UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 2
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MEMORANDUM

SUBJECT: Region 2 Response to Contaminated Sediments Technical Advisory Group Recommendations – Newark Bay Study Area, OU3 of the Diamond Alkali Superfund Site

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TO: Karl Gustavson, Chair
Contaminated Sediments Technical Advisory Group
Office of Superfund Remediation and Technology Innovation

This document provides EPA Region 2's responses to the memorandum, "Contaminated Sediments Technical Advisory Group Recommendations for Diamond Alkali Superfund Site's Operable Unit 3, Newark Bay Study Area" dated April 22, 2020. That memorandum provides the Contaminated Sediments Technical Advisory Group's (CSTAG's) recommendations in response to Region 2's November 2019 site information package (SIP), which described how the 11 principles for managing contaminated sediment risk (OSWER Directive 9285.6-08) and other contaminated sediment guidance documents were considered in developing and conducting the Remedial Investigation (RI) activities for the Newark Bay Study Area (NBSA), and an in-person presentation to CSTAG regarding those materials and site tour on November 20-21, 2019. The Passaic River Community Advisory Group (CAG), the State of New Jersey, and Glenn Springs Holdings, Inc. (GSH) were invited to present and provide written materials, but all declined.

The Administrative Order on Consent (AOC) for the NBSA Remedial Investigation/Feasibility Study (RI/FS) was executed between EPA and potentially responsible party (PRP) Occidental Chemical Corporation (OCC) in 2004. The NBSA is identified as Operable Unit 3 (OU3) of the Diamond Alkali Superfund Site. 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, and a draft RI Report is to be provided to Region 2 in early July 2020 by GSH on behalf of OCC, the corporate successor to Diamond Shamrock Corporation/Diamond Alkali Company).

CSTAG's recommendations span a range of topics from overall site management and risk reduction strategy to source control and site characterization, alignment of data collection strategies with future remedial alternative evaluation (especially with respect to prospects for monitored natural recovery), the potential influence of navigational dredging in Newark Bay and the port channels on remedial strategy, clarification of ecological risk assessment findings, and robust community involvement and engagement. Region 2 greatly appreciates CSTAG's thorough review and thoughtful recommendations related to these topics, the forthcoming OU3 RI Report (anticipated to be completed near the end of calendar year 2020), and Draft FS Report due in the fall of 2021. Region 2's specific responses to CSTAG's April 22, 2020 recommendations are provided below. The Region's responses are as detailed as possible at this time; however, the review of the compiled draft RI report is still

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underway. While further data collection is not anticipated prior to the completion of the RI/FS, the Region will review and comment on RI data evaluations and presentations in light of CSTAG's recommendations and carry the recommendations forward through the process of completing the RI/FS and contemplating risk management decisions.

Each of the April 22, 2020 CSTAG recommendations is presented below, followed by Region 2's response.

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 contributors 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***

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

and stakeholder access and information sharing.

Response: Region 2 appreciates this comment. Region 2 maintains a database of environmental sample results collected from the various operable units (OUs) of the Diamond Alkali Superfund Site, including the NBSA. The database is available for download through the public websites www.ourPassaic.org and www.ourNewarkBay.org, as well as EPA's own electronic database, EQuIS. The database contains historical and recent sample data collected by EPA, and parties performing under EPA oversight, during multiple phases of work, including remedial investigations, remedial design, and removal actions conducted for the Diamond Alkali Site; it also includes data collected by the US Army Corps of Engineers (USACE)-New York District, New Jersey Department of Environmental Protection (NJDEP), the National Oceanic and Atmospheric Administration (NOAA), Rutgers University, and other pertinent sampling programs that have collected data from the study area such as EPA's Regional Environmental Assessment and Monitoring Program (REMAP) and the Hudson River Foundation's Contaminant Assessment and Reduction Program (CARP). Region 2 will continue to coordinate with agency partners and stakeholders to compile and make available data relevant to the Newark Bay Study Area and expand the database to support decision makers. The database is formatted consistently with EPA's Multimedia Electronic Data Deliverable (MEDD) requirements.

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.***

Response: Region 2 appreciates this comment and acknowledges the challenges this comment presents. Region 2 has recognized these uncertainties in both the design of RI sampling and in its discussions with the parties performing work under EPA oversight. Because the contaminants of potential concern (COPCs) for the NBSA are all strongly associated with particles, the sediments of the bay provide the key for understanding and tracking the net input of contaminants as well as the long-term recovery. During the Phase I, II and III of the NBSA RI, Region 2 made extensive use of sediment data to characterize the various geomorphic regions of the bay. In Phases I and II, Region 2 used samples of recently deposited sediments (Be-7 bearing) to identify the current major sources of contamination and the nature of solids mixing within the bay. Forensic analysis of the contaminant patterns in these data showed the absence of important 2,3,7,8-TCDD sources within the bay while providing evidence for a mercury source in the Port Newark area. In this manner, the sediment data were used to reduce uncertainties since any major source of the COPCs will impact the sediments and, in particular, will impact recently deposited sediments if the source is active. In Phase III, Region 2 also designed, a surface sediment sampling program which incorporated spatial variation in physical characteristics (e.g. geomorphic setting, grain size, bottom shear stress) as determined in Phases I and II, to establish a statistically robust measurement basis for long-term sediment contaminant monitoring. Discussions have been initiated with the party performing the RI/FS regarding incorporating long-term monitoring programs in sediment, water and biota in the remedial alternatives that will be evaluated for the NBSA, to assess the response of Newark Bay to remedial action(s) in Lower Passaic River as well as any NBSA remedial activities or MNR.

Region 2 is beginning the estimation of future conditions using mechanistic models of sediment, water and fish tissue for NBSA. The forthcoming estimates of contaminant concentrations in these media will be used to evaluate future risks. The models will subsequently be run for various assumptions regarding the planned (OU2, the lower 8.3 miles of the Lower Passaic River) and potential (OU3, NBSA) remedial actions to estimate the level of uncertainty in forecast conditions associated with the timing of potential actions in different parts of the bay. In

addition, Region 2 plans to perform a sensitivity evaluation to account for the effect of a potential interim remedy for the upper 9-mile reach (part of OU4, the 17-mile Lower Passaic River Study Area) on Newark Bay FS results.

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.***

Response: The Region agrees with the concept that for complex sediment sites, where possible, workplans that allow for phased iterative work can be useful. For the NBSA, Region 2 notes that EPA already has an administrative order on consent (AOC) and statement of work (SOW) in place for the RI/FS that embody a phased approach to the investigations performed to date. As a result, extensive, long-term sampling of the bay has been conducted over the last 15 years. Taken together, these studies provide a good representation of bay conditions. The Phase III program was also designed to serve as the framework for future long-term monitoring elements, to be incorporated into alternatives evaluated for the NBSA in the FS. CSTAG's recommendations may also be relevant to the negotiation of agreements and SOWs for future phases of work at NBSA when new agreements may be needed (e.g. the remedial design and remedial action).

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.

Response: In considering this matter, it is important to keep in mind that the NBSA is an operable unit of the Diamond Alkali Superfund Site on the south/west bank of the Lower Passaic River in Newark. This is significant because the risks posed by the Diamond Alkali site (and the areal extent of its contamination both farther up the Passaic River and into Newark Bay and beyond) are the primary target of EPA's response. The primary contaminants associated with releases from the Diamond Alkali site are 2,3,7,8-TCDD and DDT; however, other contaminants in Newark Bay that are co-located with these contaminants would also be addressed by a potential remedy or interim remedy.

Evaluation of surface sediment contaminant concentrations in Newark Bay has identified contaminant sources with the ability to substantively impact Newark Bay sediment quality. For example, surface sediment mercury data indicate a source of mercury at the head of the Port Newark Channel that is clearly discernible in an evaluation of sediment across the length of the bay. (This source is being addressed in a separate remedial investigation for another Superfund site.) The Draft Remedial Investigation Report will present these data evaluations and accompanying Conceptual Site Model conclusions to identify important sources of contaminants. Similarly, Region 2 will evaluate the results of RI/FS efforts at other Superfund sites in and affecting Newark Bay, as appropriate, to understand the cumulative risks in the Newark Bay system and evaluate the appropriate management of remedy implementation. Region 2 agrees that it is important to coordinate with NJDEP and NYSDEC on a regular basis to maintain awareness of any potentially significant contaminant sources to Newark Bay identified by the New Jersey and New York (a small area of the southern part of the bay, including Shooters Island, is in New York) partner agencies and state-lead enforcement efforts to address these. Another potential source of impacts to the NBSA is sediment resuspension within the NBSA caused by commercial navigation. Region 2 will coordinate with the Port Authority of NY/NJ and the USACE-NY District to explore the potential for institutional controls to reduce resuspension and to forecast changes in sediment fate and transport within Newark Bay that may be driven by future expansions of the navigation channels.

In this context, the development and refinement of the RI by performing party Occidental Chemical Corporation (OCC) through its representative Glenn Springs Holdings, Inc. (GSH), as directed by Region 2, and data generated by partner agencies, are the primary means of identifying contaminant sources in areas outside/adjacent to the bay itself for remedial alternatives evaluation in the FS. Region 2 is in the process of reviewing draft chapters of the RI as they are developed and submitted by OCC/GSH.

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]

Response: From the perspective of both risk and the investigation of NBSA as an operable unit of the Diamond Alkali site, the primary COPCs in NBSA are 2,3,7,8-TCDD and DDT; Region 2 is confident that the source of these particular COPCs to NBSA has already been well characterized as part of the RI of the Lower Passaic River, as well as from various lines of evidence within NBSA. These lines of evidence include:

- Fate and transport modeling, and physical and chemical measurements in the water column within NBSA as well as the major tributaries to NBSA which shows net export of sediment and COPCs from the Lower Passaic River into NBSA;

- Core profiles of 2,3,7,8-TCDD relative to the time of deposition which shows consistency with the manufacturing history associated with this contaminant at the former Diamond Alkali facility in Newark at River Mile 3.5 of the Lower Passaic River;

- Spatial profiles of beryllium-bearing sediments and COPC concentrations in the sediment which shows the clear impact of contaminant export from the Lower Passaic River on NBSA sediments; and

- Chemical fingerprinting analyses which show, in general, consistency between various chemical signatures associated with the 2,3,7,8-TCDD released from the Diamond Alkali facility and the sediments in NBSA.

These evaluations will be documented in the RI Report for NBSA.

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.

Response: Region 2 agrees with the concept of accounting for the effect of remedial action in the Lower Passaic River as part of the FS alternatives for Newark Bay. Rather than making assumptions about the post-remedy surface weighted average concentrations (SWAC) in the Lower Passaic River, the Newark Bay FS model simulations will include a representation of the remedial action in the lower 8.3 miles (OU2) of the Lower Passaic River. The modeling previously completed by EPA in 2015 to support the OU2 Focused Feasibility Study (FFS), and started for the Newark Bay FS, explicitly includes releases of sediment and contaminants during remedial action dredging. By simulating dredging releases during the OU2 remedial action, the model is able to account for transport of contaminants released during dredging and subsequently transported to Newark Bay. Region 2 considers that it is preferable to represent the remedial action in the model simulation in this way, rather than

[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.

assume a post-remedy SWAC without accounting for increased contaminant transport to the bay. In fact, simulating the remedial action through the OU2 FFS modeling allowed for the comparison of alternatives to include quantitative metrics for contaminant transport to Newark Bay and impact on Newark Bay SWACs as part of EPA's remedy selection process for OU2. These metrics highlighted the negative impact in Newark Bay from the deep-dredging alternative evaluated by EPA, compared to the alternative that became the selected remedy.

Assuming a post-remedy condition for the portion of OU4 between RM 8.3 and Dundee Dam (upper 9-mile reach) is complicated by the fact that Region 2 has yet to issue a Proposed Plan identifying a preferred alternative, let alone select a remedy, and it would not be appropriate for the Region to speculate about the outcome of the remedy selection process. Rather than perform parallel Newark Bay FS model simulations for each of the upper 9-mile interim remedy alternatives, Region 2 plans to perform a sensitivity evaluation, in which an OU4 alternative will be included in one Newark Bay FS simulation. This will provide a basis for evaluating how to account for the effect of a potential interim remedy for the upper 9-mile reach on Newark Bay FS results.

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 for the

[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."

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.

Response: EPA Region 2 anticipates that the remedial alternatives evaluated for Newark Bay, as OU3 of the Diamond Alkali Superfund Site, will be focused on addressing the hazardous substances released from the former Diamond Alkali facility at 80 Lister Avenue, now present in the NBSA, and other significant co-located risk drivers. The human health risk assessment for OU3 identified the primary risk drivers as PCBs (from multiple sources) and 2,3,7,8-TCDD (primarily from the Diamond Alkali facility in Newark). Acute sediment toxicity for benthic invertebrates was not correlated with any particular contaminant and was only observed in three locations. Chronic sediment toxicity, which was both more widespread and variable than the acute results, was also demonstrated. Region 2 anticipates that additional sediment delineation in OU3 (which would be performed during the predesign investigation), whether for human health or ecological risk considerations, will focus on areas identified by concentrations of 2,3,7,8-TCDD, which will also address risk associated with PCBs. If additional areas are identified that need to be addressed to further reduce risk, because of PCBs or other contaminants, they will also be addressed if co-located with 2,3,7,8-TCDD and DDT. To the extent that there are other contaminants in the NBSA that pose unacceptable risk but are not site-related, i.e., contaminants released from the Diamond Alkali facility in Newark, these may ultimately be addressed through another cleanup mechanism. Any delineation of sediments in the NBSA would be assisted by the modeling of future concentrations for various remedial alternatives and the evaluation of future risks based on modeled output.

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.

Response: Region 2 agrees with the recommendation to evaluate whether early or interim actions could be used to more quickly reduce ecological and human health risks in the NBSA. The evaluation will consider the effect of the remedial action being designed for the lower 8.3 miles of the Lower Passaic River, which is the largest source of 2,3,7,8-TCDD to Newark Bay. A combination of data analyses and modeling is being used to evaluate temporal trends in contaminant exposure concentrations in the bay, and the forecasted effects of the remedy in

the Lower Passaic River. The forecasted trends in exposure concentrations account for both expected increases in contaminant transport from the Lower Passaic River to Newark Bay during the lower 8.3-mile remedial action, and reductions in contaminant transport following the remedial action. Evaluation of potential early or interim actions will consider both negative and positive effects of the lower 8.3-mile remedial action on candidate locations in NBSA.

The modeling suite used for both the Lower Passaic River and Newark Bay includes hydrodynamic, sediment transport, contaminant fate and transport and bioaccumulation components. In addition to 2,3,7,8-TCDD, the modeling analyses include PCBs, four additional dioxin and furan congeners, 4,4'-DDx and mercury, which represent the primary and several secondary NBSA risk contributors. If an area in Newark Bay is identified for the evaluation of an early or interim action on the basis of 2,3,7,8-TCDD concentrations, evaluation of the impact of the action, in combination with the lower 8.3-mile remedial action, will also include other risk drivers than 2,3,7,8-TCDD. Changes in contaminant concentrations in water, sediment and fish tissue can then be used to assess reductions in ecological and human health risk.

The potential for sediment transport from Newark Bay to recontaminate the remediated portions of the Lower Passaic River was evaluated as part of analyses that supported the remedy selection for the lower 8.3 miles of the Lower Passaic River. In those analyses, no action was assumed as the response for Newark Bay; certain remediation activities implemented in Newark Bay are likely to lessen long-term recontamination of the lower 8.3 miles of the Lower Passaic River due to contaminant transport from Newark Bay in the future.

While not an action, EPA Region 2 notes that, subsequent to the November 2019 CSTAG meeting, EPA Region 2 memorialized for administrative purposes the boundary between OU2, the lower 8.3 miles of the Lower Passaic River, and OU3, the Newark Bay Study Area, where the two meet at Kearny Point. The boundary had not previously been defined or memorialized. Taking into account data collected for both OU2 and OU3 and the engineering design of the cap for the Kearny Point subtidal flat required as part of the OU2 remedy, EPA determined that the entirety of the Kearny Point subtidal flat would be encompassed in OU2.

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 occurring. 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.

Response: Region 2 agrees on the importance of collecting additional data in the future to evaluate natural recovery and expects to evaluate continuing targeted monitoring efforts for evaluating natural recovery during design. In addition, Region 2 also believes that the existing data, analyses, and CSM support the continued evaluation of the feasibility of natural recovery for specific areas within NBSA in the FS. There are several lines of evidence indicating areas of ongoing natural recovery and the potential for future natural recovery. These areas include the historically disturbed areas as well as some areas outside the historically disturbed areas. The historically disturbed areas were historically dredged for navigational purposes but are no longer maintained at the former design depths and have experienced sedimentation over time. Because many of these areas are still deeper than adjacent undisturbed areas, they will likely experience further infilling. Review of sedimentation rates (using Cesium-137 data) and downcore profiles of increasing 2,3,7,8-TCDD concentrations with increasing depth also suggest that natural recovery has historically occurred in these areas. When an interpretable Cs-137 profile is obtained, these cores document the suspended sediment contaminant burden over time, as suspended sediments steadily accumulate at these locations. Cores obtained near the mouth of the Passaic River and near the mouth of the Kill van Kull show substantial declines in the main COPCs; for example, concentrations of 2,3,7,8-TCDD declined by 96 to 98 percent since 1963. Under Region 2's direction, the party performing the RI/FS also conducted a spatially representative study of surface sediment concentrations sampled in multiple years across the bay. This study also provides an estimate of the rate of recovery for the bay as a whole, integrating across depositional and non-depositional areas. These results suggest rates of decline of approximately 3 percent per year for 2,3,7,8-TCDD in the last decade. Notably, surface sediment concentrations for 2,3,7,8-TCDD in some areas are also higher than mean particulate-phase concentrations in the water column, thus indicating the potential for

[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

further natural recovery in these areas.

In contrast, the undisturbed sub-tidal shallows represent areas that were not historically modified for navigational purposes. These have generally experienced relatively low sedimentation rates, contain relatively shallower depth of contamination, and in some cases show 2,3,7,8-TCDD concentrations increasing from the bottom of the core towards the sediment surface. In some cases, such as the undisturbed shallows around Shooters Island, although contaminant concentrations are highest at the sediment surface, they are orders of magnitude lower than maximum concentrations found at depth in the historically disturbed areas. Some locations in the sub-tidal shallows also include areas with decreasing concentrations towards the sediment surface, indicating natural recovery. In other cases, such as the sub-tidal shallows in the southwest corner of NBSA, the relative distribution of various contaminants such as 2,3,7,8-TCDD, PCBs, mercury, and DDT is a function of the deposition history, the timeline of contaminant releases to the system and the changes in circulation in the area caused by the construction of a dike in the 1920s. Region 2 will continue to analyze the existing data in order to refine the CSM for NBSA and understand the potential for future natural recovery in individual areas.

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.***

Response: Region 2 recognizes the importance of the background or baseline conditions for the NBSA. Newark Bay has two main inputs of solids, the Lower Passaic River and Upper New York Bay. Of the two, Upper New York Bay is the more important, and the fraction of solids contributed by either input varies across the NBSA roughly depending on proximity. The two solids inputs constitute the baseline level of COPC presence in the bay, with the absolute baseline COPC concentration at any location dependent on the relative solids contributions of the two inputs and the relative contaminant concentrations in the two sources. In its study of Newark Bay, Region 2 has made extensive use of data sources from NOAA (REMAP) and the Port Authority of New York and New Jersey. These data characterize the solids entering Newark Bay via the Kill van Kull, the major conduit of solids from Upper New York Bay. For all COPCs, the solids entering via the Kill van Kull are less contaminated than the surface sediments found in Newark Bay. Solids originating from the Lower Passaic River have been extensively characterized as part of the OU2 investigation. These solids are generally more contaminated than the surface sediments of Newark Bay. The NBSA analysis reflects Region 2's recognition that the solids entering from the Lower Passaic River will undergo a dramatic reduction in contamination levels as a result of the remediation. It will also be the case that after the OU2 remediation, within the contamination delivered to Newark Bay by the Lower Passaic River, contamination on solids originating above Dundee Dam will factor more heavily than contaminants from the inventory below the dam, although at much lower absolute concentrations than are delivered by the Lower Passaic River presently. This reduction has been extensively modeled as part of the OU2 and OU3 programs. As the remedy in the lower 8.3 miles (OU2) progresses, Region 2 intends to monitor the solids from these two inputs (i.e., the Lower Passaic River and Upper New York Bay) as they enter and deposit in the NBSA as a basis to track baseline conditions over time, as suggested by CSTAG.

As part of the NBSA investigation, Region 2 has examined the mixing of the solids inputs as reflected in the COPC trends with distance along the Newark Bay axis. These trends were developed from the 2005-2007 Be-7-bearing surface sediment collection program. To the extent that there are contaminants (e.g., mercury) whose

trend across the bay is indicative of sources unrelated to OU2, these contaminant sources may ultimately be addressed through another cleanup mechanism.

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 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.

Response: The existing data are sufficient to satisfy the nature and extent goals of the RI and to develop remedial alternatives for the FS. The most recent sampling program conducted for the NBSA was the Phase III surface sediment sampling program conducted in 2016. The Phase III program consisted of the collection of 173 surface

[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.

sediment samples from a grid on the subtidal flats and 10 composite surface sediment samples (from 46 sampling locations) from the navigation channel, where ship traffic acts to mix recently-deposited sediment. The rationale for a lower sampling density in the navigation channels is associated with the fact that the harbor deepening project recently dredged the active channels to 50 feet, into geological age material, and they are subject to regular maintenance dredging.

Approximately 45% of Newark Bay's 4,077-acre area is occupied by the navigation channels and the transitional slopes. The Phase III samples are focused on the remaining area of approximately 2,200 acres of subtidal and intertidal flats and their historically disturbed areas, where elevated concentrations of COPCs are encountered.

Human health risk due to consumption of fish tissue is the driver for remedial action (due primarily to fish tissue concentrations of 2,3,7,8-TCDD and PCBs). Given that sport fish consumed by humans integrate contamination over large areas, the RI does not require a highly spatially-resolved sediment dataset to support remedial decision making. The RI dataset is adequate to characterize and support decision-making for modestly-sized subareas of the NBSA. It is possible that there are uncharacterized areas of contamination, but not at the scale that would impact fish tissue concentrations that ultimately drive human health risk. There are fairly strong correlations between geochemical evaluations of sediment contamination trends observed from the Lower Passaic River, across Newark Bay from north to south, and into the Kill van Kull/NY Harbor that are also consistent with water column suspended solids data and sediment core profiles. These evaluations will be presented in the RI Report for review.

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.

Response: Region 2 agrees that it will be important to evaluate the effect of proposed modifications to the sediment bed of Newark Bay, if actions such as navigation channel deepening and widening are proposed. Region 2 understands that the USACE is undertaking a feasibility study of deepening and/or widening the navigation channels; however, decisions have not yet been made regarding proposed new depths or widths that could be evaluated as part of the NBSA RI/FS, at this time.

Tools that have been developed for the RI/FS are well-suited for evaluating the effects of modifications to the sediment bed, such as navigation channel deepening and widening. Deepening and widening of the

navigation channels would have an effect on the hydrodynamic circulation patterns, salinity intrusion, solids fluxes from New York/New Jersey Harbor, and bed shear stresses. These changes would affect sediment and contaminant deposition and erosion patterns, and larger ships could alter ship-induced resuspension rates from presently experienced levels. Widening and deepening of the navigation channels could cut into historically deposited contaminated sediment as the channel side walls are cut back for stability. The potential for this to expose more-highly contaminated sediment would need to be evaluated.

Coordination with the USACE-NY District has occurred through the RI/FS project, on a regular schedule during some periods and on an ad hoc basis during other times. Coordination with the USACE NY District will continue as the deepening/widening feasibility study progresses.

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.

Response: The Region communicates with the relevant stakeholders as needed. The USACE and Region 2 met monthly and coordinated activities during the most recent Harbor Deepening Project. Also, contact has been initiated with USACE regarding the ongoing feasibility study for future additional harbor deepening. The Region coordinates with natural resource trustees (i.e., NJDEP, NOAA, and USFWS) regarding the oversight of RI/FS submittals by OCC/GSH and will be submitting the draft RI to NYSDEC for their input also. The Region will continue to evaluate opportunities to further communicate with the USACE on issues as they arise, so that future efforts are coordinated.

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.***

Response: Region 2's feedback to OCC/GSH on the revised draft BERA included a number of comments that pertain to this question. Region 2 has directed OCC/GSH to identify all combinations of receptors and chemicals of potential ecological concern (COPECs) resulting in hazard quotients greater than 1 as preliminary COPECs that need to be evaluated in the FS; other risk findings (i.e., NOAEL- or LOAEL-based HQs that are less than or equal to 1) will be considered to represent acceptable risks. In the BERA,

OCC/GSH will also categorize preliminary COPECs by whether unacceptable risk is considered "possible", "unlikely" or "uncertain" with the middle category likely eliminated from PRG development consideration. Region 2 expects that the BERA, when final, will identify a process that includes evaluation of a number of factors (including site relevance, existence of a dose-response relationship, spatial extent and quality and quantity of the data) that are used to determine whether results are considered possible or unlikely. All relevant information on the relative strengths and weaknesses of individual LOE (line of evidence) used in the categorization process will be summarized in the BERA and carried forward to the FS. As an initial step in the FS, EPA will review all information from the RI, BERA and HHRA to make a risk management decision on which areas and compounds (i.e., COPCs/COPECs) should be included for remedial alternatives. PRGs will only be developed for the final set of COPCs/COPECs. EPA will ensure through discussions with and oversight of OCC/GSH that appropriate remedial alternatives are evaluated in the FS.

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.***

Response: The weight of evidence process outlined in the BERA, which is expected to be finalized soon and will be used in the development of the FS, uses both different lines of evidence as well as multiple Toxicity Reference Values (TRVs) to present risk managers with a more complete understanding of risk characterization uncertainties. This in turn will provide more flexibility in the decision-making process and the establishment of the appropriate risk-based threshold concentration – PRG – for each final COPEC. Region 2 is currently reviewing the revised BERA and if it determines that the rationale for retaining multiple TRVs for consideration in the FS is unclear, the Region will direct OCC/GSH to clarify the rationale prior to finalizing the document.

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.

Response: Region 2 recognizes the decision-making uncertainties associated with use of risk results derived for migratory species and agrees with the CSTAG suggestion that future monitoring efforts should focus on resident species to the extent possible. For the fish population assessment endpoint, the BERA includes LOEs for resident

species including mummichog egg tissue residue modeling and the evaluation of previous work by Bugel and coworkers that assessed the reproductive health of Newark Bay mummichogs compared to a reference population.[9] However, this species, which is limited to intertidal and shallow subtidal portions of the bay, may not be particularly appropriate for monitoring remedial effectiveness of deeper sediments.

The BERA also identified unacceptable ecological risks in white perch and although this species doesn't spend its entire life cycle in the NBSA, it is a dominant component of the fish community and plays an important ecological role there. In addition, fish tissue samples for migratory species such as white perch and flounder were collected near the end of their seasonal occurrence in the bay. This was done with the goal of maximizing the linkage between NBSA sediment and tissue contaminant concentrations and thus their relevance for decision-making. Region 2 plans to evaluate the above considerations further during the development of the post-remedy monitoring program.

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.***

Response: In 2005, Region 2, working with a number of federal and state partner agencies, prepared and released for public comment, a combined Community Involvement Plan (CIP) for what was then known as the Lower Passaic River Restoration Project and Newark Bay Study. After a thorough review of the public comments received, the final CIP was issued in 2006. After issuance of the ROD for OU2, Region 2 recognized the need for a more targeted CIP for the lower 8.3 miles, and issued a CIP in July 2017 focused on outreach for the OU2 cleanup, though noting that recommendations in the CIP may apply to other portions of the river, and to Newark Bay, which can be found at https://semspub.epa.gov/work/02/538469.pdf.

With progress on the RI/FS for the NBSA, the Region recognizes an opportunity to develop a CIP focused on

[9] Incidentally, Region 2 would appreciate being provided the site-specific ORD mummichog data mentioned in the CSTAG comment.

Newark Bay outreach.