UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
LAND AND EMERGENCY
MANAGEMENT

June 25, 2024

MEMORANDUM

SUBJECT: CSTAG Recommendations on the Proposed Removal Actions, Big River Watershed Project (Big River Mine Tailings Site OU2 & Southwest Jefferson County Lead Mining Site OU4). Milestone 4.

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).

TO: Greg Bach, Amanda Branson, Jason Gunter, Remedial Project Managers, Superfund and Emergency Management Division, EPA Region 7.

BACKGROUND

OSWER Directive 9285.6-08, *Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites* (February 12, 2002)[1], established the Contaminated Sediments Technical Advisory Group (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 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 Big River Mine Tailings Operable Unit (OU) 2 and Southwest Jefferson County Lead Mining Site OU4 are Tier 2 CSTAG sites, and the contaminated sediment areas and actions are subject to CSTAG review per CSTAG’s policies and procedures.[4]

[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

The combined milestone 2/3 review was held in October 2020 and CSTAG's written recommendations and the Region's responses are available at the CSTAG website. [5] An informational meeting to update CSTAG on site activities was held in January 2022.

BRIEF DESCRIPTION OF THE SITE

The Big River Mine Tailings (BRMT) and Southwest Jefferson County (SWJC) Lead Mining Superfund Sites are in southeastern Missouri and cover the entirety of St. Francois County and Jefferson County, Missouri, located southwest of St. Louis. Combined, the BRMT OU2 and SWJC OU4 are referred to as the Big River Watershed Project (BRWP).

The Big River Watershed resides within the Old Lead Belt, was one of the world's largest lead mining districts, having produced more than nine million tons of pig lead. It has been estimated that approximately 250 million tons of mining and mill waste in the form of tailings and chat were produced in the Old Lead Belt from ore milling and beneficiation processes. In the past, mine waste was used extensively as aggregate for ballast in railroads, concrete, asphalt, and fill. Some mine waste is still used as aggregate and fill. Additionally, tailings were used as agricultural amendments due to the lime content.

Chat deposits include sand- to gravel-sized material resulting from the crushing, grinding, and dry separation of the ore material. Tailings deposits include sand- and silt-sized material resulting from the wet washing or flotation separation of the ore material.

Chat, tailings, and other wastes from mining, milling and smelting activities have contaminated soil, sediment, surface water, and groundwater with lead and other heavy metals at levels that pose a threat to human health and the environment. Wastes have been transported by wind, water, and reuse. Residential properties and child high-use areas within the site boundaries have been impacted by past mining practices and the migration of the resulting mine waste.

SITE REVIEW

The milestone 4 CSTAG review of the Big River Watershed Project was held April 10-11, 2024, in Farmington, MO. Milestone 4 is near completion of the Engineering Evaluation/Cost Analysis (EE/CA) per CSTAG's operating policies. During the meeting, CSTAG held a site visit to mining source areas, remediation pilot projects, and representative reaches of the Big River. The Region summarized review material in a Tier 2 consultation memo and presented on these materials. The Region also provided the BRMT EE/CA, proposed monitoring plan, the combined sites remedial investigation (RI), portions of the combined sites feasibility study (FS), the watershed mass budget model and modeling report, remediation pilot project reports, and several references from the Ozarks Environmental and Water Resources Institute and U.S. Geological Survey (USGS) used to develop the RI and Conceptual Site Model (CSM).

The EE/CA for the SWJC site was not yet available so the review focused primarily on the BRMT site EE/CA. However, both sites in the BRWP were discussed in the Tier 2 consultation memo.

[5] https://www.epa.gov/superfund/large-sediment-sites-tiers-1-2

RECOMMENDATIONS

1. River and bank early actions

The BRWP sites are a significant challenge due to their size, volume of contaminated materials, and the potential amount of remediation required to address the contamination. Mine tailings have eroded and transported from multiple source areas to the beds, banks, and floodplains of an estimated 107 miles of the Big River. These tailings are enriched in COCs, including lead (Pb), that pose a health risk to ecological receptors and humans, including children. While most of the river has limited accessibility and is privately owned, other areas are highly-used recreation and public access areas.

After considering an interim remedial action (see 2021 CSTAG review), the Region has determined that removal actions in the BRMT (upstream) and SWJC (downstream) sections of the watershed are appropriate to address COC source areas that pose a threat to public health and the environment. The proposed removal actions focus on reducing migration of COCs from contaminated sediment and riverbanks to less contaminated or sensitive downstream areas and are intended to be consistent with a final remedial approach. CSTAG notes the applicability of site characteristics and action objectives to NCP factors to be considered in determining the appropriateness of a removal action (NCP Section 300.415(b)(2)) and supports the use of removal actions to begin more substantial remediation of contaminated sediments at the BRWP sites. CSTAG has not considered the rationale or need for an exception to cost limits on fund-financed actions.

2. Removal based RAOs

The Region provided three removal action objectives[6]:

- Reduce lead concentrations through secondary source control of floodplain soil and sediment for the Site to 400 ppm.
- Reduce the COC mass and downstream transport of riverbed sediments.
- Reduce the mass of COCs from unstable riverbanks to the watershed.

CSTAG notes that the scope of the removal actions will not encompass all the riverbanks and sediment above 400 ppm lead and the proposed alternatives are not intended to reduce lead concentrations to 400 ppm. While a NTCRA may reference longer-term site goals, such as risk reduction to a remediation goal, the RAOs of each removal action should be clearly defined.

In the third RAO, it is unclear how actions will "reduce the mass of COCs from unstable riverbanks to the watershed", considering that riverbank COCs are already in the watershed. Rather, the objective is likely to reduce the release and transport of COCs from riverbanks into the Big River.

Recommendation

CSTAG recommends the Region update the removal action objectives to remove RAO 1 and to reference the release of COCs from riverbanks to the river instead of the watershed.

[6] It appears CSTAG received three different sets of RAOs: the Tier 2 consultation memo provided two RAOs for an interim action; the presentation materials included three RAOs; and the BRMT draft EE/CA contained 2 of the 3 RAOs from the presentation. It's CSTAG's understanding that the RAOs presented during the meeting are the most recent iteration of RAOs and therefore will provide a recommendation based on those three RAOs.

3. Prioritization of action areas

The 2021, CSTAG recommendations stated:

> "...in the development of alternatives, the Region should specify the areas being considered for remediation and how they were selected. The criteria for selection of these areas should be explicit so that reasons for inclusion/exclusion of areas are transparent. CSTAG recommends that the alternatives provide a decision tree for how specific areas will be prioritized and the factors that inform prioritization."

The draft FS identified and prioritized possible action areas for each of four source control methods based on the CSM and sediment transport modeling. The draft preferred alternative provided to CSTAG encompassed the BRMT and SWJC sites and included 4 miles of river riverbank stabilization and 564,800 cubic yards of sediment remediation, divided equally between the sites. In both sites, the volumes and riverbank lengths of the preferred alternative are a subset of the highest priority areas (for example, in the SWJC site, 2 out of 12.3 miles of "priority 1" bank stabilization areas are in the preferred alternative). The provided information does not indicate why an equal distribution of riverbanks and sediment volume in the upstream and downstream sites is preferred, nor does it correspond the equal scope of remediation with site information that documents higher COC concentrations and yield in the upstream site.

For some technologies such as bank stabilization, there is no indication of the proposed locations beyond the initial prioritization. The Region has expressed that there are many factors to consider for remedy area selection beyond site and COC characteristics, such as property access, high use or high-value human and ecological exposure areas, opportunities to collaborate with NRDA partners, and integration with the sitewide monitoring program. While CSTAG understands the Region's need for flexibility to make final decisions on removal locations and technologies, it is also not conventional to select an action without identifying removal locations. However, that issue reflects the unconventional nature of the BRWP sites where contaminant sources are spread across the watershed, access must be obtained from multiple parties not involved in the COC release, and the removal action does not address all identified source areas. CSTAG recognizes that the Region's prioritization efforts have substantially narrowed the areas considered for action and supports further developing this process to identify how specific areas will be selected and the factors that will inform that selection.

Recommendations

a. It's unlikely that the NTCRAs for each site reflect the exact same removal scope of work and cost. CSTAG recommends that each NTRCA develop a basis for the scope of action specific for each site.

b. CSTAG recommends further development of the decision framework for determining action areas under each NTCRA. In addition to the NTCRA RAOs, decision factors might consider the sites' long-term CSM and goals, impact on human and ecologic receptors, property access, and how combined actions will support a measurable effect within the monitoring program.

c. Given the scope of the planned action, CSTAG recommends that the action memo include a commitment to communicate key decisions made during design to the community and, to the extent feasible, provide opportunities for stakeholder and community input into agency plans.

4. Effectiveness of remediation technologies

Passive sediment collection systems or sediment traps are a major component of the proposed alternative(s). However, the volume of sediment removed using instream or overbank traps seems relatively small compared to the estimated volume within the sediment bed (estimated at 22.8 million cubic yards). Sediment trap effectiveness is a function of COC content in mobilized sediment size fractions, flow conditions, and the COC capture efficiency in different areas and trap configurations. CSTAG sought to better understand the site conditions and placement rationale for the instream (bedload) and overbank (suspended sediment) traps. For example, what is the anticipated removal efficiency of the proposed traps? How does the removal efficiency of overbank traps compare to instream traps, and what are the sediment, COC, and site characteristics that would support one approach over the other? The RI's CSM and fate and transport discussion were generic in describing that COCs are present in riverine sediments, that sediment mobility is through downstream movement, and that modeling predicts where the river will aggrade (deposit) or degrade (erode) during storm events. The discussion in the BRMT EECA on sediment trap effectiveness simply highlights that instream traps capture bedload and overbank traps collect suspended sediments. Especially for the overbank traps, there was limited information on the performance of the sites' pilots and how those pilots informed the proposed alternatives.

At present, the Region is faced with choices regarding which approaches and which areas to remediate to cost-effectively reduce COC transport and exposure. CSTAG recognizes that there are few options for reducing the downstream transport of contaminated sediment. However, the proposed removal is intended to be limited but high impact, and any selected action will take place in lieu of other actions. Thus, CSTAG anticipates that a site-specific rationale would support the inclusion of the proposed remedial approaches (including the placement of bedload or suspended sediment traps) in the applied areas based on their anticipated effectiveness.

Recommendation

CSTAG recommends that the Region assemble a more complete record to select the instream or overbank sediment traps proposed at the sites. Important elements will include a rationale for in-stream and/or overbank traps at various locations in the watershed based on anticipated effectiveness, information on effectiveness at the pilot studies or similar sites, and conceptual designs from which predictions related to sediment capture are derived.

5. Alternative development

Monitored natural recovery (MNR) is a remedy component in four of the five proposed alternatives. MNR is not well suited to removal action alternatives where source control (not COC exposure reduction over time) is the primary objective. For example, the MNR timeframe or COC levels to be achieved through natural recovery are not mentioned and it's unclear how MNR is consistent with anticipated future remedial actions that will specify remediation goals.

Recommendation

CSTAG recommends the Region does not include MNR as a component of the NTCRA alternatives for source control.

6. Removal alternative evaluation and selection

The removal action objectives are to reduce riverbed COC mass and transport and COC inputs from unstable riverbanks. However, the comparative evaluation of alternatives does not evaluate the effectiveness of the alternatives in terms of these objectives. For example, the long-term effectiveness discussion in the BRMT EECA does not distinguish between the effectiveness of Alternatives 4 and 5 ($45 and $177 million bed and bank removal alternatives, respectively) based on reductions of COC mass, transport, or input to the Big River. Without this information, it is unclear how the risk managers select among the alternatives or justify the preferred alternative. There are many possible indicators of effectiveness related to the NTCRA RAOs, such as the percent of lead or sediment mass or volume that is captured relative to that available for transport from a reach, or indicators relating to lead concentration in bedded or suspended sediments.

Recommendation

CSTAG recommends that the Region develop indicators of effectiveness that are relevant to the RAOs to evaluate and compare alternatives and to select a preferred alternative.

7. Monitoring

COC remediation in Big River will likely be an iterative process of actions, monitoring, and new decisions based on outcomes. As site actions shift from pilots to large scale removals to sitewide remedial actions, the monitoring program and decision framework should represent that shift. The current remediation approach reflects that although individual actions may not achieve sitewide objectives, the combined actions are intended to make progress toward and achieve sitewide objectives. It will be a significant challenge for a site of this size to expand monitoring beyond individual action areas to discern system wide responses, while remaining cost-efficient.

One effort to evaluate system-wide COC transport was the 2011-2013 USGS suspended sediment sampling conducted at two USGS stations, one below the Old Lead Belt mining region (USGS site number 07017610) and the other at the downstream end of the Big River watershed (USGS 07018500). The study measured COC concentrations in suspended sediment fractions, COC loading (COC mass per year or storm event) and determined that floods and associated erosive processes drive the majority of sediment and COC transport. While the proposed monitoring plan indicates that USGS stations will be used to evaluate COC transport in suspended sediments, sampling at two stations may not be able to depict systemwide responses and remedy effectiveness over the entire Big River. Additional stations in greater proximity to removal areas would enhance the monitoring plan's ability to determine the effect of remediation in reducing COC transport. Analyses (e.g., size fractions and COC content at various flow) could also support the Region's rationale for selecting among various sediment capture approaches based on location in the watershed (see recommendation 4).

Overall, the Big River Watershed Monitoring Plan (March 2024) reflects the planned iterative cleanup approach, recognizes the need for action area and sitewide monitoring objectives, and it contains planning detail to address those objectives. The plan, which is intended to be regularly updated, contains baseline, remedy effectiveness, and site-wide monitoring components with an ultimate objective to verify attainment of remediation goals at a project specific and an area-wide level.

Recommendations

a. CSTAG supports the Region's proposed approach to monitor action area and sitewide responses to depict progress toward system wide objectives and inform next decisions. To retain efficiency, CSTAG recommends that the program focus on Superfund's primary purposes embodied in the RAOs and directly related metrics, particularly COC flux and exposure concentrations in the aquatic system.

b. CSTAG recommends the Region consider additional sitewide monitoring stations in closer proximity to the proposed action areas. Periodic monitoring of COC flux and characterization at sitewide monitoring stations, including on the falling limb of a flood event (as soon after the peak discharge as is safe to perform) could serve multiple purposes. Results be used to support remedy prioritization, effectiveness monitoring, and to further develop the fate and transport CSM to justify COC capture approaches.

8. Ongoing lead exposure at high-access areas

While most of Big River has limited recreational access, there are high access beach areas with elevated lead concentrations that are subject to periodic flooding and recontamination. CSTAG was informed that recreational beaches along the Big River will be addressed through established RODs for residential cleanup. CSTAG notes that beaches aren't specifically discussed in the BRMT OU1 ROD, though it broadly defines residential properties to include "…playgrounds, parks, and green ways." Institutional controls (ICs), including outreach such as education for reducing lead exposures, are currently conducted under cooperative agreements with local health departments. Some of the beach areas on the Big River are highly attractive, high-access public recreation areas, but the informational ICs (e.g., signage) seemed inadequate to ensure visitors were aware of the potential for lead exposure, especially to small children recreating and ingesting lead contaminated beach sediment or soil. The signs at one beach area were relatively obscure (i.e., small in size, placed amongst other informational items for the park, and it was difficult to readily discern the nature of the potential lead exposure). Until the NTCRAs and additional actions (if any) are conducted, lead contamination and human health risks will likely continue at recreational beaches, and ICs will be warranted to inform users of possible risks.

Recommendation

CSTAG supports ongoing collaboration with the state and local agencies to increase the awareness and education around lead exposure at these high access beach and recreational areas.