UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

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OFFICE OF
LAND AND EMERGENCY
MANAGEMENT

MEMORANDUM

SUBJECT: CSTAG Recommendations on Operable Unit 4, Anniston PCB Site. CSTAG Milestone Meeting 2 and 3.

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).

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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]. The Anniston PCB site in Anniston, AL is a Tier 2 CSTAG site, and the contaminated sediment actions are subject to CSTAG review per CSTAG's policies and procedures[4]. Operable Unit (OU) 4 of the site is the subject of this review.

BRIEF DESCRIPTION OF THE SITE

The Anniston PCB Site is located in the city of Anniston, and parts of Calhoun and Talladega Counties, approximately 50 miles east of Birmingham, AL. The Anniston PCB Site includes commercial, industrial and residential properties and downstream areas of Snow and Choccolocco Creek and their floodplains.

PCBs were produced at the facility from 1929 to 1971. Chlorine was also produced using a mercury cell process between the 1950s and 1969 to support PCB manufacturing. During precipitation events, surface water flowed through areas with PCB-containing soil or waste, across the Solutia facility, and into various drainage ditches leading to Snow Creek. Subsequently, PCBs sorbed to suspended solids and settled in the floodplains of these drainage ditches, Snow Creek, Choccolocco Creek, and possibly further

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[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/100002365.pdf

downstream. Surface water, sediments, floodplain soils, and river banks are contaminated with PCB throughout the OU, posing a significant threat to human health and the environment.

OU-1 and OU-2 include residential and nonresidential properties, respectively, around and downstream of the facility along Snow Creek to US Highway 78. A combined OU-1/OU-2 Record of Decision (ROD) was issued in 2017. OU-3 includes the facility and two closed landfills adjoining the facility. An interim ROD for OU-3 was issued in 2011 and a future final ROD for OU-3 groundwater is anticipated. OU-4 is the subject of this review. It includes the lower end of Snow Creek and its floodplain from downstream of Highway 78 to the confluence of Snow and Choccolocco Creeks, and Choccolocco Creek from the backwater area upstream of the Snow Creek confluence downstream to Lake Logan Martin. EPA has committed to the State of Alabama and the Natural Resource Trustees to consider whether additional investigations are necessary in the Coosa River downstream of OU-4.

OU-4 is the most geographically expansive of the current OUs. It includes approximately 37 miles of Snow and Choccolocco Creeks and 6,000 acres of floodplain. The OU is defined by the boundaries of Choccolocco Creek and the adjacent floodplain. The flow of Choccolocco Creek is generally near the centerline of the 100-year floodplain.

SITE REVIEW

The CSTAG review was held September 16-17, 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, preliminary remedial goals (PRGs), overall risk reduction strategy, and the development and evaluation of remedial alternatives. The stakeholder listening session was held on September 17, 2020 and included presentations and/or submitted material from a wide variety of stakeholders including the potentially responsible parties, the community advisory group, technical assistant grant recipients, the Coosa Riverkeeper group, the State of Alabama, and the Natural Resource Trustees.

The Anniston project team submitted a site information package to CSTAG that included background information supporting the feasibility study (FS) for OU-4, a Tier 2 consultation memorandum, and supporting references. The CSTAG review was conducted early in the FS development process. Materials provided for CSTAG review were primarily produced by the potentially responsible party, prior to Region's full review. As a result, many of the materials provided to CSTAG for consideration may not reflect EPA Regional positions. CSTAG anticipates that providing comments at this early stage in the process will facilitate and expedite decisions that reflect contaminated sediment guidance.

RECOMMENDATIONS

1. Sediment Remedial Action Objectives (RAOs) and Remedial Goals

In the materials provided by the region, media-specific RAOs were presented for sediment, water, and biota for use in a final ROD. The biota RAO, "*Reduce risks from human consumption of fish*", is the only RAO related to the sediment remedy that identifies humans as the receptor. CSTAG agrees with RAOs that focus on reducing fish tissue concentrations of PCBs to minimize risk of people ingesting contaminated fish, but is concerned about the lack of a sediment RAO and remedial goal protective of humans consuming fish.

Sediment management principle 8 is to "*ensure that sediment cleanup levels are tied to risk management goals*". The Tier 2 consideration memo's response to principle 8 is minimal, noting that the PRPs have proposed a range of fish tissue remedial goals that vary by reach instead of sediment goals for human health, and that the PRPs proposed sediment cleanup goals are for benthic organisms and ecological receptors. In their documentation, the PRPs state:

> "*Meeting [risk-based] goals for fish will be determined directly by measuring concentrations in fish. This approach greatly reduces the uncertainty in the relationship between location-specific sediment concentrations and concentrations in fish that can be highly variable due to a range in factors, including climate, prey availability, area predators, and motility*."

CSTAG generally agrees that measuring fish tissue PCB concentrations can directly indicate whether fish tissue concentration goals have been met. However, the proposed approach of not relating sediment PCB exposures to fish tissue PCB concentrations (or verifying the lack of relationship) creates a disconnect between the RAO of reducing fish tissue concentrations and developing and evaluating contaminated sediment alternatives to achieve the RAO. As a result, there is no way to assess how sediment remedial alternatives will influence tissue concentrations, achieve RAOs, or be protective, as required by the NCP for a final remedy.

The 2017 contaminated sediments directive recommendation 5 discusses expectations regarding RAOs and associated PRGs for fish and sediment:

> *"For bioaccumulative organics such as PCBs…, risk reduction is often measured by declines in fish tissue PCB concentrations to be achieved by reducing sediment PCB contamination. Thus, it is important to communicate the expected reductions in concentrations of both sediments and fish tissue when discussing risk reduction expectations in CERCLA decision documents. Therefore, OLEM recommends that, for sediment sites with RAOs to reduce contaminant levels in fish tissue, generally the feasibility study (FS) and ROD should state the fish tissue and sediment contaminant concentrations that are expected to be achieved by the remediation, along with the areas expected to meet those objectives (e.g., sitewide or by segments or river reaches) and the general timeframe. The uncertainty in the expected risk reductions and associated time frames should also be discussed."*

Recommendations

a. CSTAG recommends that the region develop a RAO to protect humans from consuming fish to achieve fish tissue and sediment remedial goals over time. As stated above, "*for sediment sites with RAOs to reduce contaminant levels in fish tissue, generally the feasibility study (FS) and ROD should state the fish tissue and sediment contaminant concentrations that are expected to be achieved by the remediation, along with the areas expected to meet those objectives (e.g., sitewide or by segments or river reaches) and the general timeframe." (2017 contaminated sediments directive)*

b. The RAO to "minimize creek banks as a source…" should be expanded to ensure the floodplain is not an ongoing source of PCB to the river. While generally floodplains are depositional, small "creeklets" in the floodplain may need active control measures if floodplain contaminants are left in place.

c. A RAO to reduce the downstream migration of contaminants should be included. The current RAO to "minimize creek banks as a source" is not sufficient to control PCBs from migrating offsite and impacting downstream areas.

d. CSTAG recommends that the region review Section 4 of the 1988 RI/FS Guidance (OSWER directive 9355.3-01)[5] to develop RAOs for source control actions and RAOs that identify the contaminant of concern (COC), receptor, and exposure pathway, and acceptable contaminant levels.

2. Fish Tissue Remedial Goals

The region described the derivation of fish tissue remedial goals for human health as an issue needing resolution prior to proceeding with decision making. The region provided fish tissue remedial goals based on cancer risks from 10^{-4} to 10^{-6} and non-cancer hazards equal to 1, using default recreational fisher

[5] Available at: https://semspub.epa.gov/work/06/901141.pdf

consumption rates at the reasonable maximum exposure[6]. The PRPs developed a range of fish tissue remedial goals using consumption rates based on creel surveys and non-cancer risks and cancer risks at 10^{-5}. This range was based on the central tendency exposure (CTE) at the low end (an average exposure protective of 50% of the population ingesting fish) and the reasonable maximum exposure (RME) at the high end. The result is a significant difference in RGs calculated by EPA and the PRPs.

EPA regulation and guidance are clear in directing the development of remedial goals to be set to protect the RME scenario[7]. While the CTE can be used to describe site risks more fully, the RME generally should be the principal basis for evaluating potential risks[8]. The NCP Preamble states, "… *the reasonable maximum exposure scenario…will provide the basis for the development of protective exposure levels*." Therefore, it is unclear how setting the PRG at a remediation goal that protects the central tendency exposure would be protective of the potentially exposed populations. Basing fish tissue remedial goals on a current use creel survey assumes that future uses, after PCB remediation, will be the same as current uses in the PCB contaminated system. This approach does not consider that reasonable future uses may include increased consumption under a reasonable maximum exposure scenario.

Finally, very little specificity regarding the implementation of the PRG was provided. For example, there was no clear explanation of how a range of cleanup goals would be implemented and managed: If the higher tissue concentration was met, would there be additional remediation to reach the lower end? Recommendation 5 of the 2017 contaminated sediments directive recommends that contaminant level, media, and area for compliance be clearly described. In the materials provided, it was not clear which fish species would be evaluated, over which area, or how the sampled concentrations would be compared to the remedial goal.

Recommendations

a. CSTAG recommends that the region consider setting a cleanup goal on the RME exposure scenario, rather than the CTE.

b. CSTAG recommends that region consult EPA guidance and consider reasonable future use in the derivation of protective fish and shellfish tissue concentrations.

c. CSTAG recommends that the fish species, averaging areas, remedial goals, and the statistical methods of comparison to the remedial goal be clearly described in the decision documents. For example, a statement such as "The 95% upper confidence limit of the average of whole body total PCB concentrations of catfish sampled in each identified exposure area will not exceed the remedial goal" clearly identifies the expectation of the remedy and how attainment will be assessed.

3. Surface Water Remedial Goals

The preliminary RAO for surface water is to "*[r]educe exceedances of the AWQC for PCBs*". The human health ambient water quality criteria (AWQC) for PCBs is based on the ingestion of surface water and the consumption of biota. In the materials provided to CSTAG, it is applied as a To Be Considered (TBC) criterion. CERCLA §121 states that hazardous substances, pollutants, or contaminants left on-site at the conclusion of the remedial action shall attain Federal water quality criteria where they are relevant and appropriate under the circumstances of the release or threatened release unless the applicable or relevant and appropriate requirement (ARAR) is waived. CERCLA §121(d)(2)(B)(i) requires that this

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[6] Table 2-4, "*Technical Memorandum Summarizing Results Of Comparative Analysis Of Alternatives*" Geosyntec Consultants, July 2020.

[7] NCP Preamble (Federal Register Vol. 55, No. 46, pp. 88710 and 8712, March 8, 1990. National Oil and Hazardous Substances Pollution Contingency Plan; Final Rule, 40 CFR part 300); Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual (Part A) (EPA/540/1-89/002); and the Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions (OSWER Directive 9355.0-30, 4/22/91).

[8] *"Other measures of risk (e.g., central tendency) can be used to describe site risks more fully. However, RME risk generally should be the principal basis for evaluating potential risks at Superfund sites. (1990 NCP Preamble at 55 FR 8711; RAGS I Part A, page 6-4; and EPA's Risk Characterization Policy)"* ("Rules of Thumb for Superfund Remedy Selection" (EPA 540-R-97-013).

determination is based on the designated or potential use of the water, the media affected, the purposes of the criteria, and current information. Whether a water quality criterion is relevant and appropriate depends on the use(s) designated by the State, which is based on existing and designated uses, and whether the water quality criteria is intended to be protective of that use.

If the State has designated a water body for recreation, but not drinking water as a beneficial use, then a water quality criterion reflecting fish consumption alone may be relevant and appropriate if fishing is included in that designation. For PCBs, the CWA Section 304(a) human health water quality criterion for the consumption of fish is identical to that for the consumption of fish and water (0.000064 µg/L PCB in the dissolved phase).

Recommendations

a. CSTAG recommends the region consider modifying the RAO from "reducing exceedances" (more of an interim action RAO) of the AWQC to "attaining the CWA 304(a) AWQC" (a final action RAO).

b. CSTAG recommends the region review the determination of the AWQC as TBC rather than ARAR.

4. Ecological Risk Remedial Goals

The region reported that two sediment PRGs based on PCB risks to ecological receptors are under consideration. One PRG is 0.63 mg/kg to be applied as a surface weighted average concentration (SWAC), based on risks to non-piscivorous birds and mammals; the other is a not-too-exceed value of 4.4 mg/kg based on the 20% effect concentration (EC20) developed from site-specific benthic invertebrate toxicity testing. The Natural Resource Trustees report that a federally listed freshwater snail, *Lacy elimia*, may occur in the watershed. EPA guidelines indicate that threatened or endangered species that could be exposed to site releases may warrant special consideration, such as protecting individual organisms in order to protect the species as a whole. See OSWER directive 9285.7-28 P (1999)[9] and EPA/100/F15/005 (2016)[10].

Recommendation

CSTAG recommends that the region clarify whether site releases may affect threatened or endangered species in OU-4 and, if so, whether and how the proposed PRGs based on an EC-20 address risks to those species.

5. Consideration of Background

"The [2005] Sediment Remediation Guidance states, "Generally, under CERCLA, cleanup levels are not set at concentrations below natural or anthropogenic background levels." It also recommends that "RAOs should reflect objectives that are achievable from the site cleanup." In instances where risks unrelated to the CERCLA release exist, the site's risk reduction expectations (embodied in the RAOs and cleanup levels) should generally be based on contaminant concentrations in fish and sediment that are achievable by remedial action." (2017 contaminated sediments directive).

The region's site information indicated that upstream background COC concentrations were evaluated, however, the region did not present this information on sediments or fish, compare it to risk-based goals, or discuss it in the context of what site cleanup might be able to achieve.

Recommendation

CSTAG recommends that data be collected (or more clearly presented) to develop background concentrations of PCBs in fish and incoming/upstream solids at various flow stages to evaluate whether risk-based remedial goals are achievable.

[9] Available at: https://www.epa.gov/sites/production/files/2015-11/documents/final99.pdf
[10] Available at: https://www.epa.gov/sites/production/files/2016-08/documents/geae_2nd_edition.pdf

6. Use of SWACs

SWACs for PCBs in sediments in each of 6 reaches of the river were presented in relation to a "*PRG for PCBs in sediment assumed to be 1 mg/kg as a SWAC*" (Figure 3-12)[11]. However, the basis for dividing the river into these 6 sections is not discussed (nor was the statistical approach for deriving the SWAC or the basis of the 1 PPM PRG). The five sections from the confluence of Snow Creek with Choccolocco Creek to Lake Logan Martin cover more than 35 river miles. These sections appear large relative to exposure units or decision units associated with the range of fish species in question. If SWAC exposure units are larger than the receptors' exposure areas, then high COC areas can be "averaged out" but still drive COC bioaccumulation and risk. If SWACs are to be used as an exposure and protectiveness metric, then it is critical that they are appropriately derived and sized for the associated exposure pathway and receptor so that CULs are achieved over a relevant spatial scale(s).

Recommendation
CSTAG recommends that the region document the basis for determining river areas for SWAC calculation and CUL application by using the physical characteristics of the river (e.g., geomorphology or sediment grain size) and the smallest exposure area relevant to the human health and ecological risk receptors. A "moving window" analysis based on the smallest relevant exposure area may be preferred in the absence of physical barriers or other logical separations. Exposure units should be sized so that CULs are evaluated over spatial scales relevant to the exposure pathway and receptor.

7. Conceptual Site Model

EPA's 2005 sediment remediation guidance describes a site's conceptual site model (CSM) as a "*representation of the environmental system and the physical, chemical, and biological processes that determine the transport of contaminants from sources to receptors*", and *"[e]ssential elements of a CSM generally include information about contaminant sources, transport pathways, exposure pathways, and receptors".* Importantly*, "the CSM should capture in one place the pathways remedial actions are designed to interdict to reduce exposure of human and ecological receptors to contaminants."*

CSTAG is concerned that the COC sources, transport, and exposure pathways are not understood to a level sufficient to develop remedial alternatives that reduce risk to acceptable levels.

7a. Fish-Sediment PCB relationship: The PRP submittal describes the fish-sediment relationship as a fundamental uncertainty because biota sediment accumulation factors (BSAFs) "*have high variabilities and do not result in BSAF values that are consistent with other similar sediment sites*" and "*the uncertainties may be associated with fish movement and the possible role of creek bank erosion in supplying PCB-containing solids to the water column*." In aquatic systems, and as described in the site's CSM, the sediment bed is central to PCB exposures via direct contact, fish dietary constituents, and the water column, and it serves as both a source and receptor of bank and floodplain contaminants. The uncertain fish-sediment relationship appears to be based on a "biota accumulation factor" analysis that compared sediment sample averages to wet weight fish tissue concentration averages in sampling areas of the river. The variable or unanticipated results may not relate to a lack of sediment exposure pathways and relationship to fish tissue, but to sampling (e.g., sampling to 6", sampling without regard to habitat or preference, or low sample numbers) and analysis assumptions (lack of lipid normalization, assuming the area averaged represents the sampled fish's exposure area, or using Aroclors instead of individual or bioaccumulated congeners) that are inappropriate or inadequate to represent the modeled processes.

Uncertainty in BSAFs or a range of BSAFs does not translate into an inability to determine a sediment PRG or develop risk reduction strategies based on sediment remediation. As stated in the 1988 RI/FS guidance, "*[t]he objective of the Rl/FS process is not the unobtainable goal of removing all uncertainty, but rather to gather information sufficient to support an informed risk management decision*…" A highly

[11]The 1 mg/kg PCB SWAC is also described as a "SWAC RAL [remedial action level]", not a PRG.

precise and accurate predictive relationship between an area's SWAC and the PCB level of fish captured in that area can't be expected due to the variability in PCB concentrations (and lipid and carbon content) and the uncertainty in the underlying assumption that the captured fish were exposed similarly. However, a high degree of precision and accuracy is not necessary to make an informed risk management decision, particularly if natural recovery following active remediation is envisioned. A sediment to fish tissue relationship can be used to provide a general estimate of risk-related sediment concentrations for use in a risk reduction framework. Like any assumption, sediment remedial goals derived from a food-web model will be revisited during five-year reviews and revised, if necessary, if a different relationship becomes apparent.

Recommendations

i. CSTAG recommends that the region seek additional expertise on fish bioaccumulation of hydrophobic contaminants to evaluate current data sets and develop an understanding of fish uptake for use in deriving sediment remedial goals or action levels.

ii. CSTAG recommends that if an empirical BSAF approach is not sufficient, then the region should develop a food web model to estimate the relationship between fish tissue concentrations and sediment.

iii. If current information is insufficient to support sediment RG development from the food web model, CSTAG recommends collection of synoptic fish and sediment data to verify transport and exposure pathways between sediment, bank, surface water, and fish COC concentrations. Additional approaches such as high-resolution sampling of the bioaccessible surface sediments and surface water particulates co-located with passive samplers in water column and porewater throughout the system, supported by a stable isotope study of fish diet will help draw conclusions on the origins, nature, and relationship of PCBs between media.

7b. Sediment Banks and Bed Exposure and Transport Pathways: EPA's 2005 sediment remediation guidance states that contaminant sources and transport pathways are essential elements of the CSM. Overall, the understanding of movement of PCBs throughout the system seems to only be partially and mostly qualitatively understood. Minimal information was provided by EPA, noting that banks, the sediment bed, and surface water runoff contribute PCBs and that sediments move downstream during precipitation events. The PRP described that multiple lines of evidence were collected on sediment bed stability and these were used to conclude that sediments were unstable for most of the site, except in the backwater areas and downstream of Jackson Shoals. The evaluation of riverbanks throughout the site for stability and erosion potential was documented. As described above, the PRPs appear to suggest that banks, not sediments, are the COC source to biota. The PRP submittal concluded "*that the highest PCB concentrations [in fish] are associated with samples collected several miles downstream of the highest sediment concentrations and along areas where creek bank actions are targeted in the initial OU-4 FS documents*".[12] However, there are many possible reasons for that observation related to sampling, transport, preferred exposure areas, fish movement, or just chance.

Undoubtedly, eroding contaminated banks contribute contaminants to the aquatic system, which would include transport to the riverbed, surface water, biota, and downstream. CSTAG does not question the importance of eroding banks as a source of COCs and remedial target, and that high energy areas without sediment are unlikely candidates for sediment exposure. However, unless sediment doesn't exist on the riverbed (which may be true in some high energy areas), the exclusion of a sediment bed as a source, sink, and vector of contaminants to downstream migration and to biota is implausible. The provided materials do not indicate that the bed's role in these processes and pathways can be ignored; indeed surface

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[12] This conclusion was apparently based on a figure provided to CSTAG that depicted average fish tissue concentrations (without uncertainty bounds) in river reaches. The most upstream areas of Choccolocco creek showed an average "all fish" concentration of approximately 3.5 mg/kg; the next downstream station was the highest station was just over 5.0 mg/kg.

chemistry data show elevated PCB concentrations greater than 1 PPM throughout the system as well as contaminated fish.

The creek bank remediation area was limited to areas upstream of river mile 29.5 that had moderate or severe erosion (other areas with high PCB or high erosion were not included). The stated rationale was that approximately 85% of the annual PCB load to the aquatic systems was associated with the targeted creek banks. CSTAG found no basis for this conclusion. The calculations were not provided except that *"Combining the amount of soils eroding from the creek bank areas with average PCB concentration for these lengths of creeks provides an estimate of annual PCB loadings…"* There was no description of how erosion was documented, or if the "average PCB *concentration for these lengths of creeks*" meant sediment, creek banks, or something else. Projections of creek bank loading are challenging. Top of bank sampling or assignment of concentrations from adjacent floodplain samples may not represent loading that occurs from bank failures that release historically-deposited contaminated (or clean) materials.

Recommendations
i. To support the CSM and final remedy, CSTAG recommends that the region use or develop observations of sediment and COC erosion, deposition, and transport in the sediment bed and banks to provide a mass balance of areas, sources, and media responsible for COC loading.

ii. CSTAG recommends that the region thoroughly evaluate (or remove) the current discussion of bank PCB loading estimates. CSTAG could not discern how these were developed or if they could reasonably represent bank PCB contributions. Bank prioritization schemes that combine PCB loading levels with bank erosion potential (e.g., core length weighted averaging approaches in conjunction with the BANCS model stability evaluations) are useful to estimate PCB loading from bank erosion and failure.

8. Alternatives

In the information presented to the CSTAG, the range of alternatives was limited to a single remediation footprint and the alternatives had no meaningful differences in expected risk reduction (only the applied technologies and disposal varied). All remedies relied on MNR, but there was no discussion on rates, areas, or time frames to provide a meaningful understanding of when clean up levels and RAOs will be achieved. If a final, protective action is intended to reduce risk to human health to acceptable exposure levels, then alternatives should be developed and compared on that basis.

8a. Range of Alternatives: The NCP (300.430(e)(2)(iii)) describes including a range of remedial alternatives:

> *"As appropriate, this range shall include an alternative that removes or destroys hazardous substances, pollutants, or contaminants to the maximum extent feasible, eliminating or minimizing, to the degree possible, the need for long-term management"…*"*other alternatives which, at a minimum, treat the principal threats posed by the site but vary in the degree of treatment employed and the quantities and characteristics of the treatment residuals and untreated waste that must be managed…"*

A single remediation area delineated by one remedial action level and bank erosion criterion with minor variation in remedial approaches doesn't provide an appropriate range of outcomes for evaluation of a final remedy under the 9 NCP criteria. The level of risk reduction associated with remedial alternatives also was not presented, except to note that "*[b]ased on approximate source control reductions of approximately 80%, it's expected that it will take several decades for the PRGs to be met for OU-4*." Constraining bank remediation to the upper reaches of the site without consideration of bank PCB content and loading potential of other areas artificially limits the consideration of alternatives and potentially information developed during design.

Recommendations

i. CSTAG recommends that if a final, protective ROD is developed, then it be supported by an FS that evaluates a range of alternatives varying in the degree of cleanup from MNR-only to the "*maximum extent feasible*" sediment bed and creek bank remediation. A range of alternatives would allow the region to evaluate and compare tradeoffs related to time to achieve sediment and fish tissue PRGs, cost, and the alternatives' short- and long-term effectiveness. These alternatives should clearly document the risk reduction expected from reducing PCB loading and exposures in terms of anticipated reductions in the sediment bed and fish tissue concentrations.

ii. CSTAG recommends that bank removal alternatives are based on the management of PCB loading potential, independent of river mile (see also Recommendation 7b) in a manner that can accommodate new information on source areas developed during design, early action, or other sampling.

8b. River Bank Alternatives: Details on bank design or general principles guiding design based on environmental conditions were also lacking. Several riverbank stabilization approaches were proposed including riprap, replanting, and reshaping, but the actual technology will be determined during remedial design. Approaches that heavily rely on bank hardening can transfer energy from currently eroding banks to other areas that are currently stable as well as require compensatory mitigation that can significantly increase cleanup costs.

Recommendation

CSTAG recommends the region incorporate natural channel design concepts and approaches (e.g. bank layback, native plantings, and root wads) when designing alternatives that modify the channel or banks. In selecting a remedy and in evaluating remedy performance, the region should use predictive approaches (e.g., hydrodynamic modeling supported by physical condition/composition data and prevalent failure mode analyses) and a prospective monitoring framework to ensure that bank remediation (especially hardening without bank layback) does not result in increased bank or bed erosion further downstream and/or flooding rise. Maximizing natural design concepts will also increase cost certainty due to lesser likely compensatory mitigation requirements.

8c. MNR Predictions: Because each alternative targets the same area, they presumably rely on the same amount of monitored natural recovery (MNR) to achieve remedial goals. However, the mechanisms, timing, and the reliability of natural recovery estimates were not (or only minimally) examined. A "*conceptual sediment recovery evaluation*" was conducted for a depositional area located downstream of Jackson Shoals "*to provide a temporal estimate for the MNR*", but it was not clear how this analysis represented site remediation, alternatives, or timeframes of fish tissue PCB reduction.[13]

EPA's 2005 sediment remediation guidance discusses potential lines of evidence of monitored natural recovery and site-specific information needed to support MNR including:

- Evaluation of historical and current contaminant levels in biota and surface water;
- Evaluation of geomorphology, long-term accretion, and erosion;
- Measurement of suspended solids and contaminant transport during high-energy events;
- Measure of sediment erosion properties; and
- Development of a tool to allow prediction of future recovery and risk reduction.

Further, EPA's 2017 contaminated sediment directive recommends that the region "*start collecting natural recovery lines of evidence as soon as possible once a basis for action has been established and documented (i.e., long-term data demonstrating decreases in contaminant levels in sediment, water, and*

[13]Detail was not provided, but the analysis appears to be a sediment bed mixing equation with unknown parameterization. The resulting figure showed declines in a sediment bed concentration downstream of Jackson Shoals after PCB input concentrations were reduced by 25, 50, 75, and 100%. Those reductions are apparently intended to represent the degree of upstream source control.

biota…)".[14] Based on the information presented, there was not sufficient information to support MNR effectiveness.

Recommendation
CSTAG recommends that the region provide additional site-specific information on the mechanisms, timing, and the reliability of natural recovery to support the selection of MNR as a remedy component.

9. Cleanup Strategy

In the discussion and recommendations above, CSTAG has identified several issues with the CSM and the development and evaluation of alternatives for a final, protective remedy. CSTAG has also identified the topics and areas that it believes require greater analysis and clarification prior to selecting a preferred alternative. Current characterization data may be sufficient to support an interim action to significantly reduce site risk by targeting the highest concentration bed sediments and the most significant bank contributions that serve as sources of contamination to biota and the system.

As highlighted in the 2017 contaminated sediments directive's recommendation on early actions, the preamble to the NCP states "*In deciding whether to initiate early actions, EPA must balance the desire to definitively characterize site risks and analyze alternative remedial approaches for addressing those threats in great detail with the desire to implement protective measures quickly*." Per Superfund Task Force recommendation 5 on early actions and adaptive management, early removal and interim actions could be used to address known sources and high concentration areas in the riverbanks and riverbed to reduce risk early at this site consistent with a final remedy. Separating interim and final actions could also help to more fully inform a further evolved CSM and final remedy for OU-4 by:

- refining and improving the tissue and environmental media relationship to provide greater confidence in selecting final CULs for sediments protective of humans consuming fish;
- learning to implement and improve cleanup approaches through an adaptive management process; and
- demonstrating the impact of sediment and bank remediation on PCB exposures and risk metrics to evaluate the need for additional remedial actions in a final ROD.

Recommendations
a. If the CSM and alternative development issues identified by CSTAG cannot be resolved in a timely and efficient manner to support a final ROD, CSTAG recommends the region consider developing an interim remedy or removal action of high concentration/high mobility riverbed and riverbank COCs to achieve earlier risk reduction.

b. Under an interim approach, CSTAG recommends the region initiate an adaptive management program consistent with Recommendation 8 of the 2017 contaminated sediments directive. The adaptive management program should compare post-remediation monitoring data to final cleanup levels to determine the need for additional actions that may be needed to achieve risk-based CULs in a final ROD (see Recommendation 11, below).

10. Institutional Controls

Per the NCP 300.430(iii) (C) and (D), the use of institutional controls in combination with various engineering controls are key components to any Superfund Site cleanup. ICs presented to the CSTAG included fish advisories and control of direct exposure and sources of COCs. These are discussed below.

10a. Fish Advisory ICs: The region informed CSTAG that the Alabama Department of Public Health (ADPH) recommends zero consumption of fish from Choccolocco Creek downstream of the site due to

[14] CSTAG also notes its 2005 recommendation to "*Sample upstream of the backwater area on Choccolocco Creek to determine the quality of water and sediment that are entering OU-4*."

PCB contamination. The Coosa Riverkeeper, a local non-profit group, reported that 21.5% of fishers on the Coosa River and its tributaries participating in a recent creel survey fish for subsistence and less than half of the participants reported knowing specifics about the fish consumption advisories. The Riverkeeper believes that the effectiveness of the current fish consumption advisory program is limited by insufficient and poorly maintained signage, inadequate public education efforts, and advisories available only in English.

Recommendation
CSTAG recommends that the region work with the PRP to supplement ADPH efforts and expand and sustain public education and notification efforts to reduce PCB-related human health risks from the consumption of contaminated fish. This includes installing new signs in multiple languages as needed, inspection and replacement of signs as necessary, and discussion in public forums and distribution of informational pamphlets at sporting goods stores. Given evidence of current exposure, efforts should commence with the OU-4 feasibility study and/or any early actions. CSTAG sees potential benefits of supporting and using the Riverkeeper's local resources and expertise to implement future efforts.

10b. Remedy Permanence/Source Control and Direct Exposure ICs: Due to the large area over which PCBs have come to be located at this site, ICs for waste left in place will likely be a significant part of any remedy. Call before you dig (811) is currently in place for OU-1, 2, and 3. This program helps to ensure that PCB exposure to people and wildlife doesn't occur during utility and other subsurface work (e.g. fence building, fiberoptic cable burial and maintenance) and also ensures that contaminants are controlled with the proper BMPs during construction activities. CSTAG noted PRP willingness to support such efforts in OU-4, but local government coordination and rulemaking may be necessary to put this in effect in a timely fashion, ideally concurrent with RI/FS, remedy selection, and RD to minimize the migration of contamination and impact to receptors.

Recommendation
i. CSTAG recommends a call before you dig (811) program be developed and maintained by the PRPs in OU-4 that includes coordination with local governments and community education and outreach.

ii. Monitoring, such as periodic visual inspection, should be considered for alternatives that involve leaving a substantial mass of PCBs in yards, floodplains, and banks to evaluate ongoing source potential to the creek(s). This program could also monitor stream channel migration and bank or floodplain erosion to identify, prevent, and repair unanticipated releases of PCBs. Sediment traps for piped drainage from contaminated properties should be monitored to identify contaminant migration and protect the remedy over time.

11. Monitoring

The region did not present a detailed monitoring plan for the site. Going forward, the region will need additional information to support understanding the impact of an interim action consistent with a final action and/or develop a CSM sufficient to represent the processes that determine transport of contaminants from sources to receptors and develop evaluate alternatives for a final, protective remedy. For all these purposes, the region would benefit from a long-term monitoring program that focuses on evaluating progress toward and attainment of remedial action objectives related to fish, water, and sediment and the drivers of or impediments to attaining the objectives. For example, sediment sampling with appropriate stratification based on habitat or sediment characteristics in the design could help define particular media relationships and establish final or interim remedy effectiveness. Discernment of natural recovery rates and processes in various media including biota could establish the role of MNR in in remedial alternatives. Repeated synoptic monitoring can also identify areas where media or biota are experiencing slower than expected recovery to be considered for further in-creek or source control actions.

Recommendations

a. CSTAG recommends the region develop and implement a long-term monitoring program focused on evaluating progress toward and attainment of fish, water, and sediment remedial goals (whether interim or final) and the drivers of or impediments to attaining those goals. This monitoring plan will serve as the basis for understanding the impact of remediation and could be used to improve the CSM and adapt the remedy as necessary. The program should be initiated as soon as possible, consistent with the 2002 and 2017 directives (principle 11 and recommendation 9, respectively).

b. CSTAG recommends that sediment monitoring use a longitudinal study design, to better understand existing media relationships and exposure concentrations, stratifying the river into sampling areas as necessary. If SWACs of exposure areas or strata will be used as metric or goal, their derivation should be as free of spatial bias as possible. This study could be repeated over time to evaluate removal actions, interim actions, and/or final action performance.