DRAFT

Comments on a Linked and Integrated Approach to Assessing Risks, TMDL Development, and Evaluating Alternative Management Actions for Greater Los Angeles and Long Beach Harbor Waters

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OVERVIEW

The Ports of Los Angeles and Long Beach and their project team have worked for several years to develop the technical capability, combining data collection and model development, to inform the harbor-wide TMDL. It's clear from the supporting documents describing the project that this effort represents a considerable investment in resources as well as a commitment, on the part of the contributing organizations, to the process. The team has developed and applied a modeling approach that is broadly consistent with applications performed at other contaminated sediment sites across the country in combining the use of contaminant fate and transport modeling with bioaccumulation modeling. Contaminated sediment sites present a range of technical challenges to the owners and operators of sites, the technical teams performing assessments, and the regulatory agencies charged with overseeing site clean-ups and remedies. These challenges account for the fact that science and engineering practice related to contaminated sediment sites is dynamic and evolving. The peer-review panel has offered its comments with the intention of strengthening the technical approach to developing TMDL targets and informing the development of a successful risk management strategy.

OVER-ARCHING COMMENTS

Existing TMDL Targets. While the peer-review panel was not specifically asked to review the basis of the existing TMDL sediment and tissue targets, the use of these low values (e.g., 3.2 ppb PCBs and 1.9 ppb DDTs in sediment) warrants comment, due, in part, to the implications for decision-making, developing a sensible management strategy, and selecting management actions comprising the strategy. Justification for using such low values is commonly based on the premise that the lower the target the more protective it is of human health and the environment. However, the use of this simplistic logic can lead to a range of consequences that hinder effective decision-making, management and outcomes. The use of unrealistically low targets can make it difficult to compare alternative management actions, in a meaningful way, in order to determine the relative value (e.g. in terms of risk reduction) contributed by an action (e.g., capping at locations A, B or C) as individual actions or combinations of actions will tend to show relatively little progress toward attainment of the target. This, in turn, creates a bias in favor of the most aggressive remedial actions, despite the engineering complexities and drawbacks associated with aggressive approaches (e.g., large-scale clean-up dredging). In order for TMDL targets to effectively inform the development of a sensible and successful management strategy, these targets should be founded on using good scientific practice to characterize realistic exposure scenarios and conditions.

Evaluating Progress. Attainment of the TMDL targets is to be achieved by 2032, i.e., 20 years after implementation in 2012. Setting aside, for present purposes, the issue of how the 20 year timeline was established and if there is any scientific or engineering basis for this target, it is unclear how the models and associated data collection will be used during the project period to gauge progress toward acceptable conditions in the Harbor. Assembling and adapting a network of actions over time (e.g., potentially decades) in order to achieve a specific trajectory toward attainment should be informed by a sequence of data collection and model application efforts over time. Such iterative use of data and modeling is used to evaluate the performance of the strategy over time and to inform adjustment, adaptation and optimization of the management strategy as needed. Will the models be used in this fashion? If so, how?

Evaluation Scenarios: Given the timescales over which actions will be taken to support attainment of the TMDL, a number of scenarios should be analyzed through application of the models being developed.

- Climate change. The timescales over which TMDL attainment will be pursued (i.e., decades) necessitates giving consideration to the role of climate change in the development of a robust and coherent management strategy. For example, the evaluation of watershed loading is based on the historical record of precipitation patterns in the Los Angeles Basin. The overall study should consider how changes in the hydrology of the system due to climate change could affect the nature of watershed inputs to the Harbor. Relative sea level rise (RSLR) is another factor that may be relevant, depending on the specific management actions contemplated. While RSLR may have a small effect in the short term, if the TMDL process extends well beyond the prescribed 20-year period, which it may due to the complexities involved, then RSLR could play a more significant role in the evaluation of remedy alternatives.
- Disturbance events. Storms and other events that physically disturb the surface of the sediment pose a risk to the integrity of sediment remedies as these events can expose contaminated sediments at depth (e.g., under caps) and redistribute surficial contaminated sediments. Southern California will be more vulnerable to coastal flooding in the future due to the combination of RSLR, tides, coastal storms and waves. Coastal storms can also be associated significant land-based flooding through heavy precipitation which could affect watershed inputs of contaminants into the Harbor. Vessel groundings and unauthorized anchorages may represent another form of physical disturbance to be considered in the development and evaluation of management alternatives.
- Changes to infrastructure or operations. The evaluation of management alternatives should consider the potential for changes in infrastructure or operations that could have an influence on physical processes within the Harbor. For example, changes in the Harbor breakwater that could affect hydrodynamics and wave climate within the Harbor could influence the performance of remedies. Changes in vessel size and operations over the next 20+ years should be considered in regard to the remedies under consideration (e.g., in relation to disturbance from propeller wash).
- Management action scenarios. The challenges and uncertainties associated with contaminated sediment remediation in complex sites like ports and harbors necessitates taking an adaptive management approach to clean-up that starts with pilot-scale testing of alternative management actions and progresses from considering/implementing less intrusive before more intrusive (if necessary) clean-up / management interventions (Bridges et al., 2012).

  The proposed modeling scenarios described in the document entitled “Application of the Ports’ Linked Model for the Evaluation of Management Alternatives” are simplistic and could lead to misleading conclusions about the effectiveness of specific management actions and the timescales over which such actions may contribute to progress toward attainment. In all of the scenarios described, the means or technological approaches that would be employed are not considered. For example, in the case of the Watershed Load Reduction scenarios, reducing the loads by either 100% or 50% would be evaluated. While this may answer a theoretical question about whether watershed inputs are affecting the harbor, neither scenario considers what engineering or technological approach could be employed to achieve that degree of reduction, or even whether such a technology even exists. Furthermore, modeling an instantaneous reduction in watershed loads, which is what is proposed, is an impossible scenario. Modeling these unreal scenarios would tend to emphasize the significant role of watershed inputs (a conclusion that can reasoned without modeling the scenarios). However, the impact of these inputs on the trajectory of recovery cannot be evaluated without considering the sensitivity of other remedial or engineering actions in the harbor to these inputs. Some level of recontamination from ongoing sources is a long-term reality for ports and harbors. More meaningful questions to pose include: 1) What level of recontamination can be tolerated by the network of actions taken as a part of the overall remedial strategy? 2) Can this network of actions be designed in such a way that the overall remedy is more resilient to recontamination? 3) What are the practical limits of risk reduction that can be achieved over the timescale of interest?

The same general flaw applies to the proposed Sediment Load Reduction scenario. There is no engineering approach or technology that will reduce sediment concentrations to the existing TMDL targets for 100% of the sediment area within the Harbor. Modeling this scenario will draw attention to the role of recontamination in the Harbor, but not in a realistic fashion. Whether dredging, capping, *in situ* treatment, or a combination of these approaches are employed, a nearly pristine surface (as reflected by the existing TMDL targets) will not be produced. The same 3 questions posed above are applicable to the Sediment Load Reduction scenario as well as all of the other modeling scenarios proposed.

Conceptual Site Model Development. The conceptual site model (CSM) does not include sufficient detail in both the graphical representation of the CSM or its narrative description. The CSM description should reflect the majority of the information related to the 1) how the site is being characterized, 2) what processes are being modeled, 3) the critical assumptions in the modeling related to site processes, and 4) how the modeling is being used to inform risk conclusions about the site (as reflected in the TMDL). At present, readers of the draft reports must assemble this information from various sections of both reports. More attention to the development of the conceptual site model will bring clarity not only to an evaluation of the modeling, but to understanding how the modeling can be effectively used to inform the TMDL.

The expanded CSM should include the risk assessment exposure scenarios. For example, anglers are not equally likely to fish all sites within the Harbor. This fact, combined with the spatial variability in sediment concentrations and fish movement, has serious implications for how human health risks are assessed and calculated. While there are probably existing data to support the point, it is reasonable to assume for the sake of argument here that most fishing is occurring in regions of the outer harbor compared to the inner harbor. Depending on the spatial movement of the fish being caught, risks to anglers in the outer harbor could be substantially lower than hypothetical individuals fishing from the most contaminated area of the harbor. Incorporating such a site-based exposure scenario would require modifying the approach to using the existing fish tagging data in addition to developing an approach that considers the size of fish populations and sub-populations associated with specific sites and regions of the Harbor. Fish sub-populations are using different areas. Using data on these sub-populations to develop an average for the harbor would require using an estimated population size for each of the sub-populations. There is a logical disconnect between having one TMDL sediment value for the whole harbor and having spatially varying exposures and sub-populations of fish. The TMDL process should make use of realistic human exposure scenarios that can be supported by data and evidence.

It would also be beneficial to adapt the CSM to include potential management scenarios that will be evaluated and compared using the models. Developing such versions of the CSM will aid the project team in clearly defining the remedial scenarios under consideration while also providing an effective means for communicating these scenarios with stakeholders.

Regional Contaminant Influences. It's clear from the existing study and other contaminated sediment projects in the region, i.e., The Palos Verdes Shelf Superfund Site, that there is a significant contaminant legacy to overcome in order to meet the intent of the TMDL provisions of the Clean Water Act. This fact is illustrated by Dr. Arnot's relatively simple calculations of tissue concentration using BCFs. The TMDL effort that is underway should consider the influence of the Palos Verdes Shelf Superfund Site, given its relative proximity to the Harbor, as well as any other contaminated sites in the region with the potential to influence attainment of the TMDL.

SPECIFIC COMMENTS:

1. The description of the fish tagging data and how those data were used in the current modeling is very difficult to follow. I recommend changes (above) to how those data are used to calculate human exposure. Given the importance of the tagging data to the estimate of human exposures, some additional care should be devoted to developing the text that describes this portion of the study.
2. It would be informative to see an analysis that describes how contaminant mass for PCBs and DDTs is distributed horizontally and vertically throughout the Harbor. For example, this would provide some perspective on the relative contribution to loading made by watershed inputs to the Harbor every year. This type of analysis should be performed as a part of a mass-balance analysis for the Harbor. While mass of contaminant is only indirectly related to risks, this form of analysis can provide insights that are useful for developing remedial strategies. Harbors are complicated environments within which to develop and implement remedial strategies. It is important to develop multiple lines-of-evidence related to the processes contributing to risk and mass-balance analyses have proven to be useful in this process. United Heckathorn in Richmond Harbor is an object lesson in this regard given the challenges that have been encountered in addressing a DDTs problem in a comparatively small site, especially given the much greater complexity present in Los Angeles and Long Beach Harbor.
3. The watershed loading into the Harbor presents several complexities and challenges. In order to understand the consequences this loading has on the Harbor as a whole and the TMDL, a careful understanding will be needed regarding the distribution of the contaminants across the multiple relevant phases (e.g., particulate, DOC-associated, colloid-associated, dissolved). It's not clear to me that sufficient data or analysis has been performed yet to confidently understand the short, mid and long-term consequences of loadings from the upstream watersheds. What areas of the Harbor are most vulnerable to these loadings? What is the nature of the contaminated particles being loaded? Where are these particles going? Are the particles being transported as flocs rather than discreet particles? Is flocculation represented in the sediment transport modeling? What opportunities for interdicting the transport of sediments, e.g., sediment traps?
4. What are the implications to long-term recovery by only considering the top 16 cm of the sediment column? The potential for surface sediments to be mobilized by future disturbances is relevant to accurately estimating the trajectory of recovery as well as the appropriateness of

some remedial alternatives (e.g., thin-layer capping using clean navigation dredged material). Does the concentration of contaminants increase with depth within the top 16 cm? Does contaminant concentration increase with depth below 16 cm? Do the congener profiles for PCBs change with depth? This last question relates to the assumption used in the modeling of a constant, average ratio in PCB congeners over time. The study should consider whether the congener profile could change in a meaningful way over time, e.g., due to changes in sources within the upstream watershed.

5. It's currently unclear to me how the two models will be "linked" for purposes of performing the modeling scenarios needed to support the project. For example, how would the models be used to estimate the influence of episodic pulses through the storm-water system? Several remedial dredging projects conducted to-date have noted the importance of episodic increases in released contaminants on fish tissue concentrations. The developed models currently calculate an annual average impact on fish tissue concentration resulting from pulses or loadings from the watershed. It's unclear to me how this modeling approach would allow the project team to evaluate the relative contribution of a more stable flux from bedded sediments compared to highly variable exposure from the storm-water system.

References

T.S. Bridges, S. Nadeau, M. McCulloch. 2012. Accelerating Progress at Contaminated Sediment Sites: Moving From Guidance to Practice. *Integrated Environmental Assessment and Management* 8: 331-338