Concluding Comments on the Linked Models Applied to the TMDL for Greater Los Angeles and Long Beach Harbor Waters

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OVERVIEW

From August to December 2016 the Peer Review Team has reviewed the technical teams modeling reports and supporting materials, participated in series of conference calls with the technical team, provided multiple rounds of comments, and participated in a face-to-face meeting with the technical team, the Ports, and other stakeholders that was held on December 8, 2016. Through these series of engagements, the Peer Review Team has gained a significant, though by no means exhaustive, understanding of the relevant issues and work that has been completed. As I stated in previous comments, the work conducted by the technical team over several years demonstrates a credible commitment to developing sound technical capability to inform the TMDL process. The approach that is being developed is consistent with approaches being used nationally to inform watershed and contaminated sediment assessments and management. The Peer Review Panel did not identify any fatal flaws in the approach being taken by the technical team. The comments and recommendations that have been made by the Peer Review Team have been provided with the intent of strengthening the TMDL process and the capability being developed for informing a successful, technically sound, and sensible management strategy for Los Angeles and Long Beach Harbor Waters.

The concluding comments and recommendations made here are provided as an addition to comments and recommendations made previously as well as to provide additional emphasis on key issues.

SPECIFIC COMMENTS

Importance of characterizing upstream inputs. As work supporting the TMDL continues, I believe that increasing attention will be given to upstream inputs, the chemical dynamics of these inputs, and the nature of the threat that these inputs pose to recovery of Harbor waters. There is increasing recognition, nationally, of the challenge that ongoing sources pose to watersheds and contaminated sediment sites generally, especially ports and harbors which are commonly located at the receiving end of large, developed and industrialized watersheds. For this reason, I recommend that the technical team and ports develop a long-term plan for collecting measured data on the nature of upstream inputs that includes measurement of dissolved contaminant concentrations, DOC, POC, and the distribution of contaminants across all relevant phases over multiple years and seasons. The use of passive sampling approaches should be considered given the advantages these approaches offer (e.g., PE, SPME). Data collection should also consider measurement of key physical processes such as flocculation, which can have a significant effect on the transport and fate of particulate-associated contaminants. For example, The Particle Imaging Camera System was developed by ERDC to measure flocculation in sediment plumes for purposes of improving sediment transport modeling and estimates (see the following by Smith and colleagues http://dx.doi.org/10.1016/j.csr.2010.04.002, http://dx.doi.org/ 10.1002/lom3.10022).

Characterizing contaminant flux. In previous comments I recommended that the technical team perform a mass-balance analysis for the system. I'll repeat this recommendation here and amplify it by focusing on the importance of such an analysis to developing an understanding of the flux of PCBs and DDTs in regard to the sediment bed. As more specific consideration is given to comparing alternative management actions, an understanding of contaminant flux will become increasingly important. I will also add the importance of developing multiple lines-of-evidence in regard to contaminant flux. Modeling alone will not sufficient for this site given its complexities. Both *in situ* measures and bench scale studies should be considered in combination with modeling.

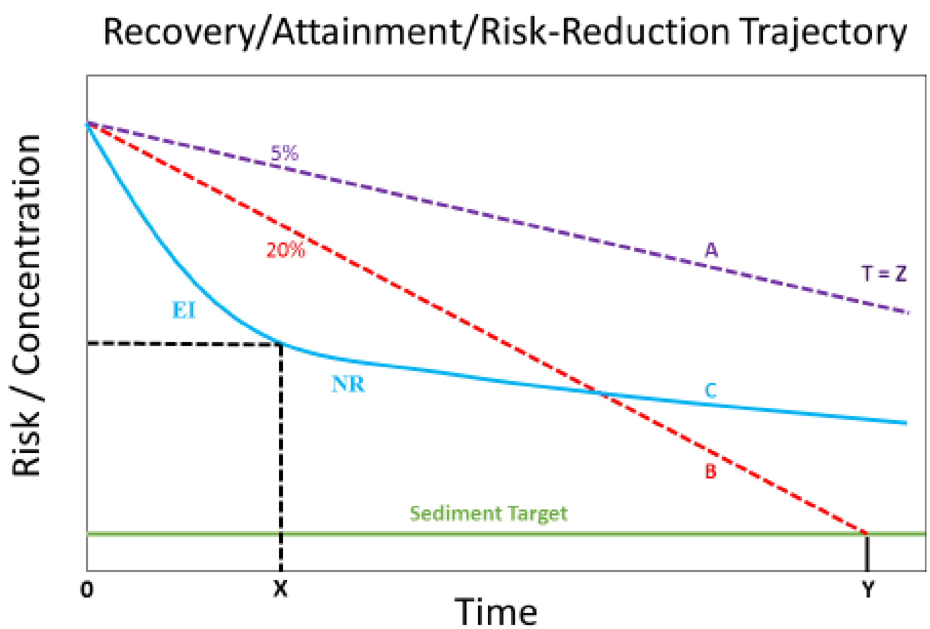
Congener-specific modeling and assessment. I expect that it will become increasing inconvenient to model and assess on the basis of a sum, total, or "average" congener profiles. I understand the reason this approach has been taken relates to the relative paucity of congener data. However, congener-specific information is critical to understanding the range of chemical behavior that is event among PCB congeners as well as estimating such endpoints as cancer risk in humans, which is dominated by a subset of congeners, specifically the co-planar PCBs.

Site-specific process investigations. As work supporting the TMDL proceeds more attention will need to be given to processes operating at individual sites, e.g., Consolidated Slip and others. One set of processes that will be critical to the TMDL process are those controlling deposition and erosion of surficial sediments. This is relevant to both gauging long-term recovery through deposition of clean sediment as well as projecting the sustainability and resilience of remedies, e.g., caps. I would recommend that the technical team consider the approaches and tools described in Hayter et al., 2014 (https://semspub.epa.gov/work/HQ/174625.pdf) for such.

Long-term, iterative use of modeling and data collection. Given the timescales over which recovery of the system will occur, i.e., decades, there will be an ongoing need to monitor the system in order to update the team's knowledge of the system, how management actions are performing, and how the system is progressing toward recovery. The task of monitoring and updating is best achieved through the combined use of modeling and data collection over time. Modeling provides critical inputs to informing effective and efficient data monitoring plans. Monitoring data is critical to updating and improving the models. Therefore, it will be important to develop a long-term vision and plan for how modeling and data collection activities will proceed and be sustained over the long-term.

The importance of realistic targets and adaptive management to successful management outcomes. I do not consider the current TMDL targets that have been established for PCBs and DDTs by the Regional Board to be realistic or achievable in any practical way. I have reviewed both the State Board's Resolution No. 2012-0008 as well as the Regional Board's Resolution No. R11-008 in order to gain clarity on how the TMDL targets were established and their purpose. These documents state that the sediment targets "are long-term sediment concentrations that should be attained" and further that "20 years will be sufficient to achieve final targets". These statements are in significant conflict with real experience at contaminated sediments sites across the country, both in terms of what sediment concentrations can be achieved through engineered intervention as well as the time-scales over which recovery occurs. There is no existing technology or combination of technologies that can reach these targets for all of the sediments in the Harbor in 20 years, or even much longer. The scientific and technical basis for both the sediment and time targets are not consistent with best practice and experience at contaminated sediment sites nationally. Fortunately, the Regional Board has included an "opportunity to reconsider the TMDL in the 6th year of implementation to revise targets, waste load allocations, and load allocations based on new or amended policies, data, and results of special studies" (State Board's Resolution No. 2012-0008). I believe making significant revisions to the targets will be critical to the ultimate success of the TMDL process in the Harbor over the long-term. I expect that the technical team's efforts will provide important input to future revisions of the TMDL.

The importance of establishing realistic and sensible targets was a subject that I addressed in previous comments. I prepared the figure below to illustrate a few additional points.



The trajectories described by lines A and B are simplistic representations that are intended to illustrate the (obvious) importance of defining a reasonable time-scale for achieving a sediment target. Achieving a sediment target by time Y would require a much more rapid reduction in sediment concentrations over time (the trajectory defined by line B) than would be required for the alternative case where time Z is a time point greater that Y. The significant point here is that setting an unrealistic time-scale creates a bias for selecting more aggressive actions or interventions that are perceived to contribute to more rapid reductions in sediment concentration (e.g., large-scale contaminated sediment dredging). However, experience at contaminated sediment sites has shown that aggressive actions may contribute very little to the ultimate rate of recovery due to a variety of factors, one of the key factors being limitations on the ability to create and sustain "clean" sediment surfaces.

Recovery at contaminated sediment sites commonly follows a pattern similar to that shown in line C in the figure, where some combination of engineered interventions (EI) are used to reduce concentrations to the practical limit of such technologies. Below this practical concentration limit additional EI are ineffective due, in part, to the limitations associated with current technologies and the dominating role of natural recovery (NR) processes (e.g., attenuation of sources, deposition of cleaner sediments, etc.) at lower concentration ranges. In fact, taking further action through EI while in the NR phase could slow down recovery in cases where the intervention exposes or releases contaminants during construction. The challenge for project teams is to identify the position of the inflection point that distinguishes these two portions of the curve. This should be approached in two complementary ways. First, by developing the type of technical capability that the project team is developing with the linked modeling, the team will be able to estimate the position of this point using existing and then updated information. The second element of this approach has to do with how management actions are pursued over time. An adaptive management approach should guide the overall implementation of the management strategy. Using such an approach, small-scale interventions are pursued first, monitored, and then scaled-up as data and evidence are collected that support the success and relative contributions being made by that action. Early actions that are not performing or contributing to recovery are scaled-back or abandoned. By taking this measured approach to implementing management interventions in a way that allows for monitoring feedbacks to decision-making, the over management strategy can be optimized with respect to total investment and time to recovery as successful technologies are expanded and unsuccessful technologies are discontinued, as appropriate. This reasoned approach to achieving recovery, however, is not compatible with the use of unrealistic and unachievable targets and timelines for the reasons discussed above as well as many others. The use of reasoned modeling scenarios to compare the modeled recovery trajectories of realistic management scenarios is an important source of information to aid dialogue between parties as well as to inform decision-making. I commented previously on the need to develop meaningful modeling scenarios.

Long-term inputs are a reality. Ongoing sources and inputs of PCBs, DDTs or other contaminants into the Harbor pose a serious management challenge with respect to achieving recovery. This reality is true for all contaminated sediment sites nationally, particularly ports and harbors. While some have argued that no sediment management actions can or should be taken if ongoing sources are not controlled, this is not a reasonable argument, in part because not all management actions or technologies are equally vulnerable to ongoing sources. We must accept that in many cases there will be practical limits to how much source reduction can be achieved through engineering actions. While actions are being taken to reduce ongoing sources, project teams should look for ways to reduce overall impacts and risks. As a part of identifying remedial actions that can be taken, the question to be explored is "to what extent will this action be threatened or compromised by ongoing sources?" Answering this question through quantitative technical analysis provides a means for identifying prudent management investments. Using this approach, actions, remedies, or technologies that are resilient with respect to ongoing sources can be identified or developed for implementation. For example, ongoing research at ERDC and elsewhere is exploring the use of activated carbon to make caps more resilient to ongoing sources.

The reality of ongoing sources further emphasizes the need to develop realistic TMDL targets. For example, the lower the targets the easier it is to argue that ongoing sources represent an insurmountable barrier to achieving improvement by taking management action on sediment. In fact, the technical team is proposing multiple modeling scenarios that are taking advantage of this very point.

It is reasonable to expect that the combination of future upstream ecosystem restoration activities and actions to control contaminant sources could result in periodic increases and decreases in loadings over the long term, as well as variation in the nature of the loadings (e.g., changes in particle loads and particle contaminant concentrations). These potentials should be considered as a part of future management plans and modeling efforts.