UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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OFFICE OF
LAND AND EMERGENCY
MANAGEMENT

MEMORANDUM

SUBJECT: Contaminated Sediments Technical Advisory Group Recommendations for Diamond Alkali Superfund Site's Operable Unit 3, Newark Bay Study Area

FROM: Karl Gustavson, Chair
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BACKGROUND

The U.S. Environmental Protection Agency's (EPA's) Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites Directive (OSWER 9285.6-08, February 2002, "Principles Memo") established the Contaminated Sediments Technical Advisory Group (CSTAG) to "monitor the progress of and provide advice regarding a small number of large, complex, or controversial contaminated sediment Superfund sites," which are known as "Tier 2" sites. CSTAG members are EPA and the U.S. Army Corps of Engineers (USACE) site managers, scientists, and engineers with Superfund sediment site characterization, remediation and decision-making expertise. One purpose of CSTAG is to guide site project managers to help ensure their sites are appropriately managed throughout the Superfund process in accordance with the 2002 Principles Memo, the Contaminated Sediment Remediation Guidance for Hazardous Waste Sites (EPA-540-R-05-012, December 2005; "2005 Guidance") and the Remediating Contaminated Sediments Directive (OLEM Directive 9200.1-130, January 2017; "2017 Directive"). The Diamond Alkali Superfund site in Newark, New Jersey, is a Tier 2 CSTAG site, and the site's contaminated sediment actions are subject to CSTAG review per EPA's policies and procedures. The Newark Bay Study Area (NBSA) is Operable Unit (OU) 3 of the site and is the subject of this review.

BRIEF DESCRIPTION OF THE SITE

Newark Bay is a 6.3-square-mile enclosed embayment on the western side of the New York/New Jersey Harbor Estuary. The Hackensack and Passaic Rivers flow into the bay on its northern side. On its southern side, the bay is connected to New York Harbor (New York) and Raritan Bay (New Jersey) through two tidal straits: the Kill Van Kull and Arthur Kill, respectively.

Port facilities, industrial facilities and Newark Liberty International Airport fringe the bay's western side, while residential and commercial buildings are present along its eastern side. The bay is adjacent to four large New Jersey cities (Newark, Elizabeth, Bayonne and Jersey City) and also borders Staten Island, New York, on its southern side. The New York/New Jersey state border crosses Newark Bay's southern portion at Shooters Island (a New York City park and bird sanctuary within the NBSA that is closed to the public).

The NBSA is part of the Diamond Alkali Superfund site, which consists of a former pesticide and herbicide manufacturing facility at 80-120 Lister Avenue in Newark, NJ (OU1) and the areal extent of contamination from the Lister Avenue facility, which includes; the lower 8.3 miles of the Lower Passaic River (OU2); the NBSA (OU3); and the 17-mile tidal portion of the Lower Passaic River from Newark Bay to Dundee Dam (OU4).

In 1987, EPA issued a Record of Decision (ROD) for OU1 that selected an interim containment remedy for the 80-120 Lister Avenue facility. The interim remedy consisted of capping, subsurface slurry walls and a flood wall, and a groundwater collection and treatment system. Construction was completed in 2001. In 2016, EPA issued an OU2 ROD, that selected a bank-to-bank capping remedy (with sediment dredging before the cap is installed). This remedy's design is currently in the remedial design phase; due to the navigational channel, the lowest 1.7-mile reach will be deepened.

The discovery of widespread dioxin contamination in the NBSA led the State of New Jersey to issue fish consumption advisories and prohibitions in 1983 and 1984. The tidal nature of the Passaic River, along with sampling and analysis, led EPA to conclude that the areal extent of Diamond Alkali's sediment contamination extended into Newark Bay. The Administrative Order on Consent (AOC) for the NBSA Remedial Investigation/Feasibility Study (RI/FS) was executed between EPA and Occidental Chemical in 2004. For the OU3 RI/FS, the NBSA is defined as Newark Bay and portions of key tributaries, including the Hackensack River, Arthur Kill, and Kill Van Kull. The NBSA RI field investigation was conducted from 2005 to 2016.

Glenn Springs Holdings, Inc. is currently performing OU2 remedial design activities as well as performing the OU3 RI/FS on Occidental Chemical Corporation's (the successor to Diamond Shamrock aka Diamond Alkali Company, the party responsible for the dioxin) behalf. The RI for OU3 is anticipated to be completed in the fall of 2020 and the FS in 2021. The Lower Passaic River Cooperating Parties Group is conducting the RI/FS for the 17-mile Lower Passaic River (OU4). The Lower Passaic River and NBSA RIs will be conducted in a comparable manner and with consideration of their linkages for the purposes of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) management decision-making and broader environmental management considerations.

SITE REVIEW

In November 2019, the Region 2 NBSA project team submitted the site information package (SIP) to CSTAG describing how the 11 principles and sediment guidance documents were considered in developing and conducting the RI/FS site characterization activities. On November 20-21, 2019, the Region presented those materials to CSTAG during an in-person meeting. The Community Advisory Group (CAG), the State of New Jersey, and Glenn Spring Holdings were invited to present and provide written materials, but all declined.

RECOMMENDATIONS

1. Site Management

The 4,077-acre NBSA is part of one of the Nation's largest and most complex contaminated sediment Superfund sites. As described in the conceptual site model (CSM, p. 2-1)[1], it is "*...one of the most urbanized and industrialized areas in the United States [and] has experienced more than two centuries of environmental degradation….*" The study area contains a major U.S. shipping port and navigation channel, industrial and municipal facilities, as well as parks and residential areas. The NBSA receives contaminant inputs from multiple small and large tributaries, and direct and indirect municipal and overland discharges. Biota, water and sediment in the NBSA are affected by multiple contaminants of concern (COCs) from current and historical releases. Clearly, the size of the study area and the number, magnitude, and complexity of contaminant releases, coupled to a long history of dredging, filling, and manipulating the (contaminated) sediment bed and estuary, are a challenge to developing a CSM to depict the *"...environmental system and the physical, chemical, and biological processes that determine the transport of contaminants from sources to receptors,..." including "...contaminant sources, transport pathways, exposure pathways, and receptors...."* (EPA 2005, p. 2-7).

The Region appropriately positions the CSM as an iterative effort that should be *"...maintained and updated throughout the life of site activities as new data and information become available..."* (CSM, p. 1-1). However, meaningfully understanding and documenting the source, pathways, and risk associated with over six square miles of currently known and unknown contributers of multiple COCs to Newark Bay that are managed by multiple entities (i.e., two states and multiple municipalities, federal programs, and responsible and participating parties) is both technically challenging and programmatically difficult. The multitude of COCs and the multi-faceted, ongoing nature of their release to Newark Bay presents site management challenges when juxtaposed against the Superfund program's defined process to address historical releases and attendant responsible parties.

CSTAG recognizes that the site characterization, remediation, and monitoring are likely to occur for decades. During this time, it is likely that new on- and off-site releases and deposits of COCs will be discovered and that a range of parties, operating under various laws and statutes, including Superfund, will be involved in addressing those releases.

Considering these issues, CSTAG recommends that the Region:

a. Establish or support mechanisms that anticipate and fulfill the long-term need for the compilation and maintenance of site data, collected from various areas and entities, in a manner that permits agency and stakeholder access and information sharing.

b. Recognize and manage the uncertainties associated with the characterization and remediation of complex estuarine systems by developing or supporting long-term monitoring and diagnostic programs that will enable the identification and refinement of COC concentrations and trends, and the processes affecting them.

c. To the extent possible, develop site workplans that embody the phased, iterative nature of data collection and permit sampling in areas and of media needed to update and refine site characterization as needed, and avoid the time-and resource-consuming re-negotiation of those agreements.

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[1] Conceptual Site Model, Newark Bay Study Area. January 2019. Revision 3. Available at: https://www.ournewarkbay.org/ConceptualSiteModel.aspx

d. Due to the potential contributions of multiple contaminated sites, including multiple Superfund and state-lead sites, adjacent to and in Newark Bay, the Region should consider, to the extent possible, other areas or cleanup mechanisms that are needed to fully address risks in the system.

2. Source Control

A critical element of site characterization is understanding COC sources to site sediment, water, and biota. The 2002 Principles Memo recommends: *"...As early in the process as possible, site managers should try to identify all direct and indirect continuing sources of significant contamination to the sediments under investigation..."* and that *"...site managers should assess which continuing sources can be controlled and by what mechanisms. It may be helpful to prioritize sources according to their relative contributions to site risks...."*

Controlling sources of COC input to the NBSA system is a significant challenge for cleanup and prevention of recontamination. Multiple contaminated tributaries, including those affected by upstream remediated, unremediated, and potential Superfund sites, flow into the NBSA. The Region appears to have a general understanding of areas and magnitude of input from tributaries. While inputs from the upstream OUs in the Passaic River are well characterized, studies of the other tributaries are primarily from older (2000-2003) surveys. Based on the materials provided in the SIP (p. 5) and CSM (Section 5.2), tributary COC sources appear uncontrolled.

With regard to current and former industrial facilities, the Region states only that: *"...Direct discharge and runoff are sources of a variety of contaminants from industrial commercial and manufacturing operations, landfills, and dredge spoils fill or deposit areas....*(SIP p. 6)" Based on this and similar statements, these sources – to the extent they are understood – appear to be uncontrolled, and their potential influence on the NBSA sediment bed was not provided. The Region described that:

> *...A number of steps have been taken to control contaminant releases to the NBSA; specifically, the implementation and enforcement of environmental regulations aimed at controlling discharges and releases to waterways [e.g., Clean Water Act (CWA), Resource Conservation and Recovery Act (RCRA), CERCLA, SPDES regulations] from POTWs, industrial sites, and contaminated sites in the watershed. Certain regional enforcement actions, such as ongoing remediation activities in the Lower Passaic River and Hackensack River watersheds, are expected to have a significant impact....*

Without understanding the sources, source strength, and control measures, it is unclear whether the 'number of steps' will address the ongoing COC source releases to the system and sitewide sediments, water, and biota. However, such sources and uncertainties should not necessarily curtail site progress. Principle 1 of the 2002 Principles Memo states: *"...where sediment remediation will have benefits to human health and/or the environment after considering the risks caused by the ongoing source, it may be appropriate for the Agency to select a response action for the sediments prior to completing all source control actions...."* The challenge for the site will be to develop cleanup(s) that reduce risk and are sufficiently resilient to recontamination from ongoing sources such that risk reduction progress is not lost. The 2002 Principles Memo further explains that this cleanup approach may take place as part of phased or interim actions (*see also* Recommendation 3).

a. CSTAG recommends that the Region seek to document and understand, to the extent possible, the nature, location, and influence of known sources of identified COCs on areas of the NBSA. The full

suite of COCs and source contributions should be included in the evaluation of ongoing COC inputs. The potential impact of these sources should be considered when evaluating where and to what level to remediate. [2]

b. CSTAG recommends that the FS alternatives consider the remedy in the lower 8.3 miles (OU2) of the Passaic River to have been implemented and the surface weighted average concentrations considered in the FS for the upper 9 miles (OU4) of the Passaic River to have been achieved. While the CSTAG understands there is some uncertainty in the timing and achievement of the RAOs for these actions, using this approach will allow the FS to proceed before the lower Passaic River 17 mile remediation is completed.

3. Risk Reduction Strategy

The Region's strategy for addressing unacceptable risk to NBSA receptors appears to focus on addressing areas of 2,3,7,8 TCDD contamination. During the site meetings, the Region communicated to CSTAG that because 2,3,7,8-TCDD is widespread, highly toxic, and co-located with multiple contaminants, this approach will address unacceptable risk in the NBSA. CSTAG understands the pragmatism of this approach because 2,3,7,8-TCDD has a high incidence of detection in sediment and biota and is a primary risk driver. However, the presence of tributaries and discharges (as described above), and disposal areas[3] contaminated with other COCs complicates the approach. The Region has sought to characterize a full range of the other COCs, including PCBs, metals, PAHs, and other organic contaminants in a spatially comprehensive manner. The findings demonstrate the presence of the range of COCs in the sediment bed in various areas and patterns. [4,5] This distribution may pose a challenge for a characterization and cleanup program premised on co-location with a single, primary COC (2,3,7,8-TCDD) (more or less so, depending on the selected 2,3,7,8 TCDD action levels). A potential concern is that despite cleanup, the NBSA would still pose unacceptable risks but from different COCs. The National Oil and Hazardous Substances Pollution Contingency Plan allows OUs to address "*...geographical portions of a site, specific site problems, or initial phases of an action...,*" thus, it may be reasonable to discretize an operable unit based on a highly toxic and prevalent COC, which may stem from a sole source. The NBSA's historical and current contaminant releases and their known complexity and history also suggest that a broader, COC, systemwide perspective may be beneficial to understand and manage risks. Invariably, the question will arise: "what COCs are left, where are they, will they cause risk, and will the risks be managed?". This issue will become particularly important if the Region decides to pursue a final, protective remedy

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[2] The spatial and temporal range of influence should be understood at a level sufficient to gauge the impact on NBSA remediation efforts. Inclusion and assessment of each source term in the NBSA modeling superstructures may not be necessary.

[3] A 27-acre CDF is located within a subtidal flat in the central portion of the Bay, between the Port Newark and Elizabeth Channels that was used to contain dredge and other materials that were unacceptable for disposal at other sites (CSM, p. 4-2).

[4] "…sediment data indicate that metals concentrations tend to be highest in the southern portion of the Bay and industrial waterfront areas, while concentrations of organic compounds are more variable between geographic/geomorphic areas, depending on depth. In surface sediments, PCDDs/PCDFs and PAHs tend to be higher in the northern portion of the Bay, while PCB and DDT concentrations are higher in the southern portion of the Bay." (CSM, p. 6-3).

[5] "No consistent horizontal pattern in concentrations throughout mid-depth and subsurface sediment depth intervals was observed."

for the NBSA, as post-remediation residual risk from the range of identified COCs should also be at acceptable levels throughout the site.

a. CSTAG recommends that, if the Region develops alternatives for a final remedy based on 2,3,7,8-TCDD and an assumption of colocation with other COCs, they clarify in the remedial action objectives and alternatives whether actions are intended to be protective for the other COCs. For example, the Region should document remedial goal exceedances of the other site COCs remaining outside proposed remedial footprints, if footprints are based on 2,3,7,8-TCDD. Such documentation would establish that the Region's approach will not leave unacceptable risks from the other COCs via exposure pathways to human and ecological receptors in the NBSA. The Region should also consider if their risk reduction strategy is to develop a final remedy for 2,3,7,8-TCDD, but an interim remedy for the other identified COCs.

b. CSTAG recommends the Region evaluate whether early actions or interim actions could be used to quickly reduce risks related to 2,3,7,8-TCDD. This risk management approach could facilitate decisions and site actions otherwise complicated by determinations of source control (see also recommendation 2a) and protectiveness for the full suite of identified COCs (see also recommendation 5a). In evaluating possible areas for early remedial action, the Region should focus on the highest risk and exposure, and lowest potential for recontamination, using an iterative process of analysis and identification. This process should recognize the influence and timing of the cleanups in adjacent, contributing areas. In particular, cleanup decisions need to recognize and accommodate the magnitude of risk reductions and effects from the Lower Passaic River source control actions, and the timing of those actions, as well as the potential for the NBSA areas to recontaminate remediated portions of the Lower Passaic River.

4. Data Collection to Support Alternative Evaluations

The 2017 Directive on remediating contaminated sediments recommends that: *"...at sites or portions of sites where unacceptable risks have been documented, site teams should consider focusing efforts on collecting data to evaluate and compare remedial alternatives early in the RI/FS*....(Recommendation 2)*"* In particular, the 2017 Directive recommends focus on understanding natural recovery and anthropogenic background concentrations of site COCs.

Given the size and complexity of the NBSA, it is likely that natural recovery processes vary throughout the area. The Region's analyses indicate contaminant burial in 'historically disturbed' areas with decreasing concentrations towards the top of cores (*i.e.,* vertical profiles of 2,3,7,8-TCDD concentrations show higher concentrations toward the bottom of the core profile). Cores from the 'undisturbed flats' often have higher surface contamination, which is not indicative of surface sediment COCs recovering via burial. The Region also indicates that the temporal comparisons between phase I/II samples (2005/2007) and phase III (2016) "may indicate a decrease in surface sediment concentrations" (SIP, p. 14), however, the Region did not present these analyses to CSTAG. As decision-making proceeds, more information will likely be needed to determine the mechanisms, locations, and rates of natural recovery, and evaluate its ability to achieve CULs in a reasonable timeframe. EPA's 2017 Directive discusses the importance of collecting data to evaluate and compare remedial alternatives early in the RI/FS, stating: *"...it is particularly important to start collecting natural recovery lines of evidence as soon as possible once a basis for action has been established and documented (i.e., long-term data demonstrating decreases in contaminant levels in sediment, water, and biota [EPA 2005, highlight 4-4])...."*

The 2017 Directive also reinforces EPA's 2002 memorandum on background concentrations[6], stating*:* *"...The contribution of background concentrations to risk associated with CERCLA releases may be important for refining specific cleanup levels for COCs that warrant remedial action. For example, in cases where a risk-based cleanup goal for a COC is below background concentrations, the cleanup level may be established based on background...."*

a. ***CSTAG recommends the Region continue to collect evidence to evaluate whether natural recovery is occurring within the NBSA, estimate the rate of natural recovery, and assess the likelihood that the mechanisms of natural recovery will continue. Such data may include regular bathymetry surveys, surface sediment sampling, and biota sampling, as well as sediment coring and radiometric analysis, and sediment traps. This information is critical to establish the specific areas or environments where natural recovery has occurred, or why it is not occuring. Such evaluations are needed to evaluate the protectiveness and long-term effectiveness of monitored natural recovery – either as a remedial alternative or as part of a combination remedy, as well as provide ongoing feedback on the relative success of source control efforts.***

b. ***CSTAG recommends that the Region conduct and support analyses appropriate to establish site-specific, background-based cleanup levels for the range of identified COCs. Source control timing and prospects will impact this derivation. CSTAG recommends that decision documents reflect the potential for changes in non-site-related COCs and/or an improved understanding of background concentrations by being clear that background-based cleanup levels will be revisited and revised, as necessary.***

5. Site Characterization

The three goals of the RI were to describe the nature and extent of COCs, support the risk assessment, and to determine the direct and indirect continuing COC sources. Phase III was the largest surface sediment sampling effort, collecting 173 samples, including ten composite samples taken within the navigation channel. The OU was divided into several subunits and a stratified, gridded sampling design was applied in each subunit. As described in the Phase III Sediment Investigation Field report[7] (p. 1-2), the objective was to fill nature-and-extent data gaps and by using subunits, to allow for decision-making at a spatial scale smaller than sitewide. Each subunit's sample size was derived "*as the minimum size necessary to estimate the mean concentration of 2,3,7,8-TCDD with less than 20 percent relative error at 95 percent confidence* (p. 1-3)." CSTAG notes that the objective of estimating a subunit's mean 2,3,7,8-TCDD concentration is different than the overall study objective of understanding the nature and extent of the identified COCs in the NBSA (and areas of elevated COC exposures), so it is unclear whether the nature-and-extent objective has been achieved. The latter objective requires professional judgment based on site understanding, inferences of possible COC releases, and a sample density that is unlikely to miss areas of elevated concentration.[8] Most importantly, it requires an estimate of the smallest spatial scale that might

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[6]OSWER Directive No. 9285.7-4 1. (September 2002) Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites. Available at: https://www.epa.gov/sites/production/files/2015-11/documents/background.pdf

[7] Final Newark Bay Study Area Phase III Sediment Investigation Field Report. Glenn Springs Holdings, Inc. June 2017 Revision 1. Available at: https://www.ournewarkbay.org/SamplingActivities.aspx.

[8] The topic of sampling objectives, including grid size determinations and "hot-spot" delineation are further described in EPA/240/R-02/005 (December 2002) Guidance on Choosing a Sampling Design for Environmental Data Collection for Use in Developing a Quality Assurance Project Plan. EPA QA/G-5S.

be relevant to the sampling objective and, ultimately, the remedial decision. There are approximately 280 surface sediment samples over the 4,077 acre site from the phased RI work; this sample density is relatively low considering the heterogeneity in location and concentrations of the multiple COCs, as well as the range of processes and environments that influence their fate.

a. ***CSTAG recommends that the Region determine whether existing data are sufficient to satisfy the nature and extent goals of the RI and sufficient to develop remedial alternatives protective of site receptors. The Region should evaluate the uncertainty of those determinations (especially in terms of the likelihood that potential areas of COC contamination were unsampled) and if that level of uncertainty is consistent with undertaking a final action intended to address the full range of COCs, receptors, and exposure pathways.*** Other objectives may require less sample density. For example, the assembled information may be sufficient to identify highly contaminated and/or high toxicity areas that warrant early action in a phased remediation approach and will be further characterized during remedial design sampling (*see* recommendation 3b on early actions). Iterative phases of spatially comprehensive, non-biased sampling (*see* recommendation 1b on monitoring programs) coupled with a higher density grid of stratified sampling in areas of interest will help identify additional areas for consideration in remediation while tracking system responses to source control and remedial actions.

6. Coordination on Navigational Dredging

The USACE New York District and Port Authority of New York and New Jersey have proposed a harbor deepening and widening project. While the precise location of these actions was not presented, there are many locations within the NBSA where widening the navigation channels in Newark Bay would disturb historically impacted tidal flats with elevated COC concentrations. Dredging such areas could resuspend contaminated sediment and create layers of high concentration residuals. Additionally, the dredging could impact the stability of tidal flats adjacent to the channel, potentially exposing contamination through erosion and creation of unstable side slopes prone to slumping. Deepening and widening of the navigation channels could also affect the rate of natural recovery processes in the tidal flat areas.

a. If a navigation channel deepening and widening or other modifications to the sediment bed are proposed, ***CSTAG recommends that the Region evaluate the impact of proposed actions on baseline risks, the fate and transport of contaminants, natural recovery processes, and potentially remediated areas within Newark Bay.*** Additionally, the Region should consider whether any navigational dredging projects – whether in the main channel or from side channels – have affected or will affect site risks owing to newly exposed sediment.

b. ***CSTAG recommends that the Region enhance communication and coordination within EPA and with the USACE, the Port authorities, and other relevant stakeholders. Specifically, the Region should enhance coordination and information sharing with the USACE to ensure that best available data inform Agency decisions. CSTAG also encourages better communication with Region 2's water programs (e.g., Clean Water Regulatory Branch/Dredging, Sediments and Oceans Section) responsible for reviewing the USACE's 404 sediment characterization plans and permits.*** Important topics include coordinating review and input on contamination and geotechnical stability evaluations; ensuring that the most recent COC data are considered during permit reviews; ensuring that dredged sediments are disposed at sites permitted to accept such wastes; and considering whether navigational dredging activities will impact Superfund remediation activities, for example, through recontamination.

7. Ecological Risk Assessment

a. Based on the information provided by the Region, CSTAG notes that the procedures and implementation of the ecological risk assessment appear to be generally consistent with the *Ecological Risk Assessment Guidance for Superfund* (EPA, 1997) and the *Guidelines for Ecological Risk Assessment* (EPA, 1998). However, it was unclear how the risk categories used to characterize risk (*i.e.,* low, medium and high risk or impact) will be used by EPA risk managers to evaluate whether the risk was acceptable or unacceptable, and how the results will be used to derive ecological receptor PRGs. ***CSTAG recommends that the baseline ecological risk assessment (BERA) clearly describes how the risk assessment's results serve as the basis for the unacceptable risk determination and how it will be used in decision-making.***

b. In the materials presented to CSTAG, the Region noted that the BERA would likely be conducted using multiple toxicity reference values (TRVs) for assessment endpoints. The use of multiple scientifically reviewed TRVs for assessment endpoints in the BERA could improve the risk manager's understanding of uncertainty in the risk characterization (*e.g.,* calculation and reporting of risk ranges) and how such uncertainty affects preliminary remedial goal (PRG) development. ***CSTAG recommends that, if completion of the BERA incudes the use of multiple TRVs for assessment endpoints, the Region should clearly explain the rationale in the BERA.***

c. In the materials provided to CSTAG, the Region noted that the Cooperating Parties Group's bioaccumulation model will include migratory species present in the bay for portions of the year. ***Due to their transient nature, CSTAG recommends against placing too much emphasis on migratory species in the risk assessments and evaluations of expected risk reduction. CSTAG recommends that, where possible, the BERA's risk assessments and future monitoring efforts focus on resident species.*** For example, *Fundulus heteroclitus* (mummichogs) could be a useful indicator of contaminant exposures and trends in localized areas that would otherwise be obscured by focusing on transient species with large home ranges. Mummichogs are abundant, have very small ranges, and are an important food source for higher level trophic species. Although mummichogs are not consumed by people (so they are not a direct human health risk indicator for fish consumption), their body burdens of COCs are influenced by sediment and water contaminant exposure pathways that also influence higher trophic level fish. The Office of Research Development has studied this species in Newark Bay and can provide information on their use for long-term monitoring and examining contaminant effects.

8. Community involvement

Principle 2 of the 2002 Principles Memo ("Involve Communities Early and Often") states:

> *...Meaningful community involvement is a critical component of the site characterization, risk assessment, remedy evaluation, remedy selection, and remedy implementation processes. Community involvement enables EPA to obtain site information that may be important in identifying potential human and ecological exposures, as well as in understanding the societal and cultural impacts of the contamination and of the potential response options...*

In the SIP (p. 7), the Region only described community involvement efforts, including municipal outreach, up to 2007. The community involvement plan, available on the NBSA public information website, indicates that it is intended to be a 'living document,' updated every three years, but the version posted is dated 2006. The most recent 'public outreach materials' on the website appear to be from 2008.

Late or absent community involvement can complicate and stall site progress. ***CSTAG recommends additional outreach, including a CIP update, to the affected communities of Newark Bay, in particular those in New York, that may have less awareness of risks and potential remediation. Such outreach would also provide opportunities for meaningful involvement as site investigations and remedial decisions progress.***