



## Summary of Accomplishments and Findings

November 2007

### Background

The *Contamination Assessment and Reduction Project (CARP)* is a landmark project bringing together federal, state and non-government partners in a determined effort to reduce contamination within the NY/NJ Harbor Estuary, particularly as it relates to dredged material management. Contamination of sediments by PCBs, dioxin and other toxic chemicals is widespread. This has resulted in significantly increased dredging and disposal costs in the Harbor as well as other impacts to the health of the estuary.

### Major Accomplishments

- CARP identified and quantified major sources of contaminants of concern to the NY/NJ Harbor Estuary.
- CARP produced a large set of baseline data characterizing levels of contaminants in sediment, water, biota and wastewaters (sewage treatment plant effluents, stormwater and combined sewer overflows) throughout the estuary.
  - Sampling and analytical methods were refined to quantify very low concentrations of contaminants, particularly in water, that in the past were reported as non-detectable.
  - The publicly available CARP database allows easy access to more than 750,000 measurements.

- A series of numerical models have been developed and calibrated to simulate movement of contaminants through the estuary and to predict the concentrations of these contaminants in water, sediment, and biota in future years under a variety of scenarios.
  - Model simulations predict how continuing contaminant inputs (from atmospheric deposition, sewage treatment plants, combined sewer overflows, stormwater, tributaries, runoff, in-place sediments and the ocean) affect concentrations of contaminants in water, sediment and biota in the estuary over the next three decades.
  - Using the model simulations, an interactive spreadsheet (“Component Response Matrix”) has been developed to allow users to see how specific load reductions affect contaminant levels in water, sediment and biota throughout the estuary.
  - Scenarios involving implementation of the Hudson River PCBs Superfund Site dredging and remediation of the highly contaminated sediments in the lower Passaic River were modeled over a more than three decade simulation period. The scenarios predict the effect that remediation will have on the suitability of future dredged sediments for placement at the Historic Area Remediation Site (HARS).

## **Overall Findings**

- The estuary is a dynamic system where, in some cases, contaminants have been transported great distances from their sources and have dispersed throughout many of the interconnected waterways.
- Sediments in the Harbor still contain large quantities of persistent contaminants from historic releases. These legacy sediments are a continuing source of contamination and generally play a larger role than current external loadings in controlling contaminant levels in water, sediment and aquatic organisms in the estuary.
- In general, model simulations indicate that levels of contaminants in all media will continue to decline even if current loads remain constant.
- Burial of contaminated sediments by “cleaner” sediments and resuspension with transport to other areas are the dominant natural processes that result in lower surficial sediment concentrations over time. Severe storms were not modeled, but they could be mechanisms for mobilizing deeper layers of contaminated sediments.
- Over the next 10-20 years, legacy sediments are expected to be the dominant influence in controlling contaminant levels in all media of the

estuary. Sediment remediation will therefore likely be the most significant future method of source control.

- Though not specifically designed to do so, municipal sewage treatment plants were shown to effectively limit the concentrations of contaminants in wastewater discharged to the estuary.

## PCBs

- PCB contamination is widespread throughout the entire estuary. Data and modeling results show that most of the Harbor's surficial sediments (i.e., the top ten centimeters) are exceeding the benchmark limits established to determine whether dredged sediments can be used as remediation material at the Historic Area Remediation Site (HARS) in the Atlantic Ocean.
- CARP data show that average concentrations of PCBs in white perch and American eel currently exceed U.S. Federal Food and Drug Administration FDA limits (for interstate commerce involving edible fish) at most locations sampled in the Harbor and in the mid-Hudson at Poughkeepsie.
- The Upper Hudson River PCBs Superfund Site is the dominant external source of PCBs to the Harbor. It is estimated that three quarters of the PCB load currently entering the Harbor originates in the Upper Hudson River.
- Modeling shows that PCBs from the Hudson upriver source are transported throughout the estuary, including Newark Bay.
- If PCB loadings continue at current levels, modeling indicates that surficial sediments in most of the Harbor are likely to remain unsuitable for HARS placement due to PCB bioaccumulation, even three decades from now. In addition, white perch and American eel will continue to exceed FDA tolerance limits in portions of the Hudson River.
- If the Hudson River PCBs Superfund dredging is accomplished upriver (and the Record of Decision's estimated load reductions are attained) and Passaic River sediments are remediated, modeling indicates that much of the Harbor's surficial sediments are likely to become HARS-suitable with respect to PCBs within three decades.
- Organic pigment manufacturing was found to be producing and releasing inadvertently synthesized PCBs. During the CARP sampling period, approximately 45% of sewage treatment inputs of PCBs to the Harbor (or 5% of the total PCB load) came from pigment manufacturing companies discharging via sewage treatment plants. At least one of these companies no longer discharges these PCBs.

- Two sewage treatment plants were discovered to be receiving and discharging unusually high concentrations of commercial PCBs. Trackdown investigations found the PCBs to be widely distributed in their sewersheds. Specific sources have yet to be identified.

## **Dioxins**

- Dioxins are a family of 17 different compounds. Various types of sources to the estuary can show different relative abundances, or signatures, of these compounds. CARP found dioxin signatures associated with defoliant manufacture (which produced relatively high amounts of 2,3,7,8-TCDD), urban waste water, and incineration activities.
- Even though 2,3,7,8-TCDD is the dominant problematic dioxin compound in sections of the Harbor (i.e., the Passaic and Hackensack Rivers, Newark Bay and the Arthur Kill), other dioxin compounds are being introduced throughout the estuary, resulting in exceedances of the New York State water quality criterion.
- Current sources of 2,3,7,8-TCDD to the Harbor are very small in relationship to the historic discharge of this compound that resulted in extremely high levels that still persist in sediments of the lower Passaic River region. Of the small current inputs, stormwater is largest contributor, accounting for more than half of the current external load to the Harbor.
- In the absence of major storms or other events that would result in the resuspension of highly contaminated buried sediments in the Passaic River, model simulations indicate that surficial sediments in Newark Bay may become HARS-suitable with respect to dioxin within three decades even without sediment remediation in the Passaic River. However, sediment remediation in the Passaic will reduce the time needed to achieve this benchmark.

## **Other Contaminants**

- In addition to PCBs and dioxin, twenty six other contaminants, measured or modeled by CARP, have been identified as potentially being in violation of state or federal (enforceable and non-enforceable) guidelines or criteria. Contaminants of greatest concern include: lead, mercury, polynuclear aromatic hydrocarbon (PAH) compounds, DDT and its metabolites, and several pesticides.

## **Next Steps**

- The U.S. Environmental Protection Agency (EPA), along with the states of New York and New Jersey, will utilize the CARP data and modeling products to inform their determinations about which contaminants require

development of Total Maximum Daily Loads (TMDLs) to meet appropriate water quality criteria.

- The NY/NJ Harbor Estuary Program will use CARP products to formulate contaminant reduction targets.
- CARP data and models will likely be used to develop sediment remediation strategies in connection with the U.S. Army Corps of Engineers' Hudson-Raritan Comprehensive Restoration Program and the Harbor Estuary Program's Regional Sediment Management strategy.
- CARP products have been used, and may be used in the future, in connection with the Lower Passaic River Restoration Project.
- The CARP data and model projections will be used in the further development of the NJ Toxics Reduction Workplan and its implementation plan. The implementation plan will identify significant contamination problems and develop source trackdown and pollution prevention strategies that can be applied to these problems.
- It is recommended that additional research be conducted and data be collected to increase confidence in the model projections, measure progress and trends, and better understand relevant effects of contaminants. Important topics include:
  - Understanding sediment transport and deposition mechanisms in Newark Bay and the Hudson River;
  - Improving estimates of contaminant loading from stormwater and combined sewer overflows;
  - Evaluating sampling and analytical procedures for PAHs;
  - Determining how varying levels of sediment contamination affect bioaccumulation; and
  - Determining the factors causing sediment-related toxicity.

### **For More Information**

- Visit the CARP website – [www.carpweb.org](http://www.carpweb.org)

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