UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 2

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SUBJECT: Region 2 Response to CSTAG Recommendations on the Lower Passaic River Project Early Action

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TO: Steve Ells, Chair
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The Lower Passaic River Restoration Project team briefed the Contaminated Sediments Technical Advisory Group (CSTAG) on the Lower Passaic River Early Action evaluation on February 12, 2008. The briefing was based on a draft Focused Feasibility Study (FFS) completed in June 2007. On April 1, 2008, CSTAG provided recommendations to the Region. Before responding to each comment individually, a general discussion of CSTAG's key concerns and the approach developed to address those issues going forward is provided below.

It is important to note that the April 1, 2008 CSTAG comments were provided without the benefit of the results from a significant data gathering effort conducted by the Region in late 2007 and early 2008. CSTAG's comments were based on information used to support the draft FFS issued in June 2007. Many of the comments raised in the CSTAG recommendations had already been raised by other internal and external reviewers of the draft FFS. As a result, the Region formulated the 2007-2008 sampling program and additional modeling and sediment stability work to address most of the concerns raised in the recommendations, with assistance from outside sediment and modeling experts.

General Discussion

The Region believes that the comments within CSTAG's recommendations that are of most significance to the remedy selection process can be summarized in the following major concerns:

- Need more data to characterize nature and extent of contamination in the Lower Passaic River.
- Need more data to characterize outside sources of contamination to the sediments of the lower eight miles of the Passaic River.
- Need to demonstrate that resuspension of legacy sediments in the lower eight miles is responsible for high levels of dioxin in surficial sediments.
- Need to clarify uncertainties regarding the use of historical data from high resolution cores combined with resuspension and sediment transport assumptions to forecast post-remediation contaminant concentrations.
- Need to evaluate the effectiveness of limited early actions in erosional zones.

As mentioned previously, many of CSTAG's concerns were raised by other stakeholders commenting on the FFS in the summer of 2007. The Region convened its consulting team and a group of outside experts to develop a sampling and sediment transport modeling approach to address many of these concerns. This collaboration resulted in the field sampling effort which was completed in early 2008 and the ongoing development of a sediment transport model to evaluate the assumptions in the Conceptual Site Model-Empirical Mass Balance (CSM-EMB).

Regarding the need for more data to define the nature and extent of contamination, there is a significant dataset available to characterize the sediments in River Mile (RM) 1-7, including over 850 samples from over 130 coring locations, which have been used to develop the CSM. This data will be better displayed in the revised CSM to document the understanding of contaminant nature and extent. In addition, in May 2008, the Region is planning to collect surface sediment samples in RM0-1 to further characterize the nature and extent of contamination. These data will be used in conjunction with the 2007-2008 sampling program described below.

Between December 2007 and March 2008, the following data were collected to quantify sources of contamination to the sediments of the lower eight miles of the Passaic River:

Head of Tide	Water column suspended sediments	2 samples
	Surface sediments	4 samples
	Sediment traps	2 samples
Tributaries (Second, Third, Saddle Rivers)	Water column suspended sediments	2 samples per tributary
	Surface sediments	2 samples on Third 4 samples on Saddle
	Sediment traps	2 samples per tributary
Combined Sewer Overflows (CSOs) and Storm Water Outfalls (SWOs)	Suspended sediments	4-5 CSOs, 2 samples each 4-5 SWOs, 3 samples ea.
River Mile (RM) 0-17	Surface sediment	23 samples
RM 8-17	Sediment probing	Over 600 locations
	Low resolution cores	20 cores, 2 samples each

Additional data to characterize contamination coming from above Dundee Dam and from Newark Bay have been obtained 1) by analyzing cores collected above Dundee Dam by Rensselaer Polytechnic Institute (RPI) and 2) from low resolution cores collected as part of the on-going Newark Bay remedial investigation and feasibility study (RI/FS)

The data from Region 2's 2007-2008 sampling effort, the RPI cores and the ongoing Newark Bay RI/FS are being incorporated into the CSM-EMB to reduce uncertainties and ensure its effectiveness as a tool to evaluate the significance of on-going source inputs to the river, to predict post-remedial surface sediment concentrations and to estimate long-term risk reduction that may result from an Early Action. The new sampling data further confirm that it is the resuspension of legacy sediments that results in the high concentrations of dioxin in the surface sediments of the lower eight miles of the Passaic River. Previous to this sampling effort, there was little site-specific data from CSOs, SWOs and tributaries to the Passaic River, resulting in uncertainties in the CSM-EMB that were considered problematic by many stakeholders. The

Region believes that the new source data eliminates much of this uncertainty and supports the CSM-EMB's conclusion that the resuspension of legacy sediments in the lower Passaic River is the most significant risk driver in the system.

The Region has also worked with experts to develop a sediment transport model to evaluate the assumptions in the CSM-EMB and to further evaluate whether limited early action alternatives could be effective in reducing risks from the highly contaminated sediments that exist throughout the lower eight miles of the river. Region 2 has also completed a thorough sediment stability analysis based on bathymetry data over time that demonstrates that erosional and depositional areas shift unpredictably from year to year. This analysis will also be incorporated into the CSM-EMB and the sediment transport model, to evaluate the effectiveness of reducing risks by addressing only a portion of the sediments in the lower eight miles of the river.

Finally, the Region believes that the additional data collected in 2007-2008, combined with high resolution core data from 2005 and the sediment transport modeling effort will collectively provide enough lines of evidence to add reasonable certainty to forecast post remediation sediment concentrations.

Below is a point by point response to CSTAG's recommendations, grouped according to the 11 sediment principles, as CSTAG provided them to the Region (CSTAG comments are in italics). Some recommendations have been paraphrased or grouped to reduce repetition in our response.

<u>Principle #1: Control Sources Early</u>

- *In order to more reliably predict the expected effectiveness of the remedial options in reducing risks, the Region needs to evaluate more quantitatively the relative contribution of risks from dioxin and PCBs entering from upstream (i.e., over Dundee Dam), from tributaries, from combined sewer outfalls (CSOs), and from instream sediments above mile eight and from Newark Bay. Therefore, CSTAG recommends that additional data be collected in order to better characterize the contaminant loads that enter the lower eight miles (i.e., from upstream of the early action area) and that enter the LPR from upstream of the Dundee Dam. The significance of inputs from downstream (Newark Bay) and lateral loading (from outfalls and tributaries) should be evaluated as well...; AND*
- *In order to further evaluate the Region's predictions resulting from the EMBM, additional information should be collected to confirm the estimate that 95% of dioxin currently accumulating in the river bottom is from resuspension and subsequent deposition of the bedded legacy sediments; i.e., an internal source is driving the current risk and need for an early action....*

As described in the general discussion above, Region 2 has just completed a major sampling effort to collect data above Dundee Dam, in the tributaries, from CSO and SWOs and in the sediments throughout the river. These data, combined with newly analyzed data from RPI cores and data collected as part of the on-going Newark Bay RI/FS are being incorporated into the revised CSM-EMB to assist in evaluating the significance of on-going sources that may need to be addressed before taking an Early Action, in predicting post-remedial surface sediment concentrations and in estimating long-term risk reduction that may result from an Early Action.

All of the data confirm the CSM-EMB's prediction that the major source of on-going dioxin contamination to the tidal Passaic River and Newark Bay is resuspension of legacy sediments in the lower eight miles of the river.

Principle #2: Involve the Community Early and Often

- *...[T]he Region should consider sharing site information earlier and provide more frequent updates as new data become available. The Region should consider hosting public information and input sessions when developing and refining treatment and disposal options for contaminated sediments.... If the proposed remedy is expected to include a CDF, discuss the potential locations with the communities and stakeholders as early as possible.*

Region 2 will continue to use its well-established structure of quarterly Project Delivery Team (PDT) meetings and periodic Remedial Options Work Group meetings to share information on the Early Action. The Work Group includes representatives from all six partner agencies, potentially responsible parties, environmental and community groups, and meets to discuss technical details of the Early Action. We are planning to hold a Work Group meeting in May 2008 to discuss the new Early Action alternatives, reconfigured to address public comments received on the draft FFS (June 2007). The alternatives include treatment and disposal options for contaminated sediments, which will be discussed with the Work Group. In addition, in recent months, Region 2 has met several times with local government officials to discuss the Early Action, focusing on treatment and disposal options, including potential use of a confined disposal facility (CDF).

- *The Region should use the information in EPA's 2005 Contaminated Sediment Remediation Guidance for Hazardous Waste Sites and the 2007 National Research Council report: Sediment Dredging at Superfund Megasites Assessing the Effectiveness to assist in communicating to stakeholders that this site presents several challenges for effective dredging and capping, and that it may take many years, if not decades, to reach remediation goals (RGs) for this site.*

Region 2 is relying on the above referenced documents and guidance from the Office of Solid Waste and Emergency Response to more effectively communicate risk management decisions related to the Early Action.

Principle #3: Coordinate with States, Local Governments, Tribes, and Natural Resource Trustees

- *Clarify the roles and regulatory responsibilities of the partner agencies. For example, clarify what work is being done as part of the Corps' restoration effort under WRDA, as part of a Superfund early action or future remedial actions under EPA's CERCLA authorities, or as part of restoration efforts being undertaken by Natural Resource Trustee agencies.*

The FFS will be clarified as recommended. In particular, the U.S. Army Corps of Engineers' (USACE's) planned Water Resources Development Act (WRDA) restoration efforts will be detailed in a companion document named the "Focused Ecosystem Restoration Plan". The FFS will include plans to replace those mudflats and wetlands impacted by the proposed Early Action alternatives and will reference USACE's companion document for any enhanced restoration proposed under WRDA. The Region is also coordinating the FFS with the Natural Resource Trustee agencies through monthly meetings and periodic conference calls.

- *Work with the Corps to have it determine whether the commercial need for navigational dredging in any parts of the lower two miles justifies the cost to perform navigational dredging.*

USACE is collecting additional data on commercial navigation needs in the lower two miles of the river to supplement the memo entitled "Lower Passaic River Navigation Analysis" currently included as Appendix F in the FFS (June 2007 draft).

- *Consider developing an alternative that addresses additional dredging for flood control but not for navigational purposes in the lower two miles. Region II could use this information on the differences in cost, short-term effectiveness, implementability, etc., as it evaluates the cleanup options for the site.*

Region 2 will evaluate a new alternative in the FFS that includes capping the sediments of the lower 8 miles of the river, with pre-dredging so as not to cause additional flooding, but with no navigation channel.

- *Work with the Corps to determine what the administrative requirements are, if any, for any alternatives that change the allowable depth of the navigation channel, including the need for Congress to deauthorize the channel or reauthorize it at a different navigational depth and length.*

Region 2 has met with USACE to discuss the administrative requirements needed to deauthorize or modify the authorized depth of the Lower Passaic River navigation channel.

- *Consult with the Region's water program regarding the timing of any expected CSO improvements and evaluate whether these affect the effectiveness and/or timing of any proposed remedy.*

Region 2's Superfund program has met with water program staff to discuss the timing of any expected CSO improvements. They depend on the completion of Total Maximum Daily Load (TMDL) calculations for the New York-New Jersey Harbor (that includes the Lower Passaic River) and subsequent issuance of point source permits to implement those TMDLs. We continue to monitor progress to evaluate their effect on any proposed remedy.

- *Coordinate with local and state governments to understand what the realistic and reasonable anticipated future land uses will be for the LPR.*

Region 2 has held extensive discussions with the State of New Jersey on the reasonably anticipated future uses for the Lower Passaic River. As a result of those discussions, the FFS is being reconfigured to reduce the number of capping alternatives that retain a navigation channel, and that channel is being limited to the lower two miles of the river. In order to justify the need for commercial navigation in the lower two miles, Region 2 and the State of New Jersey have met with the City of Newark to review its Master Plan and other documentation of reasonably anticipated future land use. The FFS will be revised to include an appropriate justification supporting navigation in the lower two miles and the alternatives that provide for it.

In order to understand the reasonably anticipated future uses for the Lower Passaic River above River Mile two, the Region organized two municipalities' workshops (in April and July 2007) to discuss revitalizing the river in conjunction with the Early Action and 17-mile Study. Each workshop was well attended by municipal officials and community groups. In general, they confirmed the results of a memorandum prepared by the State of New Jersey presenting recommendations for future navigational use of the channel (Appendix F of the draft FFS of June 2007), which was based on surveys of municipal planning officials and review of municipal master plans.

<u>Principle #4: Develop and Refine a Conceptual Site Model that Considers Sediment Stability.</u>

- *After evaluating the briefing materials and other relevant information, the CSTAG concludes that additional sampling data are needed to support the main premise of the conceptual site model (CSM) that the entire lower eight miles is a "well mixed box".*

The results of the 2007-2008 sampling program (described in the general discussion above), combined with evidence from low resolution cores collected in 1995 and 2006, high resolution cores collected in 2005 and samples collected in Newark Bay provide a robust data set that shows a small longitudinal gradient in concentrations of 2,3,7,8-TCDD and chromium in recently-deposited surface sediments between RM2 and RM12 in the Lower Passaic River. For 2,3,7,8-TCDD, concentrations on recently-deposited surface sediments in the river's main stem vary within a factor of four, as compared to concentrations in the tributaries, above Dundee Dam or in Newark Bay that are about two orders of magnitude lower than concentrations in the river's main stem. Coupled with knowledge of the oscillation of the salt front (see response to Principle # 6, ninth bullet), all the data support the conclusion that the suspended matter in the water column that is depositing at the sediment surface between RM2 and RM12 can be represented by a single average concentration for the purposes of the EMB.

- *CSTAG questions the sufficiency of the historical data supporting EMBM predictions of on-going and expected future sediment transport that will serve as the basis for estimating post-remediation contaminant concentrations in sediment in the LPR and Newark Bay.*

The 2007-2008 sampling effort described in the general discussion above will make the CSM-EMB a better predictive tool by reducing previously-identified uncertainties related to lack of site-specific data on contamination coming in from the tributaries, CSOs and SWOs, Dundee Dam and so on.

- *CSTAG commends the Region for deciding to collect additional site data and to use it with the ECOM-SEDZLJ sediment transport model that is being developed for the LPR and Newark Bay to evaluate sediment transport and fate of legacy sediment. However, the assumptions underlying the use of the ECOM-SEDZLJ model also need to be justified.*

CSTAG recommends that the Region compare the model outputs between the EMBM and the updated ECOM-SEDZLJ model in order to: 1) determine if the results of the ongoing sediment transport modeling support or contradict some of the main assumptions incorporated in the EMBM; and 2) identify and reconcile any differences between the model outputs. The use of the two models will help reduce the uncertainty regarding the prediction of river dynamics.

Region 2 is currently calibrating the sediment transport component of the ECOM-SEDZLJ model (the hydrodynamic model having been previously calibrated and peer reviewed) to evaluate the assumptions in the CSM-EMB and the recommendation in Principle #5 related to limited early action alternatives. The model will be set up using site-specific data on inputs of suspended sediments, sediment erodibility and water column suspended sediments, and will be calibrated against long-term changes in river bathymetry. The calibration and model runs will be described in a report that will include discussion of the assumptions underlying the use of the ECOM-SEDZLJ model.

- *Compare the underlying assumptions for the bases for the CSMs as described in the FFS for the early action plan and in the longer-term RI/FS, and if necessary, align them in order to ensure that data from future sampling efforts will be useful in making all remedy decisions.*

The longer-term 17-mile RI/FS is being implemented by a group of potential responsible parties named the Cooperating Parties Group (CPG) with oversight by Region 2. Under the terms of the Administrative Order on Consent (AOC), the CPG is to conduct RI/FS activities in accordance with previously approved work plans, field sampling plans and quality assurance project plans. Those plans, and the CSM described in those plans, were developed by EPA and its partner agencies who had been performing the work of the 17-mile RI/FS. Since the Early Action grew out of the 17-mile RI/FS, the Early Action's CSM also grew out of the 17-mile RI/FS CSM as developed by EPA and its partner agencies. Region 2 is overseeing the CPG's work on the 17-mile RI/FS and will ensure that data from future sampling efforts will be useful in making all remedy decisions.

- *CSTAG recommends that maps or other graphics presenting dioxin sediment chemistry sample results by location and by depth be included in the revised FFS. This would facilitate a better understanding of the nature and extent of historical and more recent site contamination throughout the eight mile area.*

Dioxin and other contaminants of potential concern have been plotted on maps by location and depth. These maps will be included in the revised FFS to supplement the existing analytical graphs that were used to develop the CSM-EMB.

<u>Principle #5: Use an Iterative Approach in a Risk-Based Framework.</u>

- *Region II should give additional consideration when revising the FFS to add one or more limited early action alternatives that address the highly contaminated erosional areas within the lower eight miles, for example, in the vicinity of the Diamond Alkali plant. The Region should perform additional analyses of all available data and/or collect additional sediment* *contaminant data and sediment stability data in order to adequately evaluate the potential effectiveness of these limited early actions. Due to our concern about the uncertainties associated with the data supporting the EMBM predictions, the CSTAG believes the existing information is insufficient to support the Region's conclusion that any early action addressing only a portion of the lower eight miles of the LPR would not be effective in reducing dioxin risks within the LPR or releases to Newark Bay.*

Region 2 is currently calibrating the ECOM-SEDZLJ sediment transport model to evaluate the assumptions in the CSM-EMB and to further evaluate whether limited early action alternatives would address the highly contaminated sediments that exist throughout the eight miles of the river. Region 2 has also completed a thorough sediment stability analysis based on bathymetry data over time that further demonstrates that erosional and depositional areas shift unpredictably from year to year. This analysis will be incorporated into the CSM-EMB and the ECOM-SEDZLJ model, to evaluate the effectiveness of addressing only a portion of the sediments in the lower eight miles of the river.

- *The Region should use the information being collected as part of the RI/FS for the 17-mile LPR to refine the CSM and verify the basis for the early actions proposed for the lower eight miles.*

Region 2 has already used the information collected as part of the 17-mile Lower Passaic River RI/FS and the Newark Bay RI/FS to refine the CSM presented in the Early Action FFS and will continue to do so. For example, multi-beam geophysical data collected by the CPG in the Lower Passaic River in 2007 are being used in conjunction with previously collected side scan sonar survey results, confirmatory geotechnical cores, sediment probing and recently-deposited surface sediment data to evaluate erosional and depositional patterns as part of sediment stability analyses. In addition, recently-deposited surface sediment data from Newark Bay are being used to provide the downstream source term input data for the EMB.

- *As the long-term RI/FS continues and if additional response actions are needed for areas not addressed by an early action, consider conducting pilot studies to evaluate the effectiveness of developing technologies such as reactive caps and sediment amendments.*

Region 2 has and will continue to discuss conducting pilot studies to evaluate the effectiveness of developing technologies such as reactive caps and sediment amendments with the CPG that is implementing the long-term 17-mile RI/FS under EPA oversight.

<u>Principle #6: Carefully Evaluate the Assumptions and Uncertainties Associated with Site Characterization Data and Site Models.</u>

- *CSTAG believes that it may be necessary to collect more sediment samples in the lower eight miles to more adequately characterize the nature and extent of contamination.*

There is a significant dataset available to characterize the sediments in RM1-7, including over 850 samples from over 130 coring locations, which have been used in developing the CSM. These data will be displayed in the revised CSM to document the understanding of contaminant nature and extent. In May 2008, Region 2 is planning to collect surface sediment samples in RM0-1 to further characterize the nature and extent of contamination. These data will supplement the 2007-2008 sampling effort described previously (sampling above Dundee Dam, in the tributaries, from CSO and SWOs and in the sediments throughout the river), and the newly analyzed data from RPI cores and data collected as part of the on-going Newark Bay RI/FS.

- *Under the proposed capping scenarios, in order to eliminate the potential for any increase in flooding due to remedy implementation, approximately four million cubic yards of sediment would first need to be removed. .... Given the significant cost and time to implement such a large dredging project, the CSTAG recommends that the Region conduct a thorough re-evaluation of the engineering assumptions and calculations used to estimate the volume of sediment to be dredged. This should also include a re-evaluation of the amount of overburden-induced sediment consolidation likely to occur after adding a thick cap to areas dominated by fine-grained, low density sediments. It may be necessary to get assistance from external experts to help with this re-evaluation.*

Region 2 has undertaken an extensive effort to reduce the amount of dredging for flood control associated with the capping alternatives. We have conducted a re-examination of the assumptions in the original cap design that has resulted in a cap with 80% less armoring, which in turn means approximately 750,000 cubic yards less dredging. In addition, we have re-evaluated the cap design to reduce the thickness of the cap, while maintaining its ability to isolate any remaining contamination in the sediments below. This has resulted in another 410,000 cubic yards reduction in dredging volume. This re-evaluation of the engineering assumptions behind the capping alternative was undertaken with advice from external experts.

- *CSTAG recommends that the Region clarify and explain the use of the contaminant data associated with the recently deposited beryllium^{7}-bearing surface sediment in the CSM-EMBM, as compared to how the contaminant data associated with the top 6 inches of sediment were used in the risk assessment. The beryllium^{7} data may not accurately represent the surface sediment (top 6-inches) dioxin concentrations across the lower eight miles of the LPR and should not be used as the primary basis to compare remedies.*

Since beryllium7 (^{7}Be) binds well to particles and has a half-life of 53 days, it is a good tracer of recently-deposited sediments in a river bed. On the other hand, the top six inches of the sediment bed are typically used in a risk assessment as the biologically active layer. Depending on the rates of deposition in different parts of the river, the top six inches of sediment may encompass sediments from different time periods into the past, while ^{7}Be-bearing sediments have always been deposited within the last several months prior to collection.

In the FFS, the Region used the contamination in the top six inches of sediment in the risk assessment and used the results of the risk assessment as the primary basis to compare remedies. The Region used the contaminant data associated with the ^{7}Be-bearing sediment layer to compare the significance of the various sources of contamination to the river (i.e., to compare tributary inputs to CSOs/SWOs to head-of-tide to Newark Bay to resuspension inputs from the river itself). In order to compare contemporaneous sediments (i.e., sediments from each source input that are deposited in approximately the same time period), the contaminant concentrations in the ^{7}Be-bearing sediments from each source were compared. The FFS will be updated to clarify the different uses for these two concepts (contaminant data associated with ^{7}Be-bearing surface sediments versus the contaminant data associated with the top six inches of sediment).

- *CSTAG understands that semi-permeable membrane device (SPMD) data were used in the EMBM to estimate dissolved contaminant concentrations, and then this estimate was used to estimate concentrations of contaminants on solids. This was done for the EMBM estimates of the tributary source contributions. CSTAG recommends that the Region consider the ... disadvantages of using SPMDs and instead consider making direct measurements of dissolved and particulate contaminant levels....*

The 2007-2008 sampling effort will provide direct measurements of tributary source contributions that will be used in the CSM-EMB, instead of the SPMD data.

- *The extreme variability in the results from the resuspension evaluations (from approximately 10% to more than 95% of the total solids) using different assumptions demonstrates the high level of uncertainty associated with the EMBM. The cumulative uncertainties associated with the forecasted contaminant concentrations for the three remedial alternatives appear to be much greater than the resulting differences between the forecasted surface sediment concentrations shown in Figure 7-4 of Appendix D of the FFS. As such, the results from the EMBM should not be the only line of evidence used by the Region in deciding which remedial alternative to choose.*

The primary goal of the EMB is to describe the significance of the legacy sediments as a source to the recently-deposited surface sediment concentrations relative to other sources such as tributaries and so on. To this end, the EMB clearly documents the importance of legacy sediments to the dioxin burden of recently-deposited material, regardless of the volume of legacy sediments resuspended. In a similar manner, the EMB clearly documents the importance of external loads for contaminants such as PCBs, PAHs, and mercury, regardless of the volume of legacy sediments resuspended.

However, the results of the EMB are not the only line of evidence used to evaluate this issue. A new sediment stability analysis, based on a thorough examination of bathymetry data over time, demonstrates that erosional and depositional areas shift unpredictably from year to year, such that no remedy could be designed to control small areas that might be erosional one year then depositional the next or vice versa. The FFS is being updated with this use of a physical line of evidence (sediment stability) to bring certainty to an issue for which the chemical line of evidence (EMB) could only provide outer boundaries.

- *CSTAG recommends that the Region provide more discussion on the uncertainties in the EMBM and clearly explain any proposed remedy in light of these uncertainties. This includes the uncertainty associated with predicted post-remedial surface sediment concentrations and estimates of contaminated sediment transport into the lower eight miles.*

The results of the 2007-2008 sampling effort described in the general discussion reduce the uncertainties in the CSM-EMB by providing site-specific data to define sources of contamination coming into the sediments of the lower eight miles. These new data continue the trends observed in the 2005 high resolution cores, which reduces uncertainty associated with the predicted future sediment concentrations. In addition, the new sediment stability analysis described previously further reduces uncertainties by providing another line of evidence to support and augment the conclusions of the CSM-EMB. Region 2 plans to use the sediment transport model to further evaluate the uncertainties in the CSM-EMB. The FFS will be updated to provide more discussion on uncertainties.

- *Since the use of a deterministic model ... may be more common in a physically complex surface water body such as this partially stratified estuary, the use of a receptor model, such as the EMBM ... needs to be more thoroughly justified.*

As cited in the draft FFS (June 2007), receptor models have been used at complex sediment sites contaminated with dioxin, PCBs and PAHs, such as the Fox River in Wisconsin (Su *et al.*, 2000), San Francisco Bay in California (Johnson *et al.*, 2000), Ashtabula River in Ohio (Imamoglu *et al.*, 2002), and Tokyo Bay and Lake Shinji in Japan (Ogura *et al.*, 2005). The intent of the FFS is to use existing data and analytical tools to evaluate taking an early action to address the sediments of the lower eight miles of the river that are the major source of on-going contamination to the tidal Passaic River and Newark Bay. The CSM-EMB uses observations based on existing data to describe the fate and transport of contaminants in the river sediments. The FFS will be updated to more thoroughly justify the use of the EMB.

- *The Region needs to justify or evaluate the limitations of the assumption that the concentrations of the contaminants of potential concern (COPC) will continue to decrease at the same rate as they have since about 1980. The Region needs to elaborate on the assumption that the five high resolution sediments cores represent "the mean surface concentration [and] will track the trends observed in the depositional settings reflected in the dated sediment cores" (page 7-23 of Appendix D of the FFS). The Region needs to justify the statement that the loads from "atmospheric deposition, groundwater, and New Jersey Pollutant Discharge Elimination System permitted discharges are considered negligible".*

As described previously, the 2007-2008 sampling effort collected data from above Dundee Dam, in the tributaries, from CSO and SWOs and in the sediments throughout the river. We also have data from newly analyzed RPI cores above Dundee Dam and from the on-going Newark Bay RI/S. For dioxin, these data continue the 25-year record of declines observed in the concentrations of COPCs. For PCBs and mercury, these data enable us to adjust the future projections to approach an asymptote, reflecting the greater influence of outside sources on the contamination in the sediments of the lower eight mile stretch. All of the contaminant trajectories will be updated with the new data: where the 25-year record of constant declines is continued, there is no reason to assume any other mechanism that would cause the decline to change in the future; where the data justify a modification in the future decline, that modification will be made. The FFS will be updated to include more explanation on how high resolution sediment cores are used to track mean concentrations on depositing sediments over time (not mean surface concentration).

Region 2 has completed calculations to show that chemical inputs from groundwater discharges are negligible. The assumption that atmospheric deposition is negligible is a standard one for river systems. Atmospheric deposition to the land area of the watershed is transported to the river through runoff and thus will be included in the EMB via inputs from the tributaries and CSO/SWOs. Therefore, the only atmospheric deposition that is not included in the CSM-EMB is that occurring on the actual water area of the river. Since the watershed area is around 935 mi^2 and the surface area of the Lower Passaic River is only about 1.5 mi^2, the analysis ignores less than 0.2% of the total atmospheric deposition. That is well within the precision of the analysis.

- *The Region needs to justify or clarify its assumption that the sediments in the LPR are well-mixed prior to deposition, since the LPR seems to be partially stratified. The LPR, by virtue of being partially stratified, is not a well mixed, homogenized water body. The Region stated that the LPR was an energetic waterway because the tide range was approximately half of the water depth, and therefore the water column and suspended sediments were well mixed in all directions, i.e., vertically, laterally, and longitudinally. If it was as energetic as implied, the tidal energy would break down the vertical stratification and the water column would indeed be well mixed. But because the water column retains its stratification, the tidal energy is not sufficient to overcome the potential energy barrier that the stratification represents. Since the tidal energy is not sufficient to break down the stratification, vertical gradients of salinity and any constituent (i.e., sediment, contaminants) transported by the flow occur.*

We agree that the Lower Passaic River is a partially stratified estuary and that there are vertical gradients in the water column. However, the movement of the salt front transports solids from Newark Bay, and picks up solids from the bed of the Passaic River and from the overlying freshwater. These solids are commingled by the tidal energy, and over a certain time interval (on the order of a ^{7}Be half-life or 53 days), a mixture of these solids is delivered to depositional areas on the bed of the Passaic River. It is critical to understanding the EMB to recognize that there is no intention to represent the instantaneous conditions in the water column associated with tidal dynamics; we are, rather, interested in the net effects of the oscillation of the salt front and its ability to mix the solids that settle out at a given location over a period of time.

Region 2 will update the FFS with the results from a hydrodynamic data analysis to examine the longitudinal extent of the salt front movement (one measure of the mixing energy available in the system). The hydrodynamic analysis consisted of a comparison of recent salinity measurements at various points on the river to flow data from the Little Falls, NJ USGS station, several miles upstream of Dundee Dam. The data were found to be well-correlated, and the correlation was applied to 30 years of daily average flow rates at Little Falls to estimate the frequency of the salt front passing each River Mile. The analysis determined that the high tide salt front location is above RM12 about 18 percent of the time, while the low tide salt front location is below RM1 approximately 10 percent of the time. In addition to this, the daily tidal excursion is on the order of 3 to 5 miles, which is a significant fraction of the tidally influenced Lower Passaic River. Measurements of tidal velocities and observations from side scan sonar (2005) and multi-beam (2007) surveys provide evidence that bottom water velocities are sufficient to resuspend bottom sediments and cause them to migrate in the upstream direction on each flood cycle. Similar behavior was found in the lower portions of the Hudson River in the New York/New Jersey Harbor Contamination Assessment and Reduction Project (CARP) modeling study (a

Harbor-wide sampling and modeling effort sponsored by the Port Authority of NY/NJ). The dynamic movements of the salt front and the significant river bottom tidal velocities result in a mixing of recently-deposited sediments between RM2 and RM12, as confirmed by recent ^{7}Be-bearing surface sediment samples, which show only a small longitudinal gradient along the axis of the river.

- *Because of the meandering nature of the LPR, the vertical, lateral and longitudinal gradients in the oscillatory velocity field would result in vertical, lateral, and longitudinal gradients in suspended sediment and in other constituents such as dissolved contaminants.*

As described above, we are in agreement that the Lower Passaic River is a partially stratified estuary, and that there are vertical and other gradients in the water column generated by the tidal oscillations. There is no intention that the EMB should represent the instantaneous conditions in the water column associated with tidal dynamics; these are not important to the purpose of the EMB, as we have direct measurements of the sediment surface concentrations. We are, rather, interested in the net effects of the oscillation of the salt front and its ability to mix the solids that settle out and accrete at a given location over a period of time. As described in the response to the comment immediately above, the oscillatory velocity field serves to reduce gradients in depositing suspended matter at a given location over time, rather than to maintain them. Nonetheless, as noted above, the CSM uses a large data set to make observations about the presence or lack of gradients in the sediment bed in all three dimensions.

As discussed in the response to Principle #4, first bullet point, the data show that there is only a small longitudinal gradient in concentrations of 2,3,7,8-TCDD and chromium in recently-deposited surface sediments between RM2 and RM12 in the Lower Passaic River. For 2,3,7,8-TCDD, concentrations on recently-deposited surface sediments in the river's main stem vary within a factor of four, as compared to concentrations in the tributaries, above Dundee Dam or in Newark Bay that are about two orders of magnitude lower than concentrations in the river's main stem. Certainly there is local heterogeneity in surface sediment results (especially when non-^{7}Be-bearing sample results are included), but the range of that heterogeneity is consistent along that stretch of the river. Coupled with knowledge of the oscillation of the salt front, the data support the conclusion that the suspended matter in the water column that is depositing at the sediment surface between RM2 and RM12 can be represented by a single average concentration for purposes of the EMB.

There is some evidence of lateral gradients in some locations in the sediment bed as the mudflats tend to have lower average surface concentrations than the channel. However, these gradients are generally comparable from RM1 to RM7 and are simply part of a consistent range in the data observed from a longitudinal perspective; i.e., the average concentration difference in the surface sediments between the channel and mudflats is the same most everywhere. The CSM incorporates vertical gradients in the sediment bed as discerned from a large data set, both low resolution and high resolution cores and surface sediment samples; the dated high resolution cores allow the age of sediments at any depth at any location to be discerned from the distribution patterns of chemical concentrations of multiple contaminants.

- *According to the FFS, the EMBM also assumes that the contaminant source profiles are independent, and as a result, only the contaminants that "distinguish the sources are characterized." The Region needs to clarify this and explain the limitations that this assumption imposes on the analysis.*

There is no evidence of synchronicity in the way that the tributaries, CSOs, SWOs, sources above Dundee Dam or from Newark Bay are discharging contaminants. This observation highlights the need to distinguish between the concepts of correlation and causation. While the processes associated with atmospheric deposition, urban and industrial land use and precipitation are common to all of the external sources in the vicinity of the Lower Passaic River, industrial discharges on the Upper Passaic River do not cause contamination in the Third River, for example. Contaminant concentrations borne by different external sources represent the set of processes unique to its water/sewer shed. Thus, contaminant source profiles are, in fact, independent, which means that the sources of the contaminants do not directly affect each other and their levels of discharge are not related. However, the source profiles may look similar, reflecting the similarities among sources in the various water/sewer sheds. This (actual, not assumed) independence is not a limitation on the analysis, but rather provides its predictive power. Conversely, if we analyze a contaminant that does not help to uniquely define a source, it provides no constraint on the solution, and thus is of no benefit in solving the EMB. However, the relationships discerned in the course of parameterizing the model allow characterization of the loads for all the contaminants of interest to the FFS. The FFS will be updated to clarify these points.

- *Since the EMBM focuses on suspended sediment transport, the Region needs to ensure that this transport mechanism is applicable to the key contaminants of potential concern to the LPR. This mechanism may not be appropriate to evaluate the transport of the more soluble PCB congeners.*

We recognize the possible importance of higher solubility for lighter PCB congeners as indicated by the comment. A set of less soluble PCB congeners will be used in the next iteration of the EMB.

- *The EMBM assumes that if 10% of a particular contaminant comes from a source (e.g., CSO's); then 10% of that contaminant in the newly deposited sediments comes from that source. The CSTAG supports the Region's decision to use the ECOM-SEDZLJ model to assess the reasonableness of this assumption.*

This inference is intrinsic to the use of conservative, particle-reactive contaminants to trace solids sources and to parameterize the EMB. Results of a particle-tracking exercise using the sediment transport model will be compared to the results of the EMB.

- *Concentrations of the contaminants associated with the suspended solids of the tributaries were estimated by taking the product of the Kd values and the concentrations estimated using the SPMDs. This calculation assumes that the surficial sediment behind Dundee Dam and the suspended solids of the tributaries are identical in composition, including organic carbon content. This assumption is a highly doubtful assumption that is not supported by any* *presented data. CSTAG recommends that the Kd values be computed on an organic carbon basis in the sediment and corrections for organic carbon differences be made in the calculation for the tributaries.*

As described previously, direct measurements of tributary source contributions will be used in the CSM-EMB, instead of the SPMD data.

- *In the EMBM model, the resuspension source term for the LPR sediment was represented by average decadal concentrations (Table 4-4) or length-weighted average (LWA) concentrations of the entire contaminated sediment bed (Table 4-5). Neither of these concentrations represents the actual surface sediments that can be resuspended into the water column. From the discussions with the Region's modelers, sediments of any age could be present at the surface, and the figures showing concentrations in the surficial sediments vary widely. Thus, the wrong concentration data for the resuspension source term for the sediment were used with the EMBM. Surface-weighted average concentrations (SWACs) of some type should have been used for the eight mile stretch of the river with the EMBM.*

The EMB was parameterized and solutions were obtained by an iterative process involving numerous possible resuspension source term constructs derived from an understanding of the solids fate and transport processes at work in the river. It is incorrect to assert a priori that any particular set of rationally developed input data are "right" or "wrong," per se. As an empirical formulation using simultaneously solved equations, the EMB itself is the judge of what "works" and what doesn't. Any input scheme applied must satisfy a model output requirement that concentration results match the recently-deposited surface sediments within some specified tolerance (25% was chosen in this case). It can be shown, within plus or minus 5%, that 95% of the 2,3,7,8-TCDD present in recently-deposited sediments must have derived from legacy sediments of the Lower Passaic River itself. Further, it is reasonable that the concentrations on the resuspended legacy sediment must lie between concentrations on the sediment which has been recently-deposited and some measure of the average concentration deposited historically; hence the choice of the legacy sediment end members selected for the model calculations.

As described in the CSM, the Lower Passaic River is not a typical tidal estuary, and the history of human alteration of the river bed must be taken into account in understanding current conditions with respect to resuspension. When the river was extensively dredged for navigation in the first half of the 20th century, a large longitudinal sediment sink was created (unlike most tidal estuaries where deposition is primarily controlled by changes in sea level). Lack of channel maintenance between the period of major dredging events and the present have allowed the channel to be extensively filled in with sediments contaminated by industrial discharges of highly particle-reactive chemicals. Generally speaking, older sediments have higher concentrations of contaminants than more recently-deposited material. Further, varying long-term deposition rates in different areas of the river have created different thicknesses of contaminated sediment sequences, depending on location. As deposition in the river has neared equilibrium conditions, the river has begun to meander in the channel. These features create two possible mechanisms for erosion of the previously deposited sequences of contaminated sediments. The river can cut down into the sediment bed from the top, eroding the more recently-deposited sediment first; but equally possible is lateral erosion into banks of contaminated sediment on the sides of the channel, cutting across sequences of various ages and concentrations.

Both of these mechanisms were tested during the EMB formulation. To characterize the resuspension of surface sediment, the average sediment concentrations dating to various historical time horizons (decadal averages) were used to parameterize the model. However, these scenarios yielded model results that were outside the established performance target values (that is, not within 25% of the concentration found on recently-deposited sediments), or suggested a mixing depth of 30 inches with resuspension accounting for 95% of the solids in the river, which, as noted in response to Principle #6, 18^{th} bullet (below) is not realistic. Conversely, inclusion of the LWA data (or the conceptualization of eroding sediments along the sides of the channel) yielded acceptable modeling results (i.e., within the performance targets) and resulted in a resuspension term that accounted for 10-15% of the solids in the river. While the different model runs reflect different resuspension conceptualizations of the river, the most realistic model run included the representation of the lateral channel side erosion, which yielded acceptable modeling results and estimated that resuspension accounted for 10-15% of the solids in the river.

Insisting on singular use of SWACs ignores the lateral channel side erosion and resuspension of sediments from older, more-contaminated deposits which occurs as the river meanders. Further, CSTAG's recommendation that 1995 surface data should be used to develop the input construct to produce a 2005 receptor concentration has the same difficulties as picking a particular decadal average. There are also limitations with the 1995 dataset, such as lack of PCB congeners and an uncertain DDT analytical methodology. Finding the appropriate weighting scheme for averaging surface concentrations that would result in a correct model solution (i.e., a solution that meets the performance target) would ultimately deliver an input construct very like that obtained from the 1990's decadal average. Nonetheless, additional runs of the model are being performed to test this construct.

- *The Region needs to provide a more robust justification for the choice of the LWA concentration over the 1990 decadal concentration, and the Region should explain why these concentrations are more appropriate than surface weighted average concentrations (SWACs). Region II needs to explain why the use of the LWA concentration results in a conservative estimate of "the contaminant flux associated with resuspension of historical inventory." In addition, the Region should explain why "this solution provides a tighter constraint on the external sources to the Lower Passaic River."*

See response to the above comment with respect to justification of the use of the LWA. The LWA concentration incorporates 1990's decadal and 1995 surface concentrations. Avoiding the LWA ignores the lateral bank erosion due to meandering. Other constructs involving more limited time horizons could be attempted, but those already used encompass the range of possibilities. That the solution using the LWA concentration provides a tighter constraint on the external sources is an observation from the model runs. The mathematics of the solution for the LWA scenario provide a narrow range of possible solids contributions by Newark Bay and the Upper Passaic because the majority of solids in the mass balance are derived from these external sources. For the 1990's decadal average scenario, 98% of the solids in the mass balance are derived from resuspension, making the result relatively insensitive to the ratio of the external sources. This result will be re-examined in the course of updating the EMB.

- *The Region needs to provide better justification for the assumption in the EMBM's average decadal concentrations analysis that current day inputs from the other sources are the same as historical inputs.*

The calculations in the EMB using various decadal averages are not intended to characterize historical conditions. The EMB does not assume that current external loads are the same as historical inputs. Rather the EMB attempts to recreate the current surface sediment concentration with current loads. The use of decadal averages was intended to characterize the depth to which the river may "dig" when resuspending sediments. Thus use of the 1980s decadal averages tests the hypothesis that resuspension preferentially exposes this layer on the river bottom under current conditions with current external loads. Other decadal averages are used to test similar hypotheses for exposure of these layers, but again with current external loads. The use of the LWA as characteristic of resuspension tests the hypothesis that resuspension is able to expose a spectrum of the entire post-1950 depositional sequence. In this scenario, no particular horizon is preferentially exposed, but rather tests the hypothesis that the river's meandering is able to expose representative layers from all time horizons.

- *The Region needs to elaborate on the EMBM's mixed layer concept (i.e., that up to 30 inches of sediment are resuspended and the resulting average adsorbed contaminant concentration represents a decadal concentration), as this is not an accurate representation of estuarine fine-grained sediment transport.*

We agree that mixing of a 30-inch layer every tidal cycle is not representative of typical estuarine fine-grained sediment transport; thus we consider this solution to be a mathematical upper bound on the amount of solids resuspension (more solids at the lower concentration represented by the 1990's decadal average are required to have the same impact as less solids at a higher concentration represented by the LWA to generate the mass balance), but not very realistic. This is why we have favored the LWA scenario (accounting for lateral channel side erosion and the top-down erosion) rather than the 1990's decadal average or SWAC which ignore lateral channel side erosion. Nonetheless, Region 2 has completed a sediment stability analysis, based on a thorough examination of bathymetry data over time. This analysis confirms that as much as 10 to 15 inches of surface sediments may be eroded or deposited in any given year, in unpredictable locations. Therefore, for the Lower Passaic River, it is conceivable that there are unusually thick layers of sediments that are being mixed together as they are transported back and forth by the scouring action of the tides.

- *Given the reliance on the EMBM, and the potential size and cost of an early action, CSTAG recommends an external peer review for the EMBM and the hydrodynamic and sediment transport modeling that will be used to re-evaluate the effectiveness of the alternatives considered in the revised FFS.*

Since the CSM-EMB, updated with the 2007-2008 sampling data, forms the main basis for decision-making in the Early Action evaluation, it is being sent for external peer review in June

2008. The sediment transport model is being calibrated to support the CSM-EMB by evaluating some of its uncertainties. It is one line of evidence that will be combined with other lines of evidence, such as the sediment stability analysis, to make the CSM-EMB a stronger decision-making tool. Therefore, Region 2 plans to complete work on the various lines of evidence supporting the CSM-EMB before making any additional peer review decisions.

<u>Principle #7: Select Site-specific, Project-specific, and Sediment-specific Risk Management Approaches that will Achieve Risk-based Goals.</u>

- *Projections of post-cleanup sediment concentrations appear unrealistically low. The CSTAG supports the Region's recent decision to reevaluate the level of post-remediation residual risk by incorporating more reasonable estimates of recontamination resulting from dredging and capping the lower eight miles. CSTAG also supports a more robust assessment of the potential for post-cleanup recontamination from upstream, lateral, and downstream sources, as discussed in Principle 1.*

Region 2 is evaluating the level of contaminant resuspension resulting from dredging and capping activities associated with each alternative. The FFS will be updated with the results of the evaluation. Region 2 will be updating the CSM-EMB with data from a major field effort that includes sampling above Dundee Dam, in the tributaries, from CSO and SWOs and in the sediments throughout the river, as well as data from RPI cores and the on-going Newark Bay RI/FS.

Therefore, the updated CSM-EMB will provide a more robust assessment of the potential for post-cleanup recontamination. New trajectories will be calculated based on the assumption that contamination in the Lower Passaic River will not drop below the baseline concentrations calculated from current surface sediment conditions above Dundee Dam, in the tributaries and in the CSO/SWOs. Instead of asymptotically approaching a concentration of zero, the trendlines will approach the baseline concentrations.

- *The CSTAG recognizes the complexity of establishing risk-based cleanup goals when background concentrations present unacceptable risks, but it is not confident that the existing limited contaminant sediment concentrations above Dundee Dam are the most appropriate concentrations to use to represent background levels in the lower eight miles; additional analysis is encouraged.*

The 2007-2008 sampling results, which include data on head-of-tide inputs, will enable the Region to better represent background concentrations in the CSM-EMB. Furthermore, the Superfund Site listed on the National Priority List (NPL) is the Diamond Alkali land site at 80-120 Lister Avenue in Newark, New Jersey. The extent of contamination from the NPL Site does not go beyond the hydraulic barrier that is the Dundee Dam. Therefore, in accordance to the definition of "background" in EPA's May 2002 guidance entitled "Role of Background in the CERCLA Cleanup Program (OSWER 9285.6-07P), the sediments above Dundee Dam represent a "location[s] that is[are] not influenced by the releases from a site, and is usually described as naturally occurring or anthropogenic."

Principle #8: Ensure that Sediment Cleanup Levels are Clearly Tied to Risk Management Goals.

- *Because it will likely take many years or even decades to achieve Remedial Action Objectives, both long-term and short-term or interim remediation goals should be developed for fish and crab tissue. Because many consumers eat only crab muscle, goals based on the ingestion of just muscle should also be presented. The time to achieve these goals should be estimated for each alternative.*

Both short-term and long-term remediation goals for fish and crab tissue were developed for the draft FFS (June 2007). The methodology is developed in Appendix B of the draft FFS and the resulting Preliminary Remediation Goals (PRGs) are presented in Table 4 of that appendix. The FFS will be updated to present that information.

The New Jersey Department of Environmental Protection (NJDEP) is the lead agency for establishing fish and crab consumption advisories for the State of New Jersey, including the Lower Passaic River. NJDEP's crab consumption advisories are based on data from surveys of urban anglers around the Newark Bay complex. When crabbers were asked if they eat the hepatopancreas, a percentage (15% in 1995) indicated that they eat this part of the crab. NJDEP also found that since the crab is cooked whole, even those consumers who do not deliberately eat the hepatopancreas are likely exposed to all or part of its contents due to its fluid nature and its dispersion in the cooking liquid. In addition, NJDEP found that 40% of crab consumers in 2005 used the cooking liquid to flavor other foods. Therefore, even though NJDEP's advisories for crab consumption include narrative recommendations for cooking practices to remove the hepatopancreas to reduce potential exposure, the advisories themselves are calculated based on consumption of the whole crab. A review of EPA guidance on fish and shellfish consumption advisories indicates that NJDEP's approach is consistent with how most other states issue shellfish consumption advisories. Since PRGs must be protective of the Reasonable Maximum Exposure (RME) individual and since Region 2 considers it unlikely that NJDEP would issue advisories specifically for consumption of crab muscle, we believe it is inappropriate to establish PRGs based on ingestion of only crab muscle.

- *As discussed under Principle #2, the risk reduction projections should be clearly and transparently communicated to affected stakeholders when describing the benefits of any proposed early action. It is expected that fish consumption advisories in the LPR will likely remain in place indefinitely.*

The FFS will be updated to clearly communicate the benefits of any proposed Early Action.

- *The CSTAG suggests that the Region consider placing more emphasis on the potential benefits from reducing dioxin loading to Newark Bay than on achieving significant risk reduction in the LPR itself. It may also be helpful to explain the anticipated benefits of the proposed action to ecological resources (i.e., beyond what was presented in the screening ecological risk assessment) in the LPR and Newark Bay.*

It is a statutory requirement (CERCLA 121(d)(1)) that remedial actions attain a degree of cleanup of hazardous substances which assures protection of human health and the environment.

Thus, the Early Action must achieve significant risk reduction in the Lower Passaic River itself. However, the FFS will be updated to place more emphasis on the potential benefits from reducing dioxin loadings to Newark Bay in addition to achieving risk reduction in the Lower Passaic River.

- *The risk assessment predicted residues in fishes and crabs for future conditions using BAFs derived from field data. The BAF is the ratio of the concentration of the chemical in the organism on a wet weight basis to that in the sediment on a dry weight basis. CSTAG suggests that BSAFs (ratio of the concentrations of the chemical in the organism on a lipid weight to that in the sediment on an organic carbon basis) instead of BAFs be used to predict chemical residues. Accumulation of nonpolar organic chemicals in organisms is controlled by the lipid and organic carbon phases, and thus, accounting for differences in lipid and organic carbon contents will improve the quality of the biota residues predicted for the future. CSTAG also suggests that the computed BSAFs be compared with BSAFs calculated for other sites to evaluate their reasonableness.*

During the development of the draft FFS (June 2007), Region 2 evaluated using BSAFs rather than BAFs to predict future fish tissue concentrations from future projected sediment concentrations. Note that in the FFS, current risk calculations are based on actual fish data, so no BAF or BSAF was used. Since we would have assumed that the ratio of lipid to total organic carbon would remain the same in the future, use of BSAFs would not affect the future hazard estimates. However, Region 2 will consider calculating BSAFs and comparing them to BSAFs calculated for other locations in the updated FFS.

- *The risk assessment should also estimate risks from direct contact exposure scenarios (e.g., recreational user and construction worker) and develop RGs for these exposures. This information can be used to inform the community about risks due to direct contact with sediment and surface water.*

Risks from direct contact exposure will be evaluated in the 17-mile RI/FS. The data available in the Lower Passaic River are too limited for direct contact exposure to be evaluated in the FFS for the Early Action. However, this was not considered a significant limitation on remedial decision-making for the Early Action, since the results of other Superfund human health risk assessments for similar river sites and bioaccumulative chemicals of potential concern (i.e., Hudson River, Housatonic River and Centredale Manor) have demonstrated that consumption of fish and shellfish is associated with the highest cancer risks compared to direct contact.

<u>Principle #9: Maximize the Effectiveness of Institutional Controls and Recognize their Limitations</u>

- *CSTAG recommends further outreach efforts to bolster the effectiveness of the existing fish consumption advisory for fish and crabs. This could be accomplished, for example, by improving outreach through public education programs, brochures, postings in bait/tackle shops, fishing license proprietors, talks to community groups or schools, and discussions about alternatives to fishing.*

Region 2 expects to coordinate with NJDEP and incorporate additional outreach efforts to bolster the effectiveness of existing fish consumption advisories in any Record of Decision that is issued on the Early Action.

- *If capping is selected as part of an early action remedy, it will be important to evaluate which institutional controls will be needed to protect the integrity of the cap in light of any planned future navigational uses and construction activities in or bordering the river. It will also be important to evaluate and identify who will be responsible for ensuring that these controls remain in place over the long-term.*

The need for institutional controls specifically to protect the integrity of a cap is discussed at several points in the draft FFS. If capping is selected in the Record of Decision, institutional controls needed to protect the integrity of the cap will be delineated and responsibilities for enforcement will be identified.

Principle #10: Design Remedies to Minimize Short-term Risks while Achieving Long-term Protection

- *The CSTAG supports the Region's recent decision to re-evaluate potential short-term risks from sediment resuspension and contaminant release resulting from remedy implementation. The Region should consider the recent information on increased risks caused by contaminant releases as a result of dredging activities in Bridges et al., 2008 and NRC, 2007. These risks must be considered when comparing remedies in light of the short-term effectiveness and long-term effectiveness and permanence criteria.*

As discussed in the response to the first recommendation under Principle #7, Region 2 is evaluating the level of contaminant resuspension resulting from dredging and capping activities associated with each alternative.

- *Estimates of contaminant releases to the water column during dredging should be compared with those generated as a result of storms, flooding and strong tides.*

An environmental dredging pilot was conducted on the Lower Passaic River in December 2005 to evaluate dredge equipment performance and monitor sediment resuspension to determine how much sediment may be resuspended from a dredging action and how far suspended sediments may be transported. Sediment resuspension data were collected at 1000 feet (far field) and at 400 feet (near field) from the dredging operations. The dredging pilot was implemented in December, after a storm event that raised the freshwater discharge to nearly three times the mean. The dredging pilot found that at the far-field monitoring locations, the net solids fluxes generated during active dredging were not statistically different from ambient river net solids fluxes (i.e., resulting from a storm event that raised the freshwater discharge to nearly three times the mean). In the near field, a difference was detected during active dredging: results suggest that the dredging operation achieved near-field solids fluxes of about one percent or less of the solids removed. These dredging pilot results are being used to evaluate the level of contaminant resuspension resulting from dredging activities associated with each alternative.

Principle #11: Monitor During and After Sediment Remediation to Assess and Document Remedy Effectiveness.

- *Before implementing any action, the Region should clearly establish baseline conditions that will be used to evaluate remedy effectiveness. The baseline data must be of sufficient quantity and quality to allow comparisons with data collected during and after cleanup to detect differences in risk that are not related just to natural variability. This should include crab and fish tissue concentrations. Baseline and long-term monitoring should also include measures of contaminant transport to Newark Bay.*

Before an Early Action is implemented, Region 2 will clearly establish baseline conditions that will be used to evaluate the effectiveness of the chosen remedy. The baseline data will include the data collected under the longer-term 17-mile RI/FS and Newark Bay RI/FS.

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