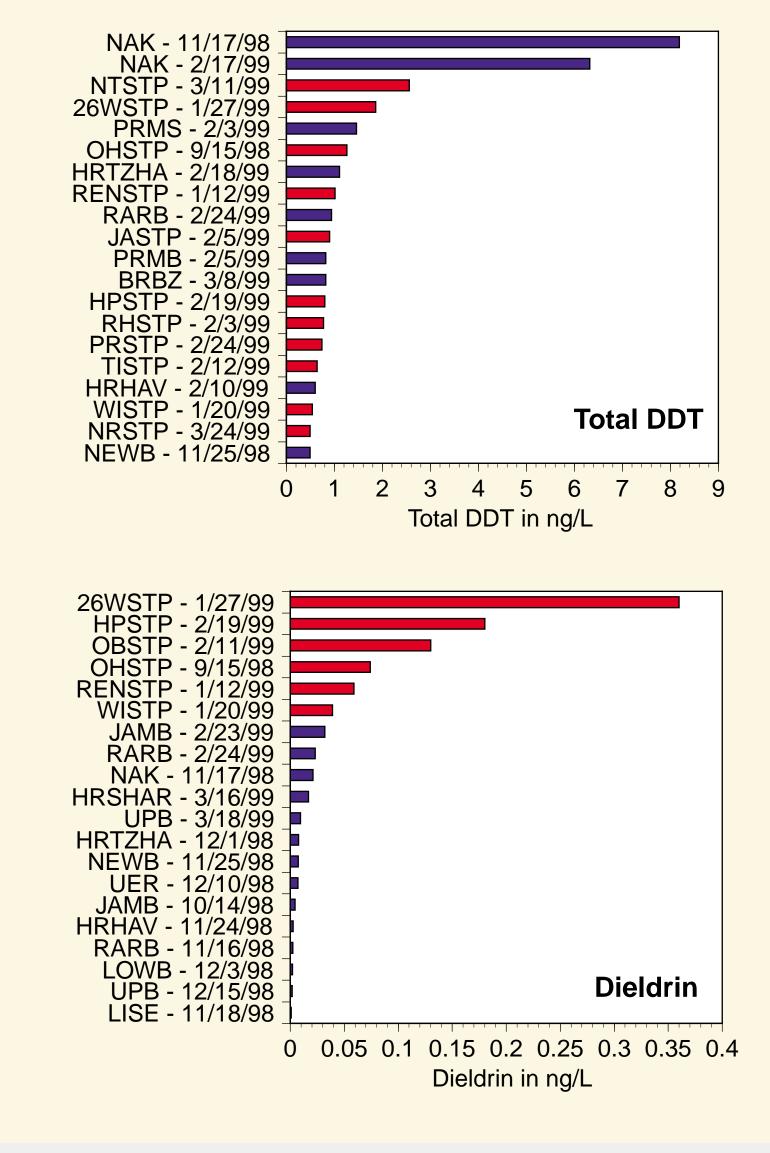
| Analyte | NYS |
|--|------|
| Aldrin | 0.00 |
| alpha HCH | 0.00 |
| beta HCH | 0.00 |
| Chlordane - sum of cis and trans isomers | 0.00 |
| Dieldrin | 6E-(|
| Endrin | 0.00 |
| gamma HCH | 0.00 |
| Heptachlor | 0.00 |
| Heptachlor Epoxide | 0.00 |
| Hexachlorobenzene | 0.00 |
| Mirex | 0.00 |
| p,p'-DDD | 0.00 |
| p,p'-DDE | 0.00 |
| p,p'-DDT | 0.00 |
| | |

Analysis: Draft NYSDEC Method HRMS - 2 (Analytical Procedures For Pesticides By Isotope Dilution HRGC/HRMS).

Plots below indicate the 20 highest concentrations detected for Total DDT, Mirex, Dieldrin, and Chlodane with corresponding site code and date of sample collection.

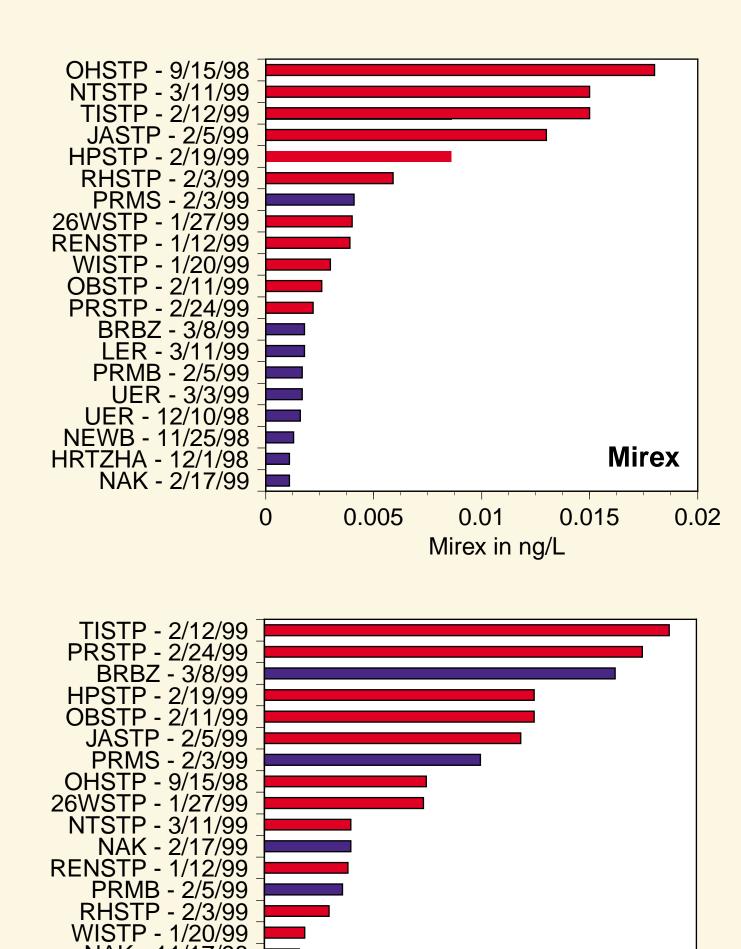
The site with the highest concentrations of total DDTs is the Arthur Kill (NAK)

The highest chlordane, dieldrin, and mire concentrations were seen in WPCF effluents (shown as red bars). The sources of these banned materials to the present wastestream are unknown but may represent diffuse but intensive past uses in urban pest control.



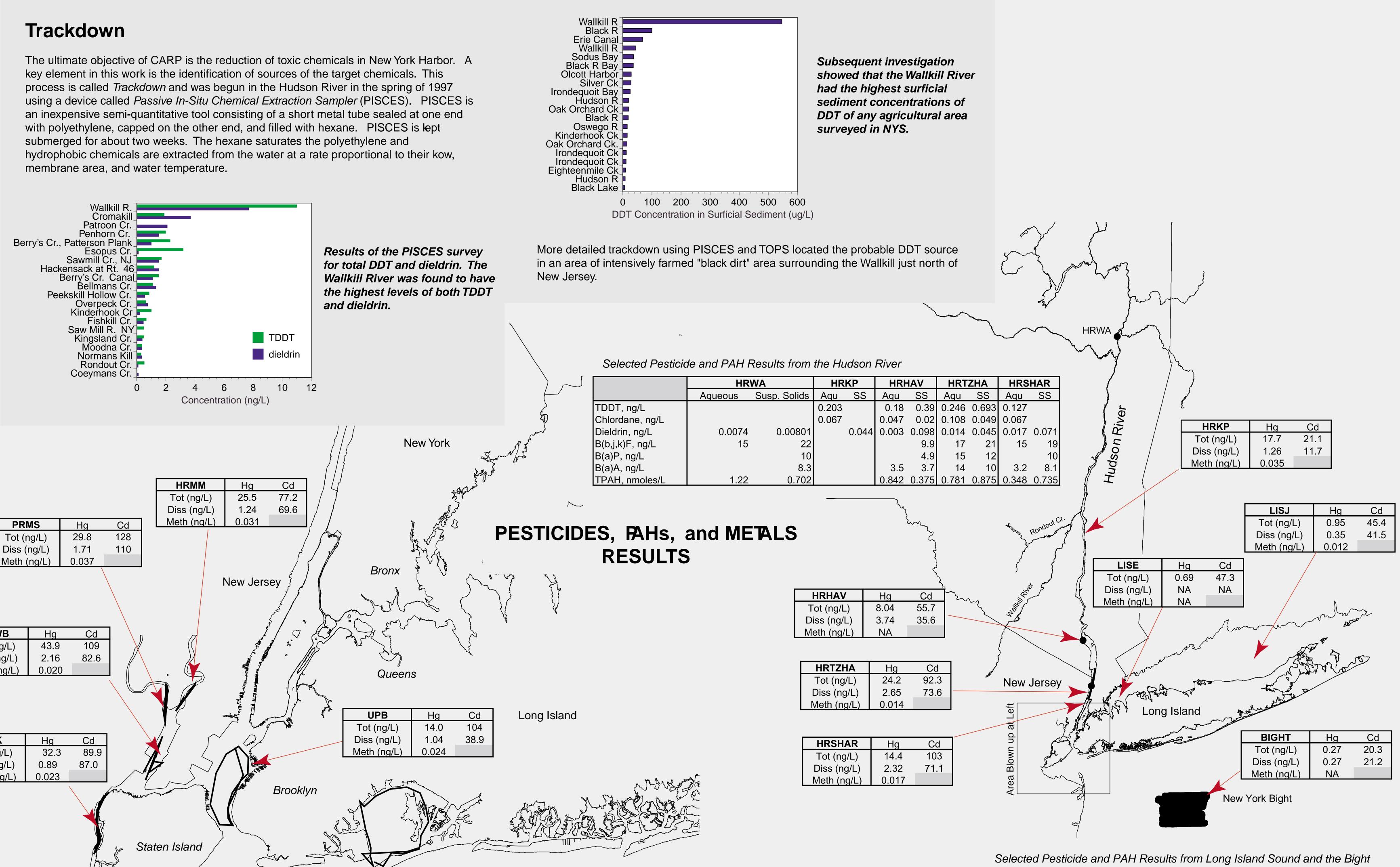
Toxic Chemicals in New York Harbor and Vicinity - Sources and Ambient Concentrations of Pesticides, PAHs, Mercury, and Cadmium.

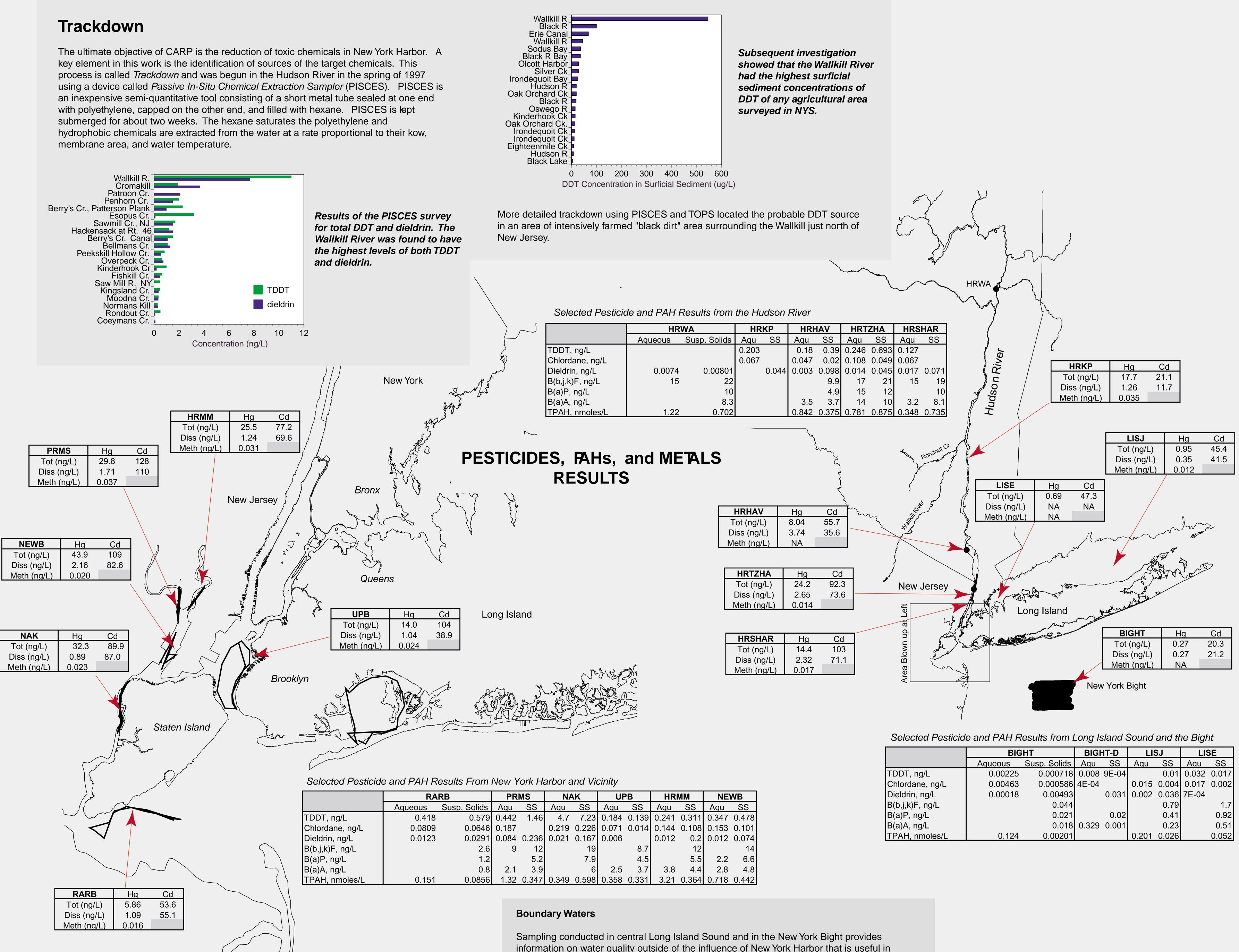
YSWQS (ppm)



Chlordane HRMM - 2/8/99 NRSTP - 3/24/99 0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 Chlordane in ng/L

The ultimate objective of CARP is the reduction of toxic chemicals in New York Harbor. A key element in this work is the identification of sources of the target chemicals. This process is called *Trackdown* and was begun in the Hudson River in the spring of 1997





| | PR | PRMS | | NAK | | UPB | | HRMM | | NB |
|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| usp. Solids | Aqu | SS |
| 0.579 | 0.442 | 1.46 | 4.7 | 7.23 | 0.184 | 0.139 | 0.241 | 0.311 | 0.347 | 0.478 |
| 0.0646 | 0.187 | | 0.219 | 0.226 | 0.071 | 0.014 | 0.144 | 0.108 | 0.153 | 0.101 |
| 0.0291 | 0.084 | 0.236 | 0.021 | 0.167 | 0.006 | | 0.012 | 0.2 | 0.012 | 0.074 |
| 2.6 | 9 | 12 | | 19 | | 8.7 | | 12 | | 14 |
| 1.2 | | 5.2 | | 7.9 | | 4.5 | | 5.5 | 2.2 | 6.6 |
| 0.8 | 2.1 | 3.9 | | 6 | 2.5 | 3.7 | 3.8 | 4.4 | 2.8 | 4.8 |
| 0.0856 | 1.32 | 0.347 | 0.349 | 0.598 | 0.358 | 0.331 | 3.21 | 0.364 | 0.718 | 0.442 |

information on water quality outside of the influence of New York Harbor that is useful in modeling. It also serves as a check on the cleanliness of the sampling system.

In order to detect organic chemicals 20 miles out into the Bight, very large sample volumes were processed - 5,000 L seems to be a minimal sample size required to quantitate DDTs on suspended solids. Chemical concentations were significantly higher in Long Island

| | BIG | BIGHT-D | | LISJ | | LISE | | |
|-----------------|---------|--------------|-------|-------|-------|-------|-------|-------|
| | Aqueous | Susp. Solids | Aqu | SS | Aqu | SS | Aqu | SS |
| TDDT, ng/L | 0.00225 | 0.000718 | 0.008 | 9E-04 | | 0.01 | 0.032 | 0.017 |
| Chlordane, ng/L | 0.00463 | 0.000586 | 4E-04 | | 0.015 | 0.004 | 0.017 | 0.002 |
| Dieldrin, ng/L | 0.00018 | 0.00493 | | 0.031 | 0.002 | 0.036 | 7E-04 | |
| B(b,j,k)F, ng/L | | 0.044 | | | | 0.79 | | 1.7 |
| B(a)P, ng/L | | 0.021 | | 0.02 | | 0.41 | | 0.92 |
| B(a)A, ng/L | | 0.018 | 0.329 | 0.001 | | 0.23 | | 0.51 |
| TPAH, nmoles/L | 0.124 | 0.00201 | | | 0.201 | 0.026 | | 0.052 |