UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

OFFICE OF LAND AND EMERGENCY MANAGEMENT
WASHINGTON, D.C. 20460

May 8, 2025

MEMORANDUM

SUBJECT: CSTAG recommendations on the Palos Verdes Shelf Operable Unit of the Montrose Chemical Corp. Superfund Site. Milestone 2 and 3 review

FROM: Karl Gustavson, Chair, on behalf of the Contaminated Sediments Technical Advisory Group (CSTAG), Office of Superfund Remediation and Technology Innovation, U.S. Environmental Protection Agency (EPA) KARL GUSTAVSON Digitally signed by KARL GUSTAVSON Date: 2025.05.08 13:21:23 -04'00'

TO: Renee Jordan Ward, Remedial Project Manager, Superfund and Emergency Management Division, EPA Region 9

BACKGROUND

OSWER Directive 9285.6-08, *Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites* (February 12, 2002)[1], established CSTAG to "monitor the progress of and provide advice regarding a small number of large, complex, or controversial contaminated sediment Superfund sites," which are known as "Tier 2" sites. CSTAG members are site managers, scientists, and engineers from EPA and the U.S. Army Corps of Engineers (USACE) with expertise in Superfund sediment site characterization, remediation, and decision-making. One purpose of CSTAG is to guide site project managers to appropriately manage their sites throughout the Superfund process in accordance with the 11 risk management principles described in the 2002 OSWER Directive, the 2005 Contaminated Sediment Remediation Guidance for Hazardous Waste Sites (EPA-540-R-05-012)[2], and the 2017 OLEM Directive on Remediating Contaminated Sediments (OLEM Directive 9200.1-130).[3]

The Palos Verdes Shelf (PV Shelf) is Operable Unit (OU) 5 of the Montrose Chemical Corp. Superfund site located in Torrance, California. It is a Tier 2 sediment site and the contaminated sediment areas and actions are subject to CSTAG review per CSTAG's policies and procedures.[4] CSTAG's first reviews of the site were in 2003 and 2005 (prior to the interim record of decision [IROD]) and are available at the CSTAG website.[5] Informational meetings to update CSTAG on PV Shelf activities were also held in February 2013, April 2018, and January 2024.

[1] Available at: https://semspub.epa.gov/src/document/HQ/174512
[2] Available at: https://semspub.epa.gov/src/document/HQ/174471
[3] Available at: https://semspub.epa.gov/src/document/11/196834
[4] Available at: https://semspub.epa.gov/work/HQ/100003253.pdf
[5] https://www.epa.gov/superfund/large-sediment-sites-tiers-1-2

BRIEF DESCRIPTION OF THE SITE

PV Shelf is a large ocean sediment site off the coast of the Palos Verdes Peninsula in southern California. The contaminants of concern (COCs) to human health (via fish tissue consumption) and ecological receptors (through direct and dietary exposures) are dichloro-diphenyl-trichloroethane (DDT)[6] and polychlorinated biphenyls (PCBs). From the 1950s to 1971, DDT waste from Montrose and PCBs from other industrial sources entered the Los Angeles County sanitation system and discharged from submarine outfalls onto PV Shelf. PV Shelf is isolated from the rest of the Montrose Superfund site and its remediation is not dependent upon actions carried out at the other OUs. The PV shelf study area is about 1.5 to 4 kilometers (km) wide, up to 25 km long.

The primary historical source of chemical contaminants on the PV Shelf was effluent discharged from the Joint Water Pollution Control Plant (the A.K. Warren Water Resources Facility) operated by the Los Angeles County Sanitation Districts (LACSD). Beginning in 1937, the plant discharged treated sewage to the PV Shelf through outfalls approximately 2.5 km offshore of White Point in the Pacific Ocean. Contaminants in the wastewater included DDT, PCBs, trace metals, and organic matter. Wastewater discharge from Montrose to the plant stopped in 1971. Sources of PCBs included various industries in the greater Los Angeles area. The plant effluent concentrations of DDTs have been near or less than the detection limit since 1989 and have not been detected since 2003. PCBs have not been detected in effluent since 1985.

In 2007, EPA conducted a Remedial Investigation (RI) and a Feasibility Study (FS). Based on these findings, EPA signed an Interim Record of Decision (IROD) in 2009. The IROD selected a 3-component remedy for PV Shelf (placement of a hot spot cap, monitored natural recovery, and institutional controls [ICs]). In 2009, as a part of the hot spot cap remedial design, EPA conducted baseline sediment sampling. From this study, the Region concluded that post capping IROD sediment projections had been met without the cap and EPA suspended the cap design and proceeded to collect data to improve the site understanding. The current Focused Feasibility Study is to support the selection of a final remedy using the latest monitoring results, conceptual site model (CSM), and bioaccumulation/food web model.

SITE REVIEW

The milestone 2 and 3 CSTAG review of the Palos Verdes Shelf OU was held on February 12, 2025, via webinar, and on February 25-26, 2025, in Carson, CA. Milestones 2 and 3 correspond with a review of the remedial action objective (RAO) and preliminary remediation goal (PRG) development and evaluation of the remedial alternatives, per CSTAG's operating policies. The review included a stakeholder input session attended by Los Angeles County Sanitation Districts (LACSD), Los Angeles Region Water Quality Control Board, Southern California Coastal Water Research Project (SCCWRP), Santa Monica Bay Restoration Commission, California Department of Fish and Wildlife, California Office of Environmental Health Hazard Assessment, California Department of Toxic Substance Control, United States Geological Survey, National Oceanic and Atmospheric Administration, and U.S. Fish and Wildlife

[6]In this document, "DDT", "total DDTs", and "DDTs" commonly refer to DDT and its degradation products the o,p'- and p,p'-isomers of dichlorodiphenyldichloroethane (DDD), dichlorodiphenyldichloroethene (DDE), p,p'-bis(4-chlorophenyl)-2-chloroethene (DDMU), and p,p'-bis(4-chlorophenyl)ethene (DDNU). At times, individual degradation products are discussed.

Service. The Region summarized review materials in a Tier 2 site consultation memo[7] and presented on those materials. The Region also provided a draft CSM update[8], a draft preliminary alternatives memorandum[9], a draft combined human and ecological risk assessment[10], and several additional site studies and references. A draft FS was not yet available for review.

CSTAG MILESTONE 2 AND 3 DISCUSSION AND RECOMMENDATIONS

PV Shelf is a large area with complex current, wave, and sediment dynamics positioned at the edge of the Continental Shelf. These factors complicate the understanding of sediment bed stability and COC fate and transport within and outside of the OU. Furthermore, site receptors exhibit a wide range of movement patterns, habitat preferences, and residence and feeding areas that can confound the cause-effect relationship between sediment and water COC levels and bioaccumulation into fish tissue. The Region has conducted significant work to inform the CSM of the site, including repeat-sampling of sediment, water, and fish to evaluate natural recovery. Decades of site evaluations from EPA, USGS, USACE, Trustees, LACSD, and State and Regional collaborators include investigations of sediment bed geotechnical properties, erosion and deposition rates, contaminant degradation, contaminant flux from the sediment bed, fish movement and residency, sediment bed stability, toxicity, bioaccumulation, and benthic community evaluations, etc.

Combined, the studies clearly depict a large area of DDT- and PCB-contaminated sediments and seawater in areas adjacent to the wastewater outfalls. Further, the fish captured at the site have tissue total DDT concentrations that exceed risk-based values, with the greatest COC levels closest to the outfalls. It is noteworthy that fifty years after the discharge of DDTs and PCBs ceased, and over twenty years since the COCs were last detected in effluent discharged at the wastewater treatment plant, that surface sediments remain contaminated and COCs in water and fish COCs remain elevated, even in the open ocean environment with water and sediment movement and fish migration. This outcome indicates the strength and persistence of this COC source.

1. Site Understanding

CSTAG's review of the Region's information and summaries indicates some areas where the findings could be presented more clearly or more objectively reflect observations. For example, a key question for Superfund is whether COC concentrations are declining through natural recovery. First, there's little doubt that contaminant concentrations have decreased in media and receptors since COC sources were controlled at the plant in the 1970s, and the solids release from the outfalls that both created and buried the highest DDT concentrations has largely abated. The current recovery rates, governing processes, and ability to achieve risk-based objectives are less clear.[11] When looking at EPA's 2024 monitored natural recovery (MNR) report[12], the average sediment total DDT concentrations have

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[7]Palos Verdes Shelf Contaminated Sediments Technical Advisory Group (CSTAG) Milestone 2 and 3 Consultation Memo. February 10, 2025.
[8]Draft Conceptual Site Model (CSM) and Bioaccumulation/Food Web Model, November 25, 2024.
[9]Preliminary Identification and Screening of Remedial Alternative Technical Memorandum, November 21, 2024.
[10]Preliminary Draft Human Health and Ecological Risk Assessment. Palos Verdes Shelf Superfund Site. Los Angeles County, California. October 2024.
[11]This is acknowledged in the preliminary alternative memorandum: "However, the time frame over which MNR would need to occur for sediment, water, and fish tissue concentrations to reach interim Record of Decision cleanup levels is uncertain" (p. 5).
[12]Available at: https://semspub.epa.gov/work/09/100038224.pdf

increased since 2009 along with white croaker total DDT concentrations nearest the outfall. However, the Tier 2 consultation memo states "Monitoring Natural Recovery data indicate that overall, levels of DDT and PCB contamination at the PV Shelf appear to be declining."[13] Recent patterns and rates of sediment erosion and deposition are spatially variable, difficult to discern, and future projections are unclear.[14] However, the Region states that "COC concentrations in surface sediment are expected to decrease over time because of burial" (CSM update p. 6). Water samples indicate a strong COC gradient from deep water to the surface and COC concentrations increased between 2015 and 2022 at some deep-water stations near and northwest of the outfalls. The Region's summary in the Tier 2 consultation memo is that "concentrations in water are declining or show no measurable change at most locations." While this is true shelf-wide, the most recent water column data suggest a persistent COC source to the water column near the outfalls. The Region's preliminary alternative memorandum (p.5) states "In addition to the general decreasing concentration trends in sediment, a recent study using PV Shelf sediment found COCs in sediment to have limited bioavailability because of aging". That statement does not reflect a site consisting of "aged" sediments where data indicate that bioavailable COCs are entering fish tissue and the water column at unacceptable levels.

In a complex system, with conflicting data, and changes in underlying processes, an objective, nuanced discussion that reflects this complexity is warranted. However, CSTAG also wants to emphasize that decision-making doesn't require every mechanism and pathway of the CSM to be fully understood, and sites like PV shelf will always have uncertainties in these relationships. Superfund's management principles provide direction for navigating the balance between action and additional study with a stated bias towards initiating response actions over the desire to definitively characterize site risks and analyze alternative remedial approaches.[15]

Below, CSTAG provides several comments and recommendation on these and related topics.

2. RAOs

Consistent with the National Contingency Plan (NCP), RAOs are typically identified after the RI Report is complete and the human health and ecological risks are known, so that remedial actions can be identified that will meet the final objective of protecting human health and the environment (for example, by mitigating risks to acceptable levels[16,17]). The Region presented four draft RAOs to CSTAG. RAO 1 focused on reducing the release of DDTs and PCBs in sediment that would result in unacceptable human health risk, RAO 2 focused on reducing the release of DDTs and PCBs in sediment that would result in unacceptable ecological risk, RAO 3 focused on reducing the release of DDTs and PCBs from

[13]CSTAG considered the basis for this statement. Sitewide and outfall area average sediment concentrations of total DDT and PCBs increased from 2009 to 2013 and then decreased in 2022 to levels higher than 2009 (CSM update figure 3-6). The CSM update (p.4) suggests that the 2009 sediment sampling study was excluded due to low reporting limits, uncertainty, and spatial heterogeneity. The 2013 to 2022 data is then described as a decline "with the magnitude of change generally between about 20% and 30%" but without comment on statistical uncertainty or spatial heterogeneity (e.g., that replicate cores in 2022 had relative percent differences ranging from 55-68% [2024 MNR study, p. 4-3]).

[14]This is acknowledged in the CSM update (p. 7): "Present-day net sediment accumulation rates are uncertain."

[15]55 Fed. Reg. at page 8704, March 8, 1990 and as discussed in the 2017 OLEM Directive on Remediating Contaminated Sediments.

[16]A Guide to Preparing Superfund Proposed Plan, RODs, and Other Remedy Selection Decision Documents, EPA 540-R-98-031 OSWER 9200.1-23P. July 1999 (Section 6.3.8 Remedial Action Objectives). Available at: https://www.epa.gov/sites/production/files/2015-02/documents/rod_guidance.pdf.

[17]Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA Interim Final. OSWER Directive 9355.3-01. October 1988. (Table 4-1). Available at: https://semspub.epa.gov/work/06/901141.pdf.

sediment to surface water above AWQC, and RAO 4 focused on minimizing potential adverse impacts during remedial action.

RAOs typically include six components (purpose of action, receptors, exposure pathway, environmental media of concern, contaminants of concern, and level to be achieved). The nature of source control RAOs, to prevent migration rather than focus solely on risk reduction, means that they can be measured in a variety of ways dependent upon the contaminant(s) and media.

Recommendations

a. RAOs should be measurable and achievable so they can support future determinations of protectiveness and site deletion. It is unclear how achievement of the objective to "reduce the release" will be measured or verified. CSTAG recommends the Region update the RAO language to reflect the exposure pathways being mitigated. For example, the objective may be to "Prevent the [exposure pathway – e.g., ingestion], site-related COCs in [media] above levels that would result in unacceptable risk for [receptor]."

b. Final RAOs should be protective of receptors (i.e., those who consume fish, ecological) by reducing COC exposure to protective levels. The RAOs (or associated text) should include specific fish tissue and, if warranted, sediment remediation goals.

c. RAO 4 is not directly related to addressing COC sources or risk. CSTAG recommends removing this as a RAO, but including a discussion of how each alternative would strive to minimize impacts to sensitive habitats and biological communities in the remedial alternative descriptions.

d. CSTAG recommends that the Region consider including a source control RAO to reduce the off-site migration of site COCs (as achieved by remediating high COC sediments prone to transport or measured reduction of transported contaminants).

3. Remediation Goals

A spatially-explicit food web model is being developed to derive risk-based sediment remediation goals (COC levels in site sediment associated with unacceptable risk to humans, fish, birds, or marine mammals). The approach is complicated, including estimates of the exposure areas of highly transient fish and wildlife species, uncertain dietary estimates, and modeling contaminant movement between multiple sources of COC exposure and multiple species. The model's COC exposure concentrations are also based on relatively sparse sampling designed to depict sitewide or outfall area average concentrations, not to identify smaller-scale areas of sediment contamination that may impact receptors. The process for developing a remediation goal from this model is under development and was not relayed to CSTAG (including the protective fish tissue concentration used to derive the sediment remediation goal and how the goal will be applied). One of the biggest challenges for developing decisions based on modeling is to recognize and accommodate the uncertainty in model output. EPA's 2017 Sediment Directive recommends that site managers "[c]onsider the limitations of models in predicting future conditions for purposes of decision making" and it discusses that model output is inherently uncertain and should be used with caution. At the same time, the NCP (300.430(a)(1)) reflects EPA's bias for action and directs that "[r]emedial actions are to be implemented as soon as site data and information make it possible to do so."

In an open ocean environment with on- and off-site COC sources and wide-ranging receptors, a sediment remediation goal will always be uncertain. Since the 2007 remedial investigation, the Region has devoted significant effort to fish tracking and modeling efforts to refine the relationship between COCs in fish tissue and sediment. At this point, additional investment may not significantly reduce the uncertainty in the linkage between COCs levels in PV shelf sediments and fish caught at the site or nearby fishing piers. However, that complexity does not negate the finding that PV Shelf fish tissue, sediment, and water COCs are elevated, especially at the outfalls, and these contaminant concentrations represent an unacceptable risk to human health and the environment.

Recommendations

a. The nature of the site, receptors, and exposures suggests that uncertainty will always exist in the linkage between PV shelf sediment and its highly mobile receptors. CSTAG recommends that if the Region considers a sediment remediation goal to be appropriate for site decisions, they should move forward with goal development (rather than conduct additional studies to seek to lessen model uncertainty).

b. CSTAG recommends that the Region consider whether a sediment remediation goal is necessary or whether the remediation goal should be limited to fish tissue concentrations at the site since that is the media that represents unacceptable risk. If sediment remediation goals are developed, the Region should communicate the uncertainty and state assumptions used to derive the goals and their rationale (especially the protective fish tissue concentration[18] and model assumptions on concentration and exposure areas).

c. If a sediment remediation goal is developed, it will be necessary to understand the area over which it will be applied. For example, will the remediation goal be applied as a not-to-exceed point concentration, or an average for the whole site, part of the site, or the model domain? CSTAG recommends that the Region state the application area of a possible sediment remediation goal. The spatial scale (or scales) should be relevant to the receptors defined by the RAOs.

d. If the Region does not develop sediment remediation goals, CSTAG suggests that the foodweb model could be used to assess and derive sediment COC action levels (sediment COC levels that trigger active remediation) or action areas to remediate unacceptable risk.

4. Technologies and Alternative Development

Site challenges for the selection and implementation of a remedy include 1) deep water, in an area subject to periodic storms that can create difficult work conditions and currents that can impact the precision of sediment removal or material placement; 2) outfall pipes that are large, critical infrastructure whose integrity and function need to be maintained; and 3) the area is distant from the shore, limiting access and options for material handling. The Region presented several alternatives consisting of various combinations of MNR, capping, dredging, and enhanced natural recovery (ENR) in the preliminary alternatives memorandum. To support the alternative evaluations, the Region has conducted natural recovery studies, described above, and a pilot capping study in 2009. The Region

[18]The preliminary alternatives memorandum seems to suggest that this level is the interim ROD target fish tissue concentration (see quote in footnote 12).

also has a long running IC program intended to lessen COC exposures to anglers and fish consumers, and the Region has indicated that the IC program will continue to be central to any remedy.

One of the nine criteria EPA used to evaluate remedial alternatives is community acceptance. CSTAG heard several stakeholders express concern about adverse impacts associated with active remediation, specifically capping. The concern appeared to be related to the 2009 pilot capping project, the potential for capping to disrupt and resuspend the sediment bed, and the perspective that natural recovery was adequately addressing the contamination.

Recommendations

a. CSTAG recommends that the Region ensure that stakeholders have up to date information on the capabilities and limitations of active remediation technologies, such as improvements made since the pilot capping effort. Advancements in capping and dredging allow for more precise implementation of these technologies. Case in point is the recent precision placement of ballast materials (9- or 12-inch rock) over 7 km of outfall pipes in a manner that did not significantly impact outfall function or operation.

b. MNR and ENR are evaluated as a single technology in the preliminary alternatives evaluations.[19] These technologies should be evaluated separately, given their different characteristics, cost, implementability, and effectiveness. Additionally, CSTAG notes that ENR is a technology that enhances natural recovery processes already occurring. Therefore, demonstration of natural recovery (as discussed in comment 5) is necessary to support inclusion of ENR as a remedial technology in the alternatives analysis.

c. One technology not fully considered is in-situ treatment using aggregate particles coated with powdered activated carbon to sequester available COCs. Upon delivery of the aggregate, the powdered activated carbon is released into the sediment bed where it sequesters and binds dissolved contaminant.[20] This approach permits faster and more accurate delivery of activated carbon to the sediment bed. Since the approach is not intended to create a thick isolation cap, it would be less likely to interfere with outfall function.

d. The NCP (300.430(a)(iii)(D)) provides specific direction on the use of ICs in remedy selection: "The use of institutional controls shall not substitute for active response measures… as the sole remedy unless such active measures are determined not to be practicable…". CSTAG recommends that if ICs are to be included in the alternatives, that they should be applied and evaluated consistent with the NCP language.

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[19]Table 5 of the preliminary alternatives memorandum contains "full monitored and/or enhanced natural recovery (MNR/ENR)" as an alternative.

[20]The Region's consideration of in-situ treatment stems from a laboratory study on the effectiveness of carbonaceous treatments, including granular activated carbon (GAC), biochar, and powdered activated carbon (PAC) in reducing freely dissolved concentrations and uptake of DDx in test organisms. CSTAG's view on the results from this study differ from the Region's. While the initial freely COC dissolved concentrations were low and reductions from GAC were inconsistent, PAC treatment showed large and significant reductions in both freely dissolved concentrations and DDx uptake. These reductions occurred at a dosing level ~50% lower than other studies of PAC efficacy.

5. Monitored Natural Recovery

Several of the alternatives include MNR and the Region cites burial, contaminant degradation, and dispersion[21] as the primary mechanisms driving natural recovery. Regarding burial, the preliminary alternatives memorandum (p.5) concludes that: "The PV Shelf is generally net depositional, and COC concentrations in the natural sediment supply, which is derived primarily from coastal erosion, are relatively low. Thus, COC concentrations in surface sediment are expected to decrease over time because of burial." It's not clear that "net depositional" is a meaningful concept at such a large site where hydrodynamic conditions and contaminant patterns are not uniform, and the input of clean sediment is relatively low.[22] Processes counter to natural recovery by burial include erosion of deposited sediment, infauna that can move deeper sediments to the surface of the sediment bed, and COC transport from adjacent areas of the deposit. If terrestrial sediment input increases from the Portuguese Bend landslide, it may contribute more sediment to parts of the site. In contrast, the outfalls release significantly less solids today than they did historically (up to the mid-2000s). This further complicates the dynamic between sediment erosion and deposition. Degradation as a mechanism of DDT and DDE reductions has been more thoroughly established, supported by USGS research and the Region's inclusion of the DDT metabolites DDMU and DDNU in the natural recovery studies. COC dispersion has long occurred at the site, as evidenced by the down-current reach of the COC footprint. Dispersion also likely causes contaminant loss and migration down shore and off the Continental Shelf, with a potential to cause COC exposures in those areas.

As evidence of natural recovery, the Region cited decreases in average DDT and PCB concentrations in surface sediment between 2013 and 2022 and COC decreases in barred sand bass between 2014/2016 and 2022/2023[23]. In contrast, site data show an apparent increase in average DDT and PCB concentrations in surface sediment from 2009 to 2013 and 2009 to 2022 (see also footnote 14), which aligns with the observed increase in white croaker DDT and PCB concentrations in the outfall area (zone 1) between 2014/2016 and 2022/2023. The increasing depth of the DDE peak in core "7C" (northwest of the outfall) was presented as a line of evidence for burial as a natural recovery mechanism. Significant burial appears to have occurred at this location during the period of low DDT/high solids output, but that burial rate also appears to have slowed. A review of the vertical COC profiles at all the locations cored in 2009, 2013, and 2022 (Appendix Q of the 2024 MNR study) is much less clear, and it shows wide spatial and inter-year variability in the depth and magnitude of the COC peaks across the site.

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[21]Dispersion relates to "[d]isturbances that physically transport sediment or otherwise disperse contaminants into the overlying water column, where they are transported away from the contaminated area" (ESTCP 2009, Technical Guide - Monitored Natural Recovery at Contaminated Sediment Sites. Available at: https://clu-in.org/download/contaminantfocus/sediments/ER-0622-MNR-FR.pdf). In this case, the CSM update (p. 6) cites "bioturbation, sediment resuspension and contaminant desorption, and molecular diffusion".
[22]In the CSM update (p. 7), EPA cites rates of 0.8 mm/year (measured in 2004) to 1.46 cm/year (measured in 1981, 1983, and 1995; a period with high solids discharge from the outfall, which has since largely stopped).
[23]Barred sand bass were selected due to their site fidelity and to reflect the sediment concentrations in areas where they were collected (2024 MNR study, p. 4-8). Figure 2-2b of the Draft Ecological Risk Assessment shows that most Zone 1 barred sand bass collected in 2022/2023 came from a shallow, less contaminated area (<20 meters deep) outside of the fish collection area, while in 2014, most fish were collected in deeper more contaminated areas, closer to the outfalls. This may help explain why barred sand bass contaminant concentrations declined between surveys.

MNR remedies include monitoring to verify the progress towards and attainment of remediation goals and the processes supporting those declines.[24] A monitoring program is likely under development by the Region (brief mention is included in the alternative evaluation memorandum). Consistency in data collection over time is central to addressing questions related to long-term natural recovery, as well as remedy effectiveness. The repeat sampling in the Region's MNR study provided a good basis for understanding current conditions, especially regarding contamination patterns and changes in the media of concern. A major benefit at PV Shelf is the coordination with the long-term monitoring programs conducted by LACSD and the Southern California Bight Regional Monitoring Program (organized by SCCWRP). These programs have substantial overlap in the endpoints, COCs, and area of impact. EPA and site stakeholders have a long history in the collaborative development and implementation of monitoring programs in this challenging environment, and these collaborations will be important for developing and optimizing a natural recovery (and remedy effectiveness) monitoring plan.

Recommendations

a. CSTAG recommends that the Region carefully evaluate and weigh lines of evidence on the rates, locations, and mechanisms of contaminant declines to determine whether natural recovery can reduce site risks to an acceptable level within a reasonable time frame. The prospects for MNR may vary across the site, and the need for this understanding is particularly acute in the outfall area where COC exposures are the highest.

b. CSTAG recommends that the Region include monitoring to verify natural recovery rates, processes, and effectiveness if MNR is included as a remedial approach. The repeat sampling of contaminated media (surface and buried sediment, water, and fish) in the MNR study and studies by local and Regional collaborators provide a strong basis for developing a MNR sampling program.

c. CSTAG suggests that developing a spatiotemporal understanding of erosion and deposition will be important if natural recovery by burial or dispersion is to be relied upon. In addition to the current lines of evidence, the Region should consider whether repeat high-resolution bathymetric surveys (a technology that has seen significant advances in accuracy and resolution) could help depict larger-scale changes in the deposit or outfall area over time and assist in demonstrating stability (or areas of instability).

6. Considerations of Spatial Scale in the Remedial Alternatives

Six preliminary alternatives (including the no action alternative) were developed, including a full removal remedy, a full MNR/ENR remedy, and three partial remedies (partial dredging, capping, or dredging + capping combined with MNR). At the time of the review, the information was preliminary, with little description of the alternatives. A significant unknown is where the technologies will be applied and how remediation goals will guide application of the alternatives or be used to assess their

[24]"Fundamental to establishing a clearly defined MNR monitoring plan is an understanding of the remedy's physical, chemical, and biological processes that are relied upon to achieve remedial goals and cleanup levels. The monitoring plan should address the risk-based RAOs established in the ROD, which are translated into remedial goals and sediment cleanup levels. Data collection should be conducted with an understanding of how the data will be used and how they contribute to a validation of remedy performance and success" (ESTCP 2009, Technical Guide - Monitored Natural Recovery at Contaminated Sediment Sites).

effectiveness. Even for “full dredging”, it’s unclear what part of the PV Shelf would be dredged (the text seems to exclude active remediation on the shelf slope). The “partial” areas are not stated, although the contaminant hotspots surrounding or nearby the outfalls are the most relevant features to focus alternatives.

One way the Region could evaluate technologies at varying scales is to define sediment management areas (SMAs) where active remedial technologies are considered to immediately reduce risks upon implementation. SMAs could be identified where the highest concentrations remain at the surface and natural recovery is not likely to be effective in a reasonable time frame. The Region may want to consider other factors in determining the size and location of SMAs, such as 1) the relationship between acreage addressed and reduction in area-wide concentrations (i.e., point of diminishing returns), and 2) encumbrances of certain technologies in select areas (e.g., capping at and near the outfalls). Higher resolution sampling will likely be needed to support SMA development for active remedy alternatives in the outfall area where the current sample density is approximately 4.5 samples/km^2.

Recommendations

a. CSTAG recommends that the Region consider developing the “partial” alternatives by focusing on high concentration SMAs to significantly reduce COC exposures and considering how a combination of technologies can be applied in these alternatives.

b. CSTAG recommends that alternatives with active components should include additional design sampling in high concentration areas to delineate SMAs and focus areas of active remediation.

7. Alternative Evaluation and Site Strategy

The Region anticipates pursuing a final remedy. This suggests that protective fish tissue concentrations will be achieved by the action. Information is still being developed, but at this point, it is unclear how the protectiveness or effectiveness of the alternatives will be evaluated and compared.[25]

Recommendation

a. All the alternatives will need to consider whether they are protective and have long-term effectiveness. CSTAG recommends that the Region explicitly state the basis for determining protectiveness and for evaluating long-term effectiveness in terms of residual risk and adequacy of controls to manage untreated waste. After considering the uncertainty in the evaluations of protectiveness or long-term effectiveness, the Region may also want to consider whether an interim remedy is appropriate to achieve significant risk reduction quickly while a final remedial solution is developed.

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[25]The current evaluation of “effectiveness” uses a rating system where, for example, MNR/ENR is rated 3, signifying “An innovative technology that may work and there have been some successful applications”; capping +MNR is rated 2, signifying “[w]ould be only partially effective, or the effectiveness is unknown.” Besides it being unclear why MNR or ENR are considered innovative, the criteria are non-conventional and do not comport with EPA’s FS guidance on effectiveness evaluations where “Each alternative should be evaluated as to its effectiveness in providing protection and the reductions in toxicity, mobility, or volume that it will achieve” (Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA. October 1988. Available at: https://semspub.epa.gov/src/document/HQ/100001529).

8. Outfall Easements

LACSD provided information on the locations, construction, maintenance, and use of the ocean outfalls which discharge treated wastewater from the AK Warren water treatment plant. LACSD expressed concern that capping contaminated sediments would impact the diffuser ports in the outfall pipelines and asked EPA to avoid an easement area and consider a 1,000-foot buffer between a cap, if selected, and the outfall. LACSD did not provide a clear basis for the 1,000-foot value. Because the easement area covers a substantial portion of the highest contamination, it will be highly relevant to any remedy's ability to achieve RAOs.

Recommendation

a. CSTAG recommends that the Region consider remedial actions within the easement area and proposed 1,000-foot buffer and determine an appropriate setback in consultation with LACSD if the selected alternative includes an active remedy. CSTAG anticipates that the appropriate setback would depend on the technologies in the selected remedy (e.g., the appropriate setback for capping may differ from the appropriate setback for dredging). If remediation of high-contamination source material is prohibited by the easements, there may be a need to remediate larger areas of less contaminated sediments to achieve RAOs.

9. Monitoring and Pre-Design Considerations

CSTAG anticipates that site monitoring will include components that evaluate the localized performance of the remedial action (performance monitoring) and the progress toward and attainment of RAOs (RAO monitoring). In the recommendations above, CSTAG supports sampling efforts to inform natural recovery (recommendation 5b) and to better characterize the spatial extent of high contamination sediments (recommendation 6b). Below, CSTAG provides additional recommendations that may be useful for filling gaps in the site understanding.

Recommendations

Fish tissue monitoring - CSTAG supports the continued evaluation of fish species that are routinely consumed by anglers. These data have been valuable in demonstrating risks to human health and bioaccumulation from the site (even though these fish may be transient). In addition, fish with high site fidelity and comparably low trophic complexity may improve understanding remedy effectiveness and impacts to the ecological receptors near the outfalls (the area with highest COC exposures). The Region has included barred sand bass because of their high site fidelity, but their collection from areas away from the outfalls limits their applicability to the outfalls (see footnote 24). LACSD has included the hornyhead turbot as a sentinel species in their "local bioaccumulation survey".

a. CSTAG recommends the Region consider which sentinel species could be an appropriate indicator of progress toward the RAOs and informing the CSM. To the extent possible, fish should be sampled from areas of the site that they are intended to depict. Tracers of diet and trophic level such as stable isotope analysis could be used to support the site fidelity of this species.

COC flux into the water column - CSTAG noted the elevated concentrations of total DDT detected in water column samples at the sediment bed and mid water column, particularly near and down gradient of the outfall, including some increases in deep water samples between

2015 and 2022. The 2007 RI Report[26] explains that flux from diffusive processes (i.e., molecular diffusion, bioturbation, biodiffusion) is responsible for elevated dissolved-phase COCs in the water column, but it's notable that elevated COC levels are observed so high in the water column (sometimes at 50 meters above the seabed)[27]. The 2011 diffusive flux study[28] verified strong COC concentration gradients at the sediment/water interface, even after several decades of sediment deposition and mixing. Diffusive flux likely has considerable implications to COC fate and transport, as well as selecting a remedy that can isolate or sequester diffusive COC transport.

b. CSTAG recommends further investigation to explain the sources and processes leading to elevated near-bed and mid-water-column water concentrations, including whether the outfall discharge influences water column COCs.

c. CSTAG recommends the Region consider a technology's ability to address COC flux when evaluating and comparing alternatives. Treatability or pilot studies may be useful during design to understand efficacy and optimize approaches.

[26]Available at: https://archive.epa.gov/region9/superfund/web/pdf/pvs-remediation-inv.pdf

[27]This also appears to be inconsistent with the RI Report (p. 5-37) which indicates that "dissolved contaminants will be rapidly diluted and flushed from the immediate vicinity."

[28]Available at: https://semspub.epa.gov/src/document/09/100040062