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

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OFFICE OF
LAND AND EMERGENCY
MANAGEMENT

MEMORANDUM

SUBJECT: CSTAG Recommendations on the Big River Watershed - Combined Sites Project for the Big River Mine Tailings OU2 & Southwest Jefferson County Lead Mining OU4. CSTAG Milestone Meeting 2 and 3.

FROM: Karl Gustavson, Chair, on behalf of the Contaminated Sediments Technical Advisory Group, Office of Superfund Remediation and Technology Innovation, U.S. Environmental Protection Agency (EPA). KARL GUSTAVSON Digitally signed by KARL GUSTAVSON Date: 2021.01.22 07:20:32 -05'00'

TO: Dan Kellerman, Remedial Project Manager, 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 (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] Operable Unit 2 of the Big River Mine Tailings site and Operable Unit 4 of the Southwest Jefferson County Lead Mining Site are being combined to develop an interim remedy. The contaminated sediment portions of the interim remedy are a Tier 2 CSTAG site, and 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.e`pa.gov/work/HQ/100002365.pdf

BRIEF DESCRIPTION OF THE SITE

The Big River Mine Tailings and Southwest Jefferson County Lead Mining Sites are in southeastern Missouri and cover the entirety of St. Francois County and Jefferson County, Missouri, located southwest of St. Louis. Combined, the sites are referred to as the Big River Watershed.

The Big River Watershed resides within the Old Lead Belt, which 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 CSTAG review of the contaminated sediment portions of the Big River Watershed interim remedy was held October 28-29, 2020 via remote webinar meetings (not held in person due to COVID-19 restrictions). The meeting addressed decision-making milestones 2 and 3 of the CSTAG operating policies, corresponding generally to a review of the site's remedial action objectives (RAOs), preliminary remedial goals (PRGs), overall risk reduction strategy, and the development and evaluation of remedial alternatives. The stakeholder listening session was held on October 29, 2020 and included presentations and/or submitted material from a wide variety of stakeholders including the potentially responsible parties, four State of Missouri agencies, the Army Corps of Engineers, the Nature Conservancy, and the Natural Resource Trustees, including the U.S. Fish and Wildlife Service.

RECOMMENDATIONS

CSTAG's understanding is that an interim remedy (IR) will be proposed for the Big River Watershed, a combined project that includes the Big River Mine Tailings Site Operable Unit (OU2) and the SW Jefferson County Lead Mining Site OU4. Like other mining impacted waterways, the site is geographically large with site related COCs (primarily lead [Pb]) present throughout the river's sediments, banks, and floodplains. According to the Region, the primary Pb source areas (mine sites and waste piles) have been controlled, but there are multitudes of secondary Pb sources in the sediment bed and banks that pose risk to human and ecologic receptors and continue to migrate downstream, and distribute to banks and floodplains, especially during flood events. The Region discussed the

challenges in developing remedial goals for a system so large, when the national Pb policy, potentially necessary for final RAO/PRG development, is not finalized. That issue combined with the extent of contaminated areas and the uncertainty in actions needed to achieve a final, protective remedy suggests that it is premature, at this time, to develop a final ROD to address mining-waste related exposures in the combined OUs. The Region has sought to address these challenges by proposing an IR approach, supported by adaptive management to chart progress and support later decisions and a final remedy.

At the time of the meeting, a draft feasibility study (FS) for the combined IR was not available to review, nor were the IR's RAOs or remedial alternatives. RAOs, PRGs, and alternatives from the separate OUs that had been considered for final actions were provided or discussed. It was expressed that these materials were similar to those being considered for the IR and could be used to inform CSTAG on the Region's plans and basis for decisions. However, CSTAG's review cannot comment on most of the elements described in its operating procedures for the combined IR because they were not available or presented. CSTAG's discussion and recommendations are therefore more cursory and focus on recommendations for the Region to consider when developing a combined IR framework.

1. Cleanup Strategy

The Region's proposal to combine OUs in an IR appears reasonable considering that the OUs represent the upper and lower portions of the same watershed and river, impacted by the same, or similar sources. CSTAG agrees with the overall approach to use an IR that targets high COC concentration, high mobility sediments, and eroding banks representing sources of Pb to the river. CSTAG also agrees that an adaptive management strategy of actions, monitoring, learning, and adaptation is a critical remedy component that will help inform the need for future actions and selection of a final, protective remedy.

Recommendation

CSTAG recommends that the Region clarify that the IR is intended to be consistent with a final action (NCP 40 CFR 300.430(a)(ii)(B)). In its discussion of the scope and role of the IR, the Region should identify the uncertainties and challenges present at the site, the rationale and purpose of the IR, how the IR will be supported by adaptive management, and how the IR and adaptive management will be used to inform a final remedy (see also recommendation 5).[5]

2. Remedial Action Objectives

The RAOs presented to CSTAG were final RAOs for the lower watershed (OU4) based on achieving protective COC levels. These are not the objectives of the conceptual IR for the combined OUs.

Recommendations

a. CSTAG recommends that the Region develop RAOs for the IR. The IR RAOs should focus on the objectives of secondary source control (e.g., Pb in bed and banks), Pb migration reduction, and COC exposure reduction to human and ecological receptors (e.g., sediment and fish tissue Pb concentrations).

[5]For example, see Section 4 of the 2012 Interim ROD at the Bunker Hill Mining and Metallurgical Complex (available at: https://semspub.epa.gov/work/10/664107.pdf).

b. The IR RAO discussion should also describe potential final RAOs and explain how the IR RAOs are consistent with these potential final RAOs.

3. Remedial Goals

The Region shared a conceptual IR PRG for Pb concentration in soil and sediment, but CSTAG was not able to determine its basis or the factors driving its selection over other values. The PRGs were not described in the context of IR objectives or their role in making progress toward potential final objectives. Specifics regarding the application of the PRG (e.g., area size and location) were not explained.

Recommendations

a. CSTAG recommends that the derivation and selection of proposed IR PRGs be explained and linked to the attainment of the IR RAOs.

b. CSTAG recommends the Region describe the remedial goals associated with the achievement of the IR RAOs, in a manner consistent with Recommendation 5 of the 2017 contaminated sediments directive:

> *"RAOs should be supported by statements that quantitatively describe the condition to be achieved by the remedy (e.g., expected concentrations in sediments or fish or expected levels of sediment toxicity) and the estimated timeframe for achieving the objective….The monitoring endpoints used to measure progress towards or achievement of RAOs… are site-specific, and should directly indicate the RAO and be linked to the remediation...*
>
> *A remedy's risk reduction expectations should answer several fundamental questions:*
> - *What condition (e.g., contaminant concentration or level of toxicity) is expected to be achieved?*
> - *In what media (e.g., sediment, fish tissue, surface water, porewater)?*
> - *In what area?"*

The Region should specify the media (soils vs sediment), application area (bank, sediment bed), and geographic area (basin, sub-basin, river mile, river reach, etc) associated with the PRG, and how the PRG will be measured (e.g., a point "not-to exceed" level or the SWAC of a decision unit/exposure area) when describing PRGs.

c. CSTAG recommends the application and evaluation of these PRGs using smaller geographic site subunits[6] at a spatial scale that will facilitate the identification of prioritized actions and the evaluation of the effectiveness of those actions.

d. CSTAG recommends that the Region document how managing sediments and bank soils at the specified PRGs will influence or be influenced by remediation in upland OUs and support the success of those final remedies. For example, riverine transport of bank and sediment bed materials will likely dominate floodplain exposure, impacting wildlife, and can impact humans where they recreate or reside.

[6] The current application area has not been established but it appears that a basin-wide average is being considered.

e. CSTAG recommends that the IR FS clarify Pb background concentrations, particularly in sediment and bank soils. The [2005] Sediment Remediation Guidance states, "*Generally, under CERCLA, cleanup levels are not set at concentrations below natural or anthropogenic background levels.*" PRGs should be developed consistent with an understanding of background concentrations and inputs.

4. Alternatives

CSTAG appreciated the range of technologies that were presented for reducing bank erosion and for capturing migrating coarse and fine Pb-contaminated materials. These approaches have generally already been piloted in the Big River watershed and are undergoing evaluation for effectiveness and optimization. CSTAG also appreciated the Region's focus on bioengineering and natural channel design. The Region has already collaborated with the trustees on projects using these concepts and, based on presentations from the State, trustees, and non-governmental organizations, there is significant support for these "soft-engineering" approaches to bank stabilization.

The Region developed mass balance approach for identifying the effect of bank and sediment bed source control actions on mass transport and Pb exposure reductions in the watershed. CSTAG considered the use of this sediment mass budget model to be reasonable for its purpose of prioritizing areas, particularly in conjunction with additional design data and sampling to verify reductions in Pb transport and exposure.

IR alternatives were not presented and specific high-priority areas for remediation were not identified based on bed or bank stability and potential for Pb exposure, contribution, or migration. Based on materials that were provided, CSTAG had concerns that the IR lacked specificity regarding the inclusion or prioritization of areas for remediation or the characteristics of areas that would drive selection of remedial technologies in those areas. This appeared to result in an open-ended remedy where actions and areas are added in the future under "adaptive management".[7] It was also not clear if various IR PRGs would be used to develop the IR alternatives.

Recommendations

a. CSTAG recommends that the metrics and measures (e.g., bank or channel stability, or reductions in Pb transport or concentration) used to evaluate effectiveness and/or optimize the piloted approaches for reducing bank erosion and capturing migrating Pb-contaminated materials should be clearly described to support future decisions that incorporate these approaches.

b. CSTAG recommends that if an IR FS is to be developed, then the Region should consider using PRGs to differentiate alternatives and present a broader range of remedial actions. Even if PRGs other than the Region's tentative PRG are screened out, the process would help to communicate the analyses and comparisons used to establish the selected IR PRG.

c. CSTAG recommends that 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

[7] E.g., in the site information package, the Region states: "*Bank stabilization could be implemented as a source control measure at any location along the Big River in Jefferson County, and at any time during the cleanup, where the river is eroding contaminated bank material.*" [p.8] and "*[t]he locations of future sediment traps would be selected and prioritized, in accordance with the adaptive management strategy…"[*p. 9].

areas should be explicit so that reasons for inclusion/exclusion of areas are transparent.[8] CSTAG recommends that the alternatives provide a decision tree for how specific areas will be prioritized and the factors that inform prioritization.

d. Because of the importance of the mass budget model in targeting areas for remediation, CSTAG recommends that the Region ensure appropriate model review and "buy-in" from stakeholders.

e. When assembling the alternatives and cost estimates, CSTAG recommends that the Region consider applying remedial technologies based on the type of area (banks or beds) and characteristics of the area selected for remediation (e.g., bank characteristics such as slope, lack of vegetation, active river head cutting or a model that incorporates all of these factors, like BANCS).

f. To permit updates to the selected areas and technologies based on newly collected data or information, CSTAG recommends that the Region discuss the process for refining specific technologies or approaches during the design and construction process based on new or updated information.

g. CSTAG recommends that additional specificity or design principles for the soft-engineering approaches be provided, e.g. an ideal slope factor (5:1, 4:1, etc.) for softened bank design.

5. Adaptive Management

The extent of contamination and the potential degree and duration of remediation in the Big River watershed suggest that a long-term, adaptive management approach may be needed. Generally, adaptive management is a process to implement actions, collect information on the effect of the actions, and inform future decisions by comparing those data to decision criteria. Although the premise of adaptive managment is to learn and adapt, adaptive management is not an open-ended "remedy" where actions and areas are added as opportunity arises.

Adaptive management facilitates decisions in complex environments with high uncertainty between management actions and outcomes. At complex contaminated sediment sites like the Big River Watershed, the fundamental uncertainty informed and addressed by adaptive management is the degree, location, and timing of remediation required to achieve final, protective remedial goals (for example, following a significant initial action). In this context, adaptive management is a long-term management approach, under which interim actions, system response monitoring, and final actions are conducted. The process permits a significant remedial action, a period of learning, and subsequent decisions informed by the learning to occur within the Superfund framework.

The Region's current vision of adaptive management appears to focus on using collected information to modify elements of a remedial action.[9] While CSTAG supports the use of monitoring to modify design and construction processes to improve remedy performance, the type of evaluation-response actions

[8] While it is anticipated that the prioritization process will be based on RAOs (e.g., Pb source control, Pb migration reduction, and Pb exposure reduction), the Region emphasized that access to privately-owned river bank areas was a primary uncertainty of whether an area could be remediated. As such, the prospect for obtaining long-term access is an important criterion in the prioritization process.

[9] One example provided by the Region was to compare the amount of plant mortality and erosion on a stabilized bank to plant growth and bank stability criteria and then have contingencies if the bank does not meet those criteria at 3 years. Those contingencies included actions such as changing plant species or planting density, modifying bank design, modifying bank selection criteria, or using other remedial technologies.

described by the Region can readily be accommodated using operations and maintenance protocols, remedy optimization approaches, contingent actions, or the five year review process and remedy modification procedures. Instead, adaptive management should be positioned as a sitewide long-term site management strategy to implement actions, collect information on the effect of the actions, and inform future decisions by comparing those data to decision criteria to ultimately result in a final, protective remedy.

Integral to this approach are monitoring plans and programs that evaluate the objectives of the remediation and support the next decision iteration. It is anticipated that the primary focus of the monitoring will be the IR objectives (reductions in Pb release, exposure, and migration) but other metrics such as bank stability, erosion/deposition, and restoration metrics will also be collected to support decisions on the approaches used to achieve the remediation objectives and goals.

Recommendations

a. CSTAG recommends that, if an adaptive management strategy is used, it be positioned as a sitewide long-term management strategy to guide iterative remedial actions that ultimately result in a final, protective remedy. The Region should consult the 2017 contaminated sediments directive (recommendation 8) that describes adaptive management steps focused on establishing goals, implementing actions, and evaluating progress against criteria to make decisions about subsequent actions.

b. CSTAG recommends the Region consider developing the following components of an adaptive management plan.

- The goals, indicators, areas, and timeframes that will be used to demonstrate progress toward and attainment of the IR remedial goals and RAOs.
- Performance criteria that will be used to evaluate effectiveness of the IR and adapt the IR remedy as necessary (see also recommendation 3).
- The sitewide monitoring indicators, areas, and timeframes that will be used to demonstrate progress toward and attainment of the final remedial goals and RAOs.
- The criteria and timing for evaluating sitewide monitoring to evaluate the need for additional actions that achieve the final RGs and RAOs for the site.
- A process for revisiting and updating the AM plan, as necessary, based on new information or developments in site understanding.

6. USACE Collaboration

EPA and USACE appear to have closely aligned objectives, approaches, and areas of focus in the Big River watershed (e.g., bank stabilization to lessen bank erosion and transport). USACE described a restoration plan that identified several areas in the Big River for stabilization, grade control, and sediment collection. CSTAG understands that an EPA ROD and Pb PRG are desired by USACE to determine which areas can be restored without handling CERLCA waste and potentially incurring liability.[10] It appears that the Pb PRG would then differentiate EPA- and USACE-only work areas based on Pb-concentration. This requirement could be problematic for both USACE and EPA. For example, in a widely contaminated

[10] It is unclear whether a final, protective PRG or an IR PRG would be needed for this purpose.

system, it will be challenging to design excavations and sediment collection systems that exclude contaminated sediment above a certain Pb concentration. System-wide Pb source control and migration reduction would also be lessened if restoration projects only target clean areas. While it is beyond CSTAG's scope to consider USACE's legal determinations, from a technical perspective, it is clear that restoration activities would be less encumbered and EPA objectives would be more readily achieved if USACE/EPA work areas weren't exclusive based on Pb content. The current paradigm also appears to potentially limit opportunities for collaboration and leveraging Federal resources despite work occurring in the same watershed with closely aligned objectives.

Recommendations

a. CSTAG recommends that the Region review the practices at other sites where USACE maintains navigation within contaminated sediment Superfund sites. Parties at these sites have in some cases collaborated for decades to ensure USACE mission completion while handling and disposing contaminated sediments in a manner consistent with Superfund decisions.

b. CSTAG recommends that EPA investigate avenues to work with USACE through written agreements (e.g., with a local waste repository sponsor) or to divide efforts (e.g. removal/disposal vs restoration) to facilitate USACE decisions on restoration priorities without regard to Pb-contamination, or even better, in a manner that can enhance reductions in Pb migration and exposure.

7. Waste Repositories

Managing waste at mining sites can be challenging due to volume considerations and the potential for mobilization of metals after disposal. Related to these challenges, the potential for groundwater and surface water impacts of unlined disposal was not presented. Disposal of materials on site is consistent with how similar sites manage waste from early actions and interim remedies, but the necessary areas, infrastructure, and monitoring needed for sediment disposal during the IR needs full consideration.

Recommendations

a. CSTAG recommends that the Region consider all likely final remedy ARARs in the design of such facilities to ensure that they are protective of groundwater and surface water in a manner consistent with the final remedy and in consideration of state standards.

b. In the long term, repositories and handling facilities may require moving large amounts of contaminated materials through communities. Therefore, CSTAG recommends developing best management practices from similar sites such that cleanup activities do not contribute negatively to community Pb dust movement in residential, recreational, or floodplain areas. Similarly, use of green remediation practices can be particularly impactful in moving such a large amount of material, as is avoiding to the extent possible emissions near sensitive populations, such as rerouting haul routes to avoid elementary schools and/or installing tailpipe controls where practicable. For more details, see: https://www.epa.gov/remedytech/green-remediation-incorporating-sustainable-environmental-practices-remediation.