

**BASELINE ECOLOGICAL RISK ASSESSMENT ADDENDUM
FOR OPERABLE UNIT 4
ANNISTON PCB SITE, ANNISTON, ALABAMA**

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1. INTRODUCTION

The Anniston Polychlorinated Biphenyl (PCB) Site (the Site) is located in portions of Calhoun and Talladega counties in the north-central part of Alabama. The Site has been divided into Operable Units (OUs), which were selected based on geographic location and complexity (Figure AD-1). OU1/OU2 is a combination of two OUs representing residential properties (OU1) and non-residential properties (OU2) located around the facility currently owned by Solutia Inc. (Solutia), and downstream along Snow Creek to Highway 78. OU3 is Solutia's Anniston facility (the Facility) and its adjacent closed landfills, the South Landfill and the West End Landfill. OU4 includes Snow Creek and its floodplain downstream of Highway 78 to the confluence of Snow and Choccolocco Creeks, and Choccolocco Creek from the backwater area upstream of Snow Creek to the embayment of Lake Logan Martin on the Coosa River. All operable units are being investigated concurrently. When the Remedial Investigation (RI) for OU4 is complete, the United States Environmental Protection Agency (the EPA) will consider whether an additional downstream investigation of the Coosa River System is warranted.

Pharmacia LLC and Solutia Inc. (P/S) prepared a Baseline Ecological Risk Assessment (BERA) for OU-4 in August 2015, which focused on key ecological receptor groups that may reside in or forage within the terrestrial and aquatic habitat in OU-4. The EPA provided an extensive list of comments in June 2016, and the BERA was revised and resubmitted in October 2016.

The EPA reviewed the October 2016 BERA and found that it adequately addressed many of the EPA's concerns with the initial version of the document (Appendix A). After reviewing outstanding comments, and meeting with P/S to discuss the issues, it was clear that the EPA's interpretation of the data collected for the BERA differed significantly from P/S's interpretation for some issues. Rather than request another revision of the BERA, the EPA agreed to include the October 2016 BERA in the Administrative Record and to add a BERA Addendum that would summarize the EPA's evaluation and interpretation of the data.

1.1. OU4 BERA Addendum Process

The EPA first outlined the issues that would be addressed in the BERA Addendum and shared that information with P/S (Appendix B). P/S provided feedback to the EPA, which was considered before the EPA's data analysis began (Appendix C). The EPA conducted a number of evaluations of the data, including an analysis of how the EPA interpretation affected the weight of evidence (WOE) evaluation and risk conclusions. The EPA's identification and technical discussion for each issue are provided in Appendix D, along with revised calculations (the issues in Appendix D are identified by the original comment number from Appendix A and the issue number assigned by P/S in Appendix C). P/S reviewed and commented on the BERA Addendum (Appendix E).

The sections of the October 2016 BERA affected by the EPA's evaluation are discussed in this document to identify any changes and modify conclusions, as needed. Remedial Goal Options (RGOs) were provided in the BERA, and the EPA-derived RGOs are provided in Section 8 of this document.

1.2. Document Organization

The remainder of the OU-4 BERA Addendum includes comments on the following:

- Section 2 – Problem Formulation
- Section 3 – Data Summary
- Section 4 – Exposure Assessment
- Section 5 – Effects Assessment
- Section 6 – OU-4 Risk Characterization
- Section 7 – Conclusions
- Section 8 – Remedial Goal Options
- Section 9 – Addendum References

2. PROBLEM FORMULATION

The EPA and P/S worked together to develop the BERA problem formulation. The EPA identified several issues that impact the problem formulation section.

2.1 Reference Locations

Section 2.1 of the BERA should have provided a description of how the reference locations were selected (Appendix D, issue 9). The Phase 2 Field Sampling Plan (FSP) described the procedures used to select the three reference areas (Figures AD-2a, AD-2b, and AD-2c). Reference locations were selected based on a systematic process that evaluated the following criteria: habitat and ecological conditions at the proposed reference locations were similar to conditions in OU-4; and the reference location had no proximity to known point sources of PCBs or other contaminants of potential concern (COPCs). A single sediment sample was collected at each proposed reference site, and submitted for analysis of the same list of chemical constituents as the sediment samples collected for toxicity testing. PCBs were not detected in any of the sediment samples collected at the reference locations in April 2009.

Additional reference samples were collected as discussed in Section 3 of the BERA. The sampling data from Reference Locations was used to draw conclusions about ecological risk. Data comparisons to data from reference locations will be discussed further in the uncertainty analysis in Section 6.2.

2.2 Pore Water Data

Section 2.3.3 of the BERA should identify surface sediment and pore water concentrations from OU-4 sediment toxicity testing as separate Lines of Evidence (LOEs) for survival, growth, or reproduction of laboratory-cultured benthic invertebrates. (Appendix D, issues 19 and 22).

These changes require the addition of pore water data in Section 3 and impact the risk findings in Section 6.3.

2.3 T&E Species

Section 2.8 of the BERA should state that it is the EPA's policy that Ecological Risk Assessments (ERAs) are not conducted specifically for Threatened and Endangered (T&E) species or for individuals thereof (Appendix D, issue 11). Appropriate surrogates are chosen for the assessment endpoints that represent site receptors and are inclusive of T&E species (i.e., receptors), if present. The EPA does not characterize risks for individual T&E organisms, but rather at the level of the local population or higher levels of organization (USEPA 1999).

The estimated risk to T&E species will be discussed in the risk findings in Section 6.3.

3. DATA SUMMARY

The EPA and P/S worked together to plan data collection activities in OU4 to support the BERA. The EPA identified several issues that impact the BERA data summary.

3.1 Data Validation.

Section 3 of the BERA discussed the data but not the data validation. The tables in BERA Appendix F include the laboratory qualifiers but not the data validator qualifiers and provide no indication as to whether the metals data was validated (Appendix D, issue 3). To resolve this issue, P/S provided revised data tables (see Appendix F in this BERA Addendum).

This section should note that every sample went through Level 2 data validation, and one of 20 samples went through Level 4 data validation. The validation of the data for metals in sediment and soil generally added “J” values to many of the laboratory data that originally had no data quality flags. Rarely was an unqualified result or a U-flagged result changed to a “J” flag or vice versa. In the few instances where the flag changed to a non-detect, the concentration was low.

The impact of data validation on risk estimation and characterization is discussed in Section 6.1.

3.2 Pore Water Data.

Section 3 of the BERA did not include a discussion or presentation of pore water data collected during sediment toxicity testing. Pore water samples were collected from the toxicity test samples by different methods, depending on the analyte (Appendix D, issue 22).

Samples for general water quality, major cations, major anions, and dissolved organic carbon (DOC) were collected by centrifugation of whole sediment at 5,200 revolutions per minute (RPM) for 15 minutes at 4 degrees centigrade (° C) at the start of the toxicity and bioaccumulation exposures. Concentrations of trace metals were sampled from each test sediment during the whole-sediment toxicity testing with a small dialysis chamber (“peeper”). Polydimethylsiloxane (PDMS) solid-phase micro extraction samplers (SPMEs) were used to estimate pore-water concentrations of PCBs in each sediment evaluated in the toxicity testing. Pore water data tables were added to Appendix F in this BERA addendum.

The impact of the pore water data on the BERA risk characterization will be discussed further in the risk findings in Section 6.3.

4. BERA EXPOSURE ASSESSMENT

The EPA identified several concerns about the BERA exposure assessment that were not addressed.

4.1 Exposure Point Concentrations in Sediment

In section 4.2.1 of the BERA, the 95% UCL of the measured sediment PCB and Hg concentrations by Reach and by assessment area (AA) should have been provided (Appendix D, issue 5). Only Surface Weighted Average Concentrations (SWACs) and the 95% Upper Confidence Limit (95%UCL) of the SWAC were presented in the BERA for contaminants in sediment. The 95%UCLs of the SWACs were used as exposure point concentrations (EPCs) in the BERA.

Table AD-1 provides a comparison of the 95% UCL of the measured sediment PCB concentrations by reach and by AA to the 95% UCLs of the SWAC. For PCBs, in all but one instance (i.e., the Lower AA [LAA]), the total PCB EPC derived as the 95%UCL of the SWAC was less than or equal to the EPC derived as the 95%UCL of the measured concentrations.

Table AD-2 provides a comparison of the 95% UCLs of the measured sediment Hg concentrations by reach and by AA to the 95% UCLs of the SWAC. For Hg, five of nine EPCs derived as the 95%UCLs of the SWAC were less than or equal to the EPC derived as the 95%UCL of the measured concentrations.

The PCB and Hg EPCs in sediment will be discussed further in the uncertainty analysis in Section 6.2.

4.2 Exposure Point Concentrations in Riparian Soil in Area C1

In the BERA, reach C1 is divided into three EUs (sediment, the eastern floodplain soils, and the western floodplain soils). Soils 100 feet on either side of Choccolocco Creek were defined as riparian and considered a fourth EU for reaches C2 through C9. The EPA would like to evaluate a riparian EU for C1. (Appendix D, issue 6)

The soil data in Appendix F were reviewed. There are 94 soil samples from Reach C1 East and 6 soil samples from Reach C1 West. None of the soil samples are labelled riparian. The only COPCs analyzed in these samples were Aroclors, Total PCBs and solids. There are no metals data for soil samples from Reach C1, and no tissue data was collected in Reach C1.

EPCs for the riparian corridor were calculated using data from within 100 feet of both sides of the creek. Defining the riparian zone for Snow Creek using the same 100-foot metric, based on Figure AD-3, 18 of the soil samples from Reach C1 East and 4 of the soil samples from Reach C1 West were collected within the riparian zone. Total PCBs in Reach C1 east “riparian” soils ranged from 2.13 to 59 milligrams per kilogram (mg/kg), and in Reach C1 west “riparian” soils ranged from 0.115 to 206.5 mg/kg. Although a sufficient number of samples are available to calculate a 95%UCL for “riparian” soil in Reach C1 East, the recommended 95%UCL selected

by ProUCL is an H-statistic UCL of 25.02 mg/kg. ProUCL notes that 95%UCLs based on the H-statistic often result in unstable (both high and low) values of the 95%UCL, and recommends avoiding the use of 95%UCLs based on the H-statistic (U.S. EPA 2015). Therefore, the maximum concentration measured in “riparian” soils in both C1 Reaches is the preferred EPC for PCBs.

Table AD-3 (Table 6-18a in the BERA) indicates calculated risk for the Sandpiper-1 in Reach C1 riparian, and Table AD-4 (Table 6-21 of the BERA) indicates calculated risk for Raccoon-2 and Mink-1 in Reach C1 riparian using the SWAC 95%UCL for UAA riparian soils as the EPC. Table AD-5 (Table 6-18d in the BERA) shows that LOAEL HQs for Hg, vanadium (V), lead (Pb) and chromium (Cr) exceed 1.0 for the Spotted Sandpiper-1 in Reach C-1.

The food chain models (FCM) were re-calculated using the maximum measured PCB concentration in Reach C1 East and C1 West sediment and “riparian” soil for the sandpiper and raccoon instead of the 95%UCL for the UAA, and measured tissue concentrations (Tables AD-6 and AD-7). Because the “riparian” samples in C1 were not analyzed for metals, the maximum concentration measured in UAA soils was used as the EPC for inorganics. The mink exposure parameters assume 0% for the soil ingestion rate in Table AD-8 (Table 4-2a of the BERA), so use of the maximum soil/sediment concentrations would not affect the risk estimate for this receptor, and re-calculation is not necessary.

The change in risk findings based on this analysis will be discussed in Sections 6.3.

4.3 BAF for PCB 126

Section 4.4.1.6 of the BERA should have included a discussion about the fact that there is no site-specific BAF for PCB 126 in the BERA; this congener was evaluated using a literature-based earthworm BAF that underestimated the concentrations of dioxin-like compounds (DLCs) measured in earthworms collected on-site. (Appendix D, issue 31). The BERA refers to calculations in Appendix F, which concludes that toxic equivalent (TEQ) concentrations are unlikely to pose an unacceptable risk to wildlife because modeled concentrations did not result in exposure estimates that exceeded NOAELs. However, the most toxic PCB congener, PCB 126, was not included in the BERA TEQ evaluation, because a site-specific BAF could not be calculated.

The uncertainty associated with the exclusion of this congener will be discussed in Section 6.2.

4.4 Method to Estimate Dioxin Concentrations in Bird Eggs

Section 4.4.1.7 of the BERA Dioxin concentrations in bird eggs were not estimated using the California Office of Environmental Health Hazard Assessment (OEHHA) (2015) method and transfer coefficient. The Baseline Problem Formulation (BPF) noted that this LOE may be evaluated (Appendix D, issue 29). The EPA has reviewed the OEHHA (2015) method used to estimate total PCBs in bird eggs in the BERA and determined that this additional analysis would not improve the risk estimation at the site and therefore is not necessary. This determination is based on a number of reasons:

- 1) OEHHA (2015) method is highly generalized and therefore estimates it produces have substantial uncertainty.
- 2) Data on sediment dioxin/furan concentrations are very limited (5, 3, and 2 samples collected in the Upper, Middle, and Lower AAs, respectively). Risk estimates based on these limited data would be highly uncertain.
- 3) The EPA-approved OU4 BPF (BBL 2006), identified daily dietary doses of COPCs as the primary measurement endpoint for evaluation of risks to terrestrial and aquatic birds. COPC concentrations in eggs were identified as a secondary exposure measure that may be used.

Given the high uncertainty associated with the OEHHA (2015) model, the limited sediment data upon which to apply the model, and the secondary nature of the egg concentration endpoint, additional analysis for dioxin/furans in eggs was determined to be unnecessary.

4.5 Bird Body Weight

The equation used to estimate bird egg concentrations could be adjusted by the bird's body weight to make it applicable to ecological risk assessment for smaller bird species (Appendix D, issue 30). The OEHHA (2015) model for estimating COPC concentrations in eggs includes food ingestion parameters that are not scaled to body size. Because smaller animals generally consume more food than larger animals (Nagy 2001), this lack of scaling will result in underestimation of modeled egg concentrations. However, because:

- 1) OEHHA (2015) method is highly generalized, and therefore the estimates it produces have substantial uncertainty. This uncertainty is unlikely to be substantially reduced by scaling to body weight.
- 2) Estimated egg concentrations were given a lower weight relative to dietary exposure estimates in the Weight of Evidence (see Section 6.3.6.1 in the OU4 BERA), and
- 3) The EPA-approved OU-4 BPF (BBL 2006), identified daily dietary doses of COPCs as the primary measurement endpoint for evaluation of risks to terrestrial and aquatic birds. COPC concentrations in eggs were identified as a secondary exposure measure that may be used.

Given the high uncertainty associated with the OEHHA (2015) model and the secondary nature of the egg concentration endpoint, inclusion of body weight scaling was determined to be unnecessary. EPA considers the egg analysis performed and presented by P/S to be a reasonable good faith effort to model maternal transfer of COPCs to eggs.

5. BERA EFFECTS ASSESSMENT

The EPA identified several issues with the BERA exposure assessment that need correction or inclusion for the BERA to be acceptable.

5.1 Sediment Toxicity Test Results

- 5.1.1 The control-normalized 42-day number of young per female is a valid endpoint for characterizing toxicity of sediment and site-specific risk to the benthic invertebrate community in OU-4 for this BERA (Appendix D, issue17).

The BERA discounts use of the 42-day *Hyalella azteca* reproductive endpoint due to high variability in the control samples. Section 3.3 of BERA Appendix C states “U.S. EPA cautions about the uncertainties introduced by poor performance in laboratory control samples and states that even if reference sediment samples have acceptable performance, “any samples showing poor performance should not be judged to have shown toxicity, since it is unknown whether the adverse factors that caused poor control performance might have also caused poor performance in the test sediment.” This section concludes that “This variability in control response adds significant uncertainty to the predictability of models based on these [the *Hyalella* 42-day reproductive] endpoints.”

The acceptability criterion for the 42-day sediment toxicity test with *H. azteca* is control survival of greater than or equal to 80% on Day 28. Laboratories participating in round-robin testing reported the following control sediment responses after 28-day exposures: survival > 80% for >88% of the laboratories, length > 3.2 millimeters (mm)/individual for >71% of the laboratories, and dry weight > 0.15 mg/individual for > 66% of the laboratories. Reproduction from Day 28 to Day 42 was > 2 young per female for > 71% of the laboratories. All three control batches tested met the above criteria (summarized below).

Endpoint	Round Robin Controls	Control Batch 1	Control Batch 2	Control Batch 3	Coefficient of Variation (CV)
28-day Survival	> 80	97.5	99.2	96.7	1.3 %
Mm/individual	> 3.2	4.06	4.7	3.77	11 %
Mg/individual	> 0.15	0.23	0.36	0.24	26 %
Young per female	> 2	4.2	9.1	2.1	70 %

There are no requirements for acceptable control variability for this test. U.S. EPA (2000) notes that the reproduction endpoint is often more variable than growth. It also notes that based on 28-day length, larger amphipods (> 4.3 mm) tend to have higher reproduction. For the Anniston samples, the CV for the controls (sample size [n] equal to [=] 3 labs) for the 42-day young per female was 70%. Norberg-King et al. (2006) reported a CV of 49% for this endpoint (n = 5 labs).

Ivey et al. 2016 reported CVs of 38% (n =6) and 51% (n = 6) for the same endpoint, tests conducted using two different diets. Variability associated with this endpoint is high across studies. Although variability in the Anniston control samples was higher than in the studies on which the acceptability is based, control sample size for Anniston was only n=3. Control normalization methods were used to normalize the batch data. Additionally, high variability does not indicate poor control performance; control performance was acceptable for all controls in the Anniston toxicity tests. The control-normalized 42-day number of young per female is a valid endpoint for characterizing toxicity of sediment and site-specific risk to the benthic invertebrate community in OU-4 for this BERA.

5.1.2 The BERA does not include the most sensitive endpoint measured in the toxicity tests, *Chironomus dilutus* adult biomass, due to calculation of adult biomass from measured 13-day *C. dilutus* biomass (Appendix D, issue 18).

The method for and uncertainty associated with calculation of a parameter (adult biomass) from a measured parameter should be discussed in this section. Percent emergence and 13-day biomass were measured during the study. The long-term midge sediment toxicity tests were run with 7-day old larvae instead of less than 24-hour old larvae, so the 13-day growth endpoint corresponds to the 20-day weight endpoint specified in U.S. EPA (2000). Replicate adult biomass is calculated by first calculating the individual replicate dry weight and multiplying by the mean number of emerged larvae in the treatment. Then, mean total adult ash-free biomass is obtained by calculating the average of replicate total adult ash-free biomass for each sediment. This estimate of adult biomass assumes that the average weight of emerging adults is proportional to the average weight of larvae on day 13. P/S (2016) exclude this endpoint from their EC0*, EC10* and EC20* calculations, as they state that the above assumption cannot be verified and is not likely, leaving the calculated adult biomass endpoint highly uncertain.

Toxicologists from the Columbia Environmental Research Center (CERC) were consulted regarding the use of and validity of this endpoint in the long-term midge toxicity test. The purpose of estimating adult biomass, or the contribution of biomass contributed by the emerging midges, is to provide an estimate of benthic productivity and the potential reduction of benthic productivity due to direct or dietary exposure to contaminants. Capturing this endpoint is important for characterizing a reduction in biomass at a life-stage that is ecologically important to fish, birds, and wildlife that consume emergent insects. However, data are not available to evaluate or support the assumption that adult biomass is proportional to larval biomass. Adult biomass is not included as a standard endpoint in the long-term midge sediment toxicity test, and there are no criteria available to evaluate the acceptability of this endpoint (U.S. EPA 2000). Therefore, the EPA interpretation of the sediment toxicity test results will not include the adult biomass endpoint.

Both adult biomass and percent adult emergence classified 65% of sediment as toxic, and were the most sensitive of the *C. dilutus* endpoints. Day 13 biomass also classified 65% of sediment as toxic. Adult biomass and percent emergence classified a higher percentage of sediment as highly toxic (58%) compared with day 13 biomass (46%). The sediment toxicity thresholds calculated using these endpoints are shown below. The second most sensitive endpoint measured in the

long-term midge toxicity tests, percent emergence, will be used as the toxicity threshold derived from the site-specific toxicity tests for *C. dilutus*.

Endpoint	P/S (2016) ^A (mg/kg Total Aroclors)		Ingersoll et al. (2014) ^B (mg/kg Total Homologs)	
	EC0*	EC10*	TT _{LR}	TT _{HR}
Percent Emergence	2.04	6.8	1.87	7.11
13-Day Biomass	6.02	13.6	15.0	35.9
Adult Biomass	0.894	2.29	1.14	3.37

A EC0* and EC10* are the non-linear regression-predicted PCB concentrations (mg/kg dry weight [dw]) that would cause an additional 0% or 10% effect beyond the lowest response measured in the reference sediment.

B Toxicity threshold low range (TT_{LR}) and high range (TT_{HR}) reported in Ingersoll et al. (2014).

5.2 CTC for COPCs in Benthic Invertebrates and Small Mammals

The EPA recommends the use of the conservative assumption that a cited value is dry weight if the basis (dry or wet weight [ww]) is not specified in a paper (Appendix D, issue 25). The studies cited were carefully reviewed to determine the basis of the cited tissue concentrations. No information was found in the Duke et al. (1970) (see BERA Section 5.5.4.5.1 and related tables) or the Nebeker and Puglisi (1974) (see BERA Section 5.5.4.3.1 and related tables) stating whether the tissue concentrations in the paper were presented on a dry or wet weight basis (benthic invertebrate CTCs). No information was found in the McCoy et al. (1995) paper regarding basis (see BERA Section 5.5.2.1 and related tables; small mammal CTC). The CTCs derived from these studies were assumed to be dry weight.

5.3 Benthic Invertebrate Community Surveys (BICS)

Section 5.6.2 of the BERA needs to state that the benthic community surveys are a secondary LOE (Appendix D, issue 14). The text should not state that there appear to be no adverse effects of PCBs on the benthic receptor communities, since PCBs were not measured in the community samples. The results of the community surveys will not be used to down weight WOE conclusions based on chemistry measurements.

Additionally, the BERA compared the benthic community data on-site with reference, but did not evaluate the benthic community on an up-to downstream basis. Also, the BERA utilized the Hilsenhoff (1988) protocols to evaluate the BICS data instead of a state approved protocol (Appendix D, issue 15 and 16).

Biological integrity can be measured utilizing a suite of metrics that measure diverse biological attributes and respond to different stressors. A benefit of using a multi-metric index approach is the ability to incorporate and integrate information from a number of metrics that, when integrated into a single measure, can provide a meaningful indicator of overall biological condition (Barbour et al. 1995; Barbour et al. 1999). Use of a multi-metric index helps to increase sensitivity to a broad range of ecosystem stressors and to minimize any weaknesses or limitations that each underlying metric may have if used individually.

The EPA proposed using the Wadable Multi-Habitat Bioassessment Index (WMB-I) protocol developed by the Alabama Department of Environmental Management (ADEM) (ADEM 2014) to evaluate up- to downstream differences in the benthic invertebrate community structure (BICS) data; the OU-4 BERA only compared benthic community structure within OU-4 (site-overall) with reference conditions. The index was developed for streams that meet the following conditions:

- The water body must be lotic.
- Macroinvertebrates must be collected from late April through the end of June.
- Streams above the fall line (Interior Plateau/Transition Hills; Piedmont, Ridge and Valley; and Southwest Appalachians) must consist of riffle-run reaches.
- Streams below the Fall line should be low gradient, glide-pool reaches.
- The drainage area for the stream must be > 5 square miles and < 75 square miles.

The WMB-I protocol notes that streams outside the range of these characteristics should be analyzed using a comparable reference reach(es). The drainage areas for all except one of the Site stations exceed 75 square miles (range from 70 to 481 square miles).

The WMB-1 method is Eco-region specific; the metrics developed for the Piedmont, Ridge and Valley ecoregion in AL were used to evaluate the Anniston BICS data. The metrics included in the index are: number of Ephemeroptera, Plecoptera, and Trichoptera (EPT) taxa; percent non-insect taxa; Shannon Diversity Index; percent of EPT individuals, excluding Hydropsychidae and Baetidae (more tolerant EPT families); and percent tolerant taxa. Although similar metrics were evaluated in the OU-4 BERA, the BERA only used analysis of variance (ANOVA) to test whether the benthic community metrics measured on-site (site-overall) differed from reference conditions. Percent of non-insect taxa was not evaluated in the BERA. It is recognized that this metric penalizes the presence of molluscs and gastropods, but this bias should be reflected equally across the site-specific reference and assessment areas. The formula used to calculate a metric for the Shannon Diversity Index will result in a loss of this metric from the WMB-I score when measured values are less than 2.7; again, this should also be reflected equally across the site-specific reference and assessment areas.

The Discrimination Efficiency (DE) describes the ability of each metric and overall indices to distinguish between reference and stressed sites. It is calculated as the percentage of metric scores in verified stressed sites that are worse than the worst quartile of those in verified reference sites (Definition 3.3, ADEM 2014). The Pennsylvania Department of Environmental Protection evaluated the DEs for various parameters across drainage area sizes ranging from 0 to 1000 square miles (PA DEP 2012). DEs were excellent across all stream drainage area sizes for EPT taxa richness and % sensitive individuals, but decreased for the Shannon Diversity Index in streams draining more than 100 square miles of land. Rather than eliminating this metric from their large stream protocol, it was retained to be consistent with the small stream benthic community analysis.

The Eco-region specific DE for each metric in the WMB-I protocol is not utilized in the multi-metric index score calculations; rather, it is utilized in the interpretation of the final index value (Section 8.1, ADEM 2014). The same formula is used to calculate a score for a particular metric,

regardless of Ecoregion or Ecoregion-specific DE for each metric (Sections 7.1 through 7.5, ADEM 2014) (e.g., Ecoregion-specific DEs and reference areas do not affect the calculated multi-metric index values).

The BERA Addendum up- to downstream evaluation based on the ADEM metrics is mathematically correct and does not incorporate the Ecoregion-specific DE or reference condition comparison. For the BERA addendum, EPA calculated a multi-metric index score for the 5 metrics identified as having the highest DE for the Piedmont, Ridge and Valley Ecoregion in AL to evaluate the Anniston BICS data. The metric score calculation is mathematically identical, regardless of the Ecoregion, at this stage of the calculation. The reference comparison and numeric placement into condition categories is Step 8 of the calculation; this step was not included in the up- to downstream assessment done for this Addendum report. The evaluation conducted for this addendum only compared the multi-metric index values calculated for the site-specific reference areas, the UAA, the MAA and the LAA. The EPA is using the rubric contained in the ADEM protocol to compare upstream and downstream reaches based on multi-metric index scores instead of using the protocol to assign impairment status with respect to protocol definitions.

Even though the WMB-I analysis does not meet all of the criteria specified within the method, the BICS sample collection and analysis methods used in the OU-4 BERA also had problematic issues. Benthic community samples were collected using different sampling methods appropriate to the habitat type; measurements from the different habitats could not be standardized per unit area basis. No information was presented as to whether a similar level of effort was expended to collect samples from the different habitats. Co-located chemistry samples were not collected at the BICS sample locations. During each season, samples were collected from two locations per habitat within each AA. A single replicate sample was collected at each sampling location. The ANOVA analysis presented in the OU-4 BERA treats the data as being four independent samples, not two samples and two replicates.

Although the portion of Choccolocco Creek that is OU-4 of the Anniston Site does not meet all of the specific stream characteristics specified in the WMB-I protocol, use of the multi-metric index calculation portion of this protocol does indicate differences in benthic macroinvertebrate community structure between the three AAs and the reference locations, particularly in the UAA (Table AD-9, Figures AD-4a and AD-4b). The index values calculated for each riffle or run are not dependent on the Eco-region specific reference locations, which were developed for streams with drainage areas > 5 square miles and < 75 square miles; comparison of Site multi-metric indexes to reference conditions to evaluate impairment occurs in Step 8. Calculation of the multi-metric index value is Step 7. The up- to downstream analysis using the calculated multi-metric index values is appropriate as an LOE to evaluate and interpret the BICS data. The WMB-I results indicate impacts to the benthic invertebrate community in the UAA, both in riffle and run habitats.

6. BERA OU-4 RISK CHARACTERIZATION

The EPA previously identified concerns about the BERA risk characterization that have not been addressed in the BERA. Some of the issues presented in previous sections result in additional risk characterization discussions in this section.

6.1 BERA Risk Estimation and Characterization

All of the issues discussed in previous section have some impact on the BERA Risk Estimation and Characterization. Those that need additional discussion are provided below.

6.1.1 Hazard Quotient (HQ) rounding and interpretation. (Appendix D, issue 1).

The Environmental Protection Agency (EPA) Staff Paper on Human Health Risk Assessment (HHRA) (U.S. EPA 2004) is the document cited by P/S as a justification for rounding HQs to a single digit in the July 6 comments from Pharmacia LLC and Solutia Inc. (P/S) on the proposed BERA Addendum outline. U.S. EPA (2004) states “In a final risk description, all cancer risks and non-cancer hazard indices should be presented with one significant figure only”; this statement is specifically referring to data presentation in an HHRA. The U.S. EPA (2004) document also notes that the number of significant figures presented during a risk assessment changes to reflect the needs of the assessment. It states “For example, risk information presented in Risk Assessment Guidance for Superfund (RAGS) Part D tables (Tables 6 through 9 in RAGS) typically present cancer risk information with two significant figures. This summary information allows risk assessors reviewing the document to check the accuracy of the cancer risk calculations and provide appropriate comments.” Rounding the HQs to one significant figure did not facilitate review of the OU-4 BERA. Rounding the calculated HQs to one significant figure resulted in the risk conclusions for LOAEL-based HQs between 1.0 and 1.49 being characterized as “indeterminate” (“low” in the OU-4 BERA report) rather than “unacceptable” (“moderate” in the BERA report). Because rounding calculated HQs to a single digit impacts the risk conclusion for HQs between 1.0 and 1.49, the HQ must be presented to at least one decimal place.

Tables AD-10 through AD-24 show the revised NOAEL- and LOAEL-based HQ summaries.

6.1.2 Data Validation and Non-Mercury Metal Conclusions (Appendix D, issues 3 and 10).

The assignment of data quality flags did not affect the conclusions for whether the metals in sediments and soils were site-related or the BERA Figures (6-10 to 6-14) that compare the data. However, there remains considerable uncertainty in the interpretation of the abiotic chemistry data results, as outlined below:

- There was one reference data point for non-Hg metals in soils.
- There were no data for non-Hg metals in Reach C1 soils, however C1 had the highest concentrations of metals in sediments.

The lack of non-Hg metals data limits the ability to discern potential upstream to downstream trends in the concentrations of metals in soils.

The non-mercury metal concentrations in tissues were impacted by the validated data and data qualifier revisions added to Appendix F. The EPA replotted the data that depict concentrations of metals in fish, aquatic biota, and terrestrial biota by excluding the data for non-detected metals results from the validated data in Figures AD-5 through AD-9. The original BERA Figures (6-15 to 6-19) are included as Addendum Figures AD-10 through AD-14.

For barium (Ba) in fish (Figure AD-5), the highest concentrations, which were over 15 mg/kg, were identified as non-detects by the data validation. Despite this change, Ba concentrations in fish remain similar to the reference station. Upstream to downstream trends were more apparent after removing the faulty data.

For Chromium (Cr) in aquatic biota (Figure AD-6), the situation was similar to barium in aquatic biota. There were several results for Cr showing 4 mg/kg in biota that originally had a “B” flag, but upon validation assumed a “U” flag. The plot created by eliminating the non-detected values shows that concentrations of Cr in aquatic biota of OU-4 were higher than at the reference stations. For Cr in fish (Figure AD-6), the concentrations of Cr in fish above 4 mg/kg were determined to be non-detect in the data validation. However, the concentration of Cr in the fish from the reference station remains higher than in OU-4. While the conclusion does not change, Figure AD-6 changed substantially.

Cobalt concentrations in aquatic biota were originally depicted as higher at the reference stations (Figure AD-12) than at the site. Once the non-detected samples were eliminated, Figure AD-7 now shows cobalt detected in aquatic biota in the upstream assessment area but not at the reference stations. Cobalt was not detected in fish collected from the reference stations.

Concentrations of Pb in fish tissues and other aquatic biota (Figure AD-8) showed a decreasing trend from upstream to downstream. Concentrations of Pb were highest in the middle reach as a result of a single high data point for Pb in earthworms.

There were few samples of fish tissue in which V was detected. Results for V in tissues (Figure AD-9) do not indicate a strong trend, but tend to show higher concentrations in OU-4 biota than in biota at the reference stations.

In summary, Figures AD-4 through AD-9 were created for this Addendum to reflect the correct information. As a result of the revisions based on validated data, the non-Hg metals in sediment, soils, and biota cannot be ruled out as contaminants of potential concern (COPCs) based on comparison to reference or by upstream to downstream trends.

The tables in Appendix B of the BERA appear to have incorporated the non-detects from the validated data in the calculation of the Bioaccumulation Factors (BAFs), so no changes to the tables are necessary. As shown in Table AD-25, there are a few non-Hg metals with LOAEL HQs above 1 for aquatic and terrestrial mixed diet receptors.

6.2 BERA Uncertainty Analysis

6.2.1 Compare PCB Aroclor and PCB Homolog Data (Appendix D, issue 4).

The laboratory measured PCB homolog groups by an in-house modification to Method 8270C. The Standard Operating Procedure (SOP) for the modification to Method 8270C was presented in the appendix to the Revision 5 Quality Assurance Project Plan (Arcadis 2008). The selective ion monitoring (SIM) method was used to analyze for total PCB homologs and homolog groups in surface water, soil, sediment, and biological tissues. Total PCB Aroclors were measured by Method 8082 in most soil and sediment samples and in fish and tissues. EPA has promulgated a method for analyzing for PCB homologues as PCB congeners (Method 1668B). The high-resolution method for 209 PCB congeners eliminates the subjectivity of splitting the PCB mixture into homologs or identification of patterns for Aroclors.

The SOP for the laboratory's in-house modification to Method 8270 GC-MS-SIMPCB requires a demonstration of analyst capability. EPA has requested from P/S information on the laboratory's demonstration of capabilities and any validation provided for the method. The Stage 4 validation packages for the homolog SIM data were requested from P/S. The information will be placed in the administrative record for the site. The additional information was requested due to the fact that the method was modified.

Judgments for how the instrument data is split into homolog groups can depend on the analyst. The homolog groups were split out by chromatogram retention time with standards for Aroclor 1242, Aroclor 1260 and Aroclor 1268. PCB mixtures were used to determine beginning and ending retention times for homolog groups instead of using individual PCB congeners for this purpose. The average of the response for the first and last eluting compound within each level of chlorination was used for quantification. Forty percent (40%) of the PCB homolog SIM data for soil was "J" qualified. Fifty percent (50%) of the PCB homolog SIM data for sediment was "J" qualified. Fifty-six percent (56%) of the PCB homolog SIM data for tissues was "J" qualified. More of the PCB homolog data was "J" qualified compared to the PCB Aroclor data measured by Method 8082.

The same extract was used to run the PCB Aroclor analysis and the homolog SIM analysis when a sample was tested by both methods. While it is expected that the PCB Aroclor analysis and the homolog SIM analysis might give slightly different results, it is noted that the homolog SIM method measured higher concentrations of total PCBs in samples containing lower-chlorination PCBs, while the PCB Aroclors method measured higher concentrations of total PCBs in samples containing mid-range chlorination PCBs.

Both the homolog SIM method and the PCB Aroclor method depend on the judgment of the analyst when deciding how to break the mixture of 209 PCB congeners into groups of either PCB Aroclors or PCB homologs. It is possible for the PCB Aroclor method to double count overlapping peaks. However, this is also true of the homolog SIM analysis. Corrections are applied to the quantification of each chlorination level by the homolog SIM method based on mass spectrometer responses. The corrections for overlapping peaks are specific to a particular instrument. With supporting information on the demonstration of the method by the particular analyst, the overall method performance can be evaluated.

A validation report for a single sample delivery group was reviewed. The validation report described how the data were validated. The “J” qualifier was assigned to the results for particular homologs when the matrix spike or matrix spike duplicate recovery was less than the 50% lower limit on recovery specified in the SOP. In the sample delivery group reviewed, when there was a problem the laboratory control sample recovery was lower than the 50% lower limit. Since the laboratory control sample is a spike into a clean matrix, it should represent the best performance of the method/instrument, free of matrix issues; and problems with it could be expected to extend across the sample delivery group. The validation protocol rejected data only when the sample was non-detect and the matrix spike or matrix spike duplicate recovery was less than 10%. A detected homolog with matrix spike recovery of less than 10% was J-flagged, and data was not rejected.

Given the high proportion of J flagged data, especially for total pentachlorobiphenyls, the PCB homolog SIM method might have underestimated the concentrations of total PCBs more often than the concentrations were overestimated (as compared to the Aroclor method). The underestimation appears to have affected the tissue samples to a greater degree than the soil or sediment samples.

Concentrations of PCBs in benthic invertebrates measured using the homolog SIM analytical method may have been underestimated. Risk conclusions based on exposure of higher trophic level receptors to measured PCB concentrations in benthic invertebrates may be less conservative.

6.2.2 Homologue and Aroclor results for the backwater area where Snow Creek and Choccolocco Creek meet. (Appendix D, issue 7).

In the toxicity testing samples collected from the backwater area, concentrations of mono- and di-chlorinated homologs are high, but the Aroclor analysis is not picking up the lower chlorinated Aroclors. The total Aroclor data may be under-predicting the actual PCB concentrations present. Additionally, the presence of lower chlorinated congeners in sediment may be a concern for groundwater, particularly in the Backwater Area.

P/S has stated that although the lower chlorinated congeners are present in sediment, Choccolocco Creek is a gaining waterbody, and the presence of lower chlorinated congeners in sediment should not be a groundwater concern.

The EPA believes that conditions within a gaining stream could reverse during high flow storm events. Seasonal variation in flow could also reverse the stream condition. The potential impact of lower chlorinated congeners in sediment on groundwater in OU-4 should be discussed in the RI. However, lasting groundwater impacts from lower chlorinated congeners in high flow conditions on groundwater are expected to be low.

6.2.3 The 95% UCL of the measured sediment PCB and Hg concentrations by Reach and by assessment area (AA) should be considered (Appendix D, issue 5).

The comparison of EPC calculation approaches for total PCBs and Hg indicates substantial variability depending upon the approach chosen (measured or surface-weighted). For PCBs, EPCs derived as the 95% UCL of the SWAC were lower than or equal to EPCs derived as the 95% UCL of the measured concentration for all Reaches, and for the UAA and MAA (Table AD-1). Hg EPCs derived as the 95%UCLs of the SWAC were lower than or equal to EPCs derived as the 95%UCL of the measured concentrations for all Reaches except C3 and C4, and for the UAA (Table AD-2).

In general, calculation of the EPC using the 95% UCL of the SWACs produced lower values as compared to the 95% UCL of the measured concentrations. Risk conclusions based on the 95% UCL of the SWAC should, therefore, be considered less conservative than would risk estimates based on the 95% UCL of the measured concentrations of PCBs and Hg in sediment.

6.2.4 Reference Locations (Appendix D, issue 9).

As described in Section 2, reference locations were selected based on a systematic process. PCBs were not detected in reference sediment samples collected when the locations were selected or in sediment samples collected for the OU-4 BERA. However, PCBs were detected in the three surface water samples collected at Reference Location 2 and one surface water sample collected at Reference Location 3 (Figures AD-2a through 2c). The highest PCB concentration measured in aquatic plant tissue collected for the BERA was in a sample collected at Reference Location 2. One small mammal tissue sample collected at Reference Location 1 contained PCBs at concentrations higher than some small mammal tissue concentrations measured in OU-4. The PCBs observed in surface water (Reference Locations 2 and 3), aquatic plants (Reference Location 2), and one small mammal (Reference Location 1) were anomalous, and the source(s) of these PCBs is unknown. Detection of PCBs in samples from the reference areas adds to the uncertainty associated with comparison of site results with reference results.

6.2.5 Footnote b of Table AD-26 (BERA Table 5-2a) states that “EC0 was set at a concentration of 0.05 (the mean reference sediment concentration)”. However, total PCB Aroclors were not detected (ND) in any of the reference sediment samples; 0.05 mg/kg is the maximum reporting limit (RL). The effect on the calculated EC0* and EC10 values should be discussed (Appendix D, issue 20).

Looking at Figure AD-15 (Response vs. Dry Weight-Normalized Total PCB Concentration (Sum of Aroclors) in OU-4 Sediment for *Hyalella azteca* Toxicity Tests, from Appendix C of the BERA), the curve drops rapidly for the Young/female normalized to survival (% of control) endpoint. The effect of the selected numerical value for non-detected PCB concentrations on the derivation of site specific effects thresholds was evaluated. Dose-response analyses were performed using the U.S. EPA Toxicity Relationship Analysis Program (TRAP; version 1.30a; https://archive.epa.gov/med/med_archive_03/web/zip/trap1-30a.zip). Dose response analyses were performed on *Hyalella azteca* reproduction (42-d reproduction normalized to 42-d survival normalized to controls), survival (42-day survival), and growth (42-d measured total biomass [mg]) bioassay results and associated total PCB as Aroclor sediment concentrations presented in Anniston, OU-4 BERA, Appendix F. Dose response analyses were performed for reproduction,

survival, and growth with values for non-detected PCB concentrations represented by the method detection limit (mdl) and by 0.5*mdl. Concentrations associated with a specific percent effect (i.e., ECx) were identified. The results of these analyses are presented in Tables AD-27, AD-28, and AD-29 and Figures AD-16a and b, AD-17a and b, and AD-18a and b for reproduction, survival, and growth, respectively.

The results indicate that the value selected to represent non-detected PCB concentrations has minimal effect on the resulting ECx estimates. Whereas setting non-detects to 0.5*mdl increased ECx values from 11% to 23% for reproduction (Table AD-27), it produced no change on ECx values for survival (Table AD-28) or growth (Table AD-29). The lack of any change in survival and growth ECx values may be due to the steepness of the dose-response for these effects as compared to reproduction.

The conclusion from this analysis is that the value selected to represent non-detected values had little influence on the final ECx values derived from the site-specific bioassays for the Anniston OU-4 BERA. The EC0* and EC10* values calculated in the BERA are appropriate.

6.2.6 There is uncertainty about whether the EC0 and EC0* can be considered a no observed effect concentration (NOEC) (Appendix D, issue 21).

The Anniston OU-4 BERA developed two values, the EC0 and the EC0*, to quantify lower limit sediment thresholds based on the site-specific bioassays. Whereas the EC0 was defined as the sediment PCB (or Hg) concentration associated with the average response at the bottom of the reference envelope, the EC0* is the sediment PCB (or Hg) concentration predicted by the dose-response analyses to produce 0% effect above the EC0. Although some effects may occur within the reference envelope, these effects are considered representative of reference conditions and not toxicity. Because some effects may occur at either the EC0 or the EC0*, neither threshold can be considered to be no effect concentrations. However, because these levels of effects are characteristic of the reference condition, exceeding the EC0 or EC0* does not present an unacceptable risk.

6.2.7 CTC for COPCs in Benthic Invertebrates

The benthic invertebrate critical tissue concentrations (CTCs) recommended by EPA were not utilized in the BERA (Appendix D, issue 24).

One AE selected for this ERA was the benthic invertebrate community. An assessment endpoint (AE) is an expression of the environmental value to be protected (U.S. EPA 2016). Effects on assessment endpoints are estimated using measures of effects on surrogate receptor species representative of that AE. Use of a single, sensitive receptor species is protective of all species within that AE, and is appropriate for an ERA.

One LOE utilized for evaluating risk to the benthic invertebrate community was comparison of tissue residues in benthic invertebrates collected on-site with tissue concentrations reported in published studies that were associated with adverse effects on survival, growth or reproduction.

This LOE integrates multiple exposure pathways for invertebrates, including direct contact with sediment and water, ingestion of sediment and water, and ingestion of prey.

There are no available compendia of aquatic biota tissue CTCs for use in BERAs. There are often few studies in the toxicological literature for particular COPCs, and numbers of studies are further reduced when the search is limited to those reporting whole-body concentrations. Some studies report tissue concentrations but do not specify whether the reported concentration is on a dry- or wet-weight basis. Toxicity thresholds may be available for a limited number of species, however species-specific biology and physiology or life history characteristics may affect exposure to or uptake of a COPC; a CTC reported for an epibenthic species may not be representative of a CTC for an infaunal species. Some studies were not designed to identify a CTC, but report both tissue residues and a measured adverse effect, which allows calculation of a CTC from the data presented in the paper. Studies conducted in the field may evaluate effects on benthic invertebrates exposed to a mixture of COPCs. All of these issues contribute to and result in high uncertainty associated with tissue residue evaluations and conclusions. Additionally, the primary objective of the tissue sample collection efforts conducted for the OU-4 BERA was to use measured or modeled prey concentrations in site-specific dietary exposure models to evaluate risk to upper trophic level receptors that utilize OU-4 of the Anniston Site as a foraging area, to reduce the uncertainty associated with estimating prey concentrations using literature-based BAFs. Due to the uncertainty associated with the tissue evaluation, this LOE is considered a secondary LOE for this BERA.

The proposed CTC TRVs from all of the studies are summarized in Revised Table AD-30. Sections 3.4 and 4.4 of Appendix D of the OU-4 BERA describe the rationale for selecting the studies used to derive the P/S-proposed lowest observed effect concentration (LOEC) and NOEC TRVs. The LOEC and NOEC for PCBs in benthic invertebrate tissue range from 5 to 1875 and 0.2 to 382 mg/kg dw, respectively. The LOEC and NOEC concentrations for Hg in benthic invertebrate tissue range from 18 to 90 and 12.7 to 56 mg/kg dw, respectively.

EPA recommended that CTC values from Van Geest et al. (2011) be used to evaluate toxicity of PCBs to all benthic invertebrates, and that CTC values from Mendez-Fernandez et al. (2015) be used to evaluate toxicity of Hg to all benthic invertebrates, rather than selecting receptor-group specific CTC values.

Van Geest et al. (2011) conducted a bioaccumulation study with three test species, and observed reduced survival (64% vs. greater than 80% in most tested sediment) of *Hexagenia* spp. (mayfly nymph) in a field-collected sediment containing 4.8 mg/kg PCBs; tissue accumulation was 1.4 mg/kg wet weight. Prior to the bioaccumulation study, sediment was screened for acute toxicity for 4 to 12 days; adequate survival was expected in all tested sediment. Greater than 80% survival was observed in a sediment with 1.3 mg/kg PCBs, while almost 100% mortality was observed in a sediment with 6.4 mg/kg PCBs. The sediment where reduced survival was observed contained elevated concentrations of other contaminants (PAHs, dioxins). The PAH concentrations in the 4.8 and 6.4 mg/kg PCB sediment were 9.4 and 5.5 mg/kg, respectively. The threshold effect concentration (TEC) for PAHs is 1.61 mg/kg, and the probable effect concentration (PEC) is 22.8 mg/kg. Although the PAH concentrations exceeded the TEC, both were well below the PEC. The polychlorinated dibenzodioxin/furan (PCDD/F) concentration in

the sediment with 64% survival was 0.95 mg/kg, while greater than 80% survival was observed in a sediment with a PCDD/F concentration of 2.5 mg/kg. PCDD/Fs were not present in the 6.4 mg/kg PCB sediment. The TEC for PCBs is 0.0598 mg/kg, and the PEC is 0.676 mg/kg. The PCB concentration in sediment where reduced survival was observed is well above the PEC for PCBs. The study authors noted that nymphs had difficulty burrowing into the sediment where 64% reduced survival was observed because of its coarse physical structure, however this behavior was not observed during the screening tests. Although co-contaminants were present, and grain size issues and effects on burrowing were observed, the results from the Van Geest et al. 2011 study have fewer shortcomings than the studies proposed by P/S to derive CTCs for PCBs (Slide 15, May 16, 2017 presentation). None of the congeners tested by Fisher et al. (1999) are dioxin-like congeners, and congener 47 (from which the LOEC value is derived) only comprises 0.14% by weight of Aroclor 1254, the primary Aroclor present at the Anniston site. Poor control survival was observed in both the Borgmann et al. (1990) (15% and 33%) and Nebeker and Puglisi (1974) (48%) studies.

Mendez-Fernandez et al. (2014) conducted toxicity tests on field-collected sediment to determine whether residue levels of arsenic (As), Hg, zinc (Zn) and Pb could be used to predict chronic toxicity and estimate effective tissue residues. Many of the tested sediment were from copper or Hg-mine impacted areas, but four of the tested non-reference sediment were collected from areas not impacted by mines, including sediment N19 (toxic) and N20 (non-toxic). The only metal in both sediment N19 and N20 that exceeded the TEC value (0.99 mg/kg) was cadmium (Cd) for both samples (1.7 and 1.1 mg/kg, respectively), and the Cd concentration in both was well below the PEC (4.98 mg/kg). Measured oligochaete tissue concentrations of all metals except Hg were within the range measured in the four reference sediment samples, all of which were non-toxic. All the tissue concentrations for other metals except Zn in samples N19 and N20 are below the threshold body burdens cited in Bervoets et al. (2016). The Hg concentration in N19 can be considered a LOEC (89.6 nanomoles per gram [nmol/g] dw; 17.97 mg/kg dw), and in N20 can be considered a NOEC (63.5 nmol/g dw; 12.7 mg/kg dw). Both the Van Geest et al. (2011) (LOEC of 5 and NOEC of 2 mg/kg dw) and the Mendez-Fernandez et al. (2014) (LOEC of 18 and NOEC of 12.7 mg/kg dw) studies provide acceptable CTC values for evaluating risk to benthic invertebrates.

Additionally, P/S did not consider the lowest CTC for PCBs in molluscs (from Duke et al. 1970), described in Section 3.4.4 of Appendix D, appropriate for CTC development because the measured endpoint was oyster shell growth, which varies in response to a variety of environmental factors and is not considered predictive of organism health. P/S selected the endpoint measured in the Lowe et al. (1972) study, which was also shell growth rate (shell height and in-water weight). As stated on BERA Table 6-24, "Low end selected when multiple values". The 96-hour LOEC from Duke et al. should have been selected as the CTC, or neither growth-based CTC should have been selected for molluscs. The EPA applied an acute-to chronic uncertainty factor of 0.1 to calculate a LOEC of 3.3 mg/kg for PCBs in molluscs. Duke et al. (1970) did not state the basis for this value in the paper, therefore the EPA assumed a LOEC CTC of 3.3 mg/kg dry weight. This value was added to Revised Table AD-31.

HQs were calculated using both the P/S proposed benthic invertebrate CTCs and the EPA recommended CTCs (Table AD-31). Using the EPA recommended CTCs, calculated LOEC HQs exceed 1.0 for molluscs in all three AAs, and the calculated LOEC HQ for emergent insects in

the UAA exceeds 1.0. Using the mollusc CTC from Duke et al. (1970), the calculated HQ for molluscs also exceeds 1.0 in all three AAs. None of the LOEC HQs calculated using the TRVs proposed by P/S exceed 1.0. The P/S-proposed receptor-specific TRVs underestimate risk to the benthic invertebrate AE.

However, due to the uncertainty associated with the benthic invertebrate CTC values, this LOE will be treated as secondary LOE. The primary objective for collection of benthic invertebrate tissue for the OU-4 BERA was to have site-specific tissue data to utilize in the dietary exposure models for upper trophic level receptors.

6.2.8 CTC for PCBs in Fish

The EPA recommended CTC from the Foekema et al. 2014 was not used as the CTC for PCBs in fish tissue in Section 5.5.3.1 of the BERA (Appendix D, issue 27).

The derivation of fish tissue-based CTCs for PCBs is described in Section 3.3 of BERA Appendix D. The critical study used to derive fish CTCs in the BERA was a study by Hansen et al. (1973) that evaluated reproductive effects in sheepshead minnows (*Cyprinus variegates*) exposed to Aroclor 1254 at six concentrations (0, 0.09, 0.14, 0.39, 1.1 or 5.6 micrograms per liter [µg/L]). No Observed Effect Concentration (NOEC) and Lowest Observed Effect Concentration (LOEC) tissue concentrations of 1.9 and 9.3 mg/kg ww (7 and 34.4 mg/kg dw, respectively) based on fry survival were reported. At the LOEC concentration, a 26% decrease in fry survival was observed.

The EPA reviewed studies that reported CTCs for PCBs in non-salmonid fish. Additional data was extracted from the Environmental Residue Effects Database (ERED). Studies that reported greater than 80% mortality or an increase in growth or fecundity were not included in the summary table. Nine studies reported LOECs for whole body fish PCB concentrations, and reported values ranged from 0.14 to 65 mg/kg ww. The median CTC value was 7.5 mg/kg ww. The reported PCB CTCs for whole body fish are much less variable than the CTCs reported for benthic invertebrates (Table AD-32).

EPA recommended using the CTCs derived from the Foekema et al. (2014) study, which evaluated the effects of a mixture of 25 PCBs similar to Aroclor 1254 in the common sole (*Solea solea*). The study reported effects concentrations in terms of lipid weight which can be converted to whole body concentrations using the lipids measured in sole in Foekema et al. (2012) (2%). Disrupted or delayed development of larvae between 6 and 40 days post-fertilization was observed at a tissue-residue of 6.82 mg/kg ww (27.3 mg/kg dw). Lethality to 50% of larvae, within 6 days post-fertilization, occurred at a tissue-residue of 7.48 mg/kg ww. Tissue-based HQs were recalculated using the LOEC from the Foekema et al. (2014) study (Table AD-33). Use of the CTC from Foekema et al. (2014) study instead of the CTCs from Hansen et al. (1973) only changed the risk conclusion for forage fish in the LAA.

6.2.9 CTC for Dioxin in Fish Tissue

The EPA-recommended CTC for dioxin in fish tissue was not included in Section 5.5.3.4 (Appendix D, issue 28). The derivation of fish tissue-based CTCs for dioxin-like compounds (DLCs) is described in Section 3.3 of BERA Appendix F. Steevens et al. (2005) developed a residue effects distribution for fish eggs and embryos, the life stage that is most sensitive to toxicity mediated by the aryl hydrocarbon receptor (AHR). Residues reported on a whole egg or embryo basis were combined into a species sensitivity distribution (SSD) based on the geometric means of NOEC and LOEC values; endpoints included significant reductions in survival, growth, or reproduction. Because of the lipophilicity of DLCs, effect residues in fish eggs can be related to maternal tissue concentrations after lipid normalization. For nonpolar organic compounds, the ratio of a lipid-normalized chemical concentration in eggs to the concentration in adult fish was found to be approximately 1:1 egg to adult fish (Russell et al. 1999 as cited in P/S 2016).

Studies on lake trout (*Salvelinus namaycush*), brook trout (*Salvelinus fontinalis*), rainbow trout (*Oncorhynchus mykiss*), channel catfish (*Ictalurus punctatus*), lake herring (*Coregonus artedii*), fathead minnow (*Pimephales promelas*), Japanese medaka (*Oryzias latipes*), northern pike (*Esox lucius*), white sucker (*Catostomus commersonii*), and zebrafish (*Danio rerio*) were included in the SSD. Most of the studies included in the SSD were conducted using 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). Mean, lower and upper 95%UCL benchmarks were selected at different species protection levels (i.e., protective of 99, 97.5, 95, or 90% of fish species). The DLC CTC selected for use in the OU-4 BERA was the 95% UCL effect residue protective of 90% of species, 2.2 nanograms (ng) TCDD/gram (g) lipid. To convert the lipid-based CTC to units of mg/kg dw, the mean and maximum lipid fraction of fish captured in OU-4 were used to calculate two CTC values for TCDD, 255 ng/kg and 572 ng/kg dw, respectively.

EPA recommended using the mean value (0.699 ng/g lipid) protective of 90% of species rather than the 95%UCL of the mean for the same protection level. This would result in CTCs for TCDD of 0.081 and 0.182 mg/kg dw for the mean and maximum lipid fraction fish, respectively.

A recent paper, published after the Anniston BERA was conducted, cites a median lethal dose (LD50) for TCDD in lake sturgeon eggs of 0.61 ng/g ww (1.22 ng/g dw, assuming 50% solids for fish eggs [May et al. 2009]) (Tillett et al. 2017). Figure 5 of Tillett et al. (2017) presents a range of LD50 values (0.04 to 13 ng/g ww) for TCDD in eggs of 16 fish species, including 3 salmonid species. The CTC value from the Tillett et al. (2017) study is higher than either of the CTCs from the Steevens et al. (2005) paper. Although the Steevens et al. (2005) does not report the endpoints measured in the studies used to develop the SSD, acceptable endpoints for inclusion in the SSD were significant reductions in growth, reproduction or survival. The Tillett et al. (2017) study summarized studies reporting an LD50; the CTC value based on an LD50 would be expected to be higher than a CTC based on a significant decrease in growth or reproduction. The CTC value from the Tillett et al. (2017) paper was added to this analysis in response to comments. The CTC derived by Steevens *et al.* (2005) using the SSD method and based on growth, reproduction and survival endpoints from numerous studies is considered by EPA to be the recommended CTC value to use to evaluate this LOE.

HQs were calculated for TCDD and tetrachlorodibenzofuran (TCDF), the primary DLCs detected in fish tissue, using the P/S, EPA, and Tillett et al. (2017) CTC values (Table AD-34). Seventeen fish were submitted for analysis of DLCs. The CTCs proposed for use by P/S resulted

in estimated unacceptable risk for 6 and 24% (TCDD and TCDF, respectively) of fish submitted, using the mean lipid CTC, and for 0 and 6% using the maximum CTC. The CTCs recommended by EPA resulted in unacceptable risk for 6 and 47% of fish submitted (TCDD and TCDF, respectively), using the mean lipid CTC, and for 6 and 29% using the maximum CTC. The CTC values selected by P/S underestimated potential risk to fish from measured concentrations of DLCs in fish tissue. Tissue concentrations of TCDF were generally higher than tissue TCDD concentrations. Only fish collected from the MAA and LAA had tissue concentrations of TCDD or TCDF that exceeded the EPA-recommended CTC.

6.2.10 BAF for PCB 126

There is no BAF for PCB 126, the most toxic PCB congener, in Table AD-35 (BERA Table F-6) (Appendix D, Issue 31). The most toxic PCB congener, PCB 126, was evaluated in the BERA TEQ evaluation using a literature-based earthworm BAF because a site-specific BAF could not be calculated. However, the literature-based BAF used to perform this evaluation underestimated concentrations of dioxin-like compounds (DLCs) measured in earthworms collected on-site. Risk to the Carolina wren (the most sensitive receptor) from exposure to DLCs in earthworms was assessed using the site-specific data for PCB 126 measured in earthworms collected from OU-4 and exposure parameters used in the OU-4 BERA to fill a gap in the Arcadis BERA by presenting a worst-case scenario. The results of this analysis are presented in Table AD-36. The worst-case scenario was evaluated for brevity. However, protective levels of exposure for the full range of AEs are provided in the Remedial Goal Option (RGO) tables.

Analysis for PCB 126 in earthworm tissue was conducted in 5 samples (Appendix F from Anniston OU-4 BERA) and detected in only three. Exposure estimates were calculated using these data (Table AD-36). For simplicity, soil ingestion was excluded from the analysis, earthworms were assumed to comprise 15% of the diet, and terrestrial spiders were assumed to comprise 31% of the diet (the same fractions used in the Anniston OU-4 BERA; BERA Table 4-1b; Addendum Table AD-37). As spiders were not collected onsite, the BERA used the measured worm tissue COPC concentrations as representative of concentrations expected in spiders. The estimated exposure therefore only considered PCB-126 from earthworm/spider portion of the diet; all other food types and PCB or dioxin/furan congeners were excluded. Despite the very limited nature of the exposure estimates, NOAEL HQs greater than 1.0 were obtained for all three estimates (Table AD-36).

These results suggest that modeled dioxin-like PCB and dioxin/furan exposure in the BERA may underestimate total exposure because of the exclusion of some of the more toxic congeners, such as PCB-126. However, it should be noted that PCB 126 was not detected at high frequencies in OU-4 soil (4 of 39, 0 of 35, and 7 of 28 samples from Upper, Middle, and Lower AAs, respectively; BERA Table F-2 (Addendum Table AD-38), Anniston OU-4 BERA). This low frequency of occurrence of PCB-126 suggests that the underestimation of risk may vary spatially and be highly localized.

6.3 Risk Findings

6.3.1 The HQ interpretation did not follow the Ecological Risk Assessment Guidance for Superfund (ERAGS; U.S. EPA 1997) (Appendix D, issue 2a).

The following risk categories should be used consistently throughout BERA: no observed adverse effect level (NOAEL) $HQ < 1.0$, risk is acceptable; NOAEL $HQ \geq 1.0$ and lowest observed adverse effect level (LOAEL) $HQ < 1.0$, risk is indeterminate. LOAEL $HQs \geq 1.0$ indicate unacceptable risk and should be evaluated based on the magnitude and the ecological significance of the response in the selected critical study.

The risk categories used in the OU-4 BERA were defined as follows: NOAEL $HQ \leq 1.0$, risk is negligible; NOAEL $HQ > 1.0$ and LOAEL $HQ \leq 1.0$, low risk. LOAEL $HQs > 1.0$ and ≤ 10 , indicate moderate risk, and LOAEL $HQs > 10$ were interpreted to indicate high risk.

HHRAAs are typically more conservative than ERAs. For an HHRA, the reference dose (RfD) is a NOAEL value and uncertainty factors (UFs) are incorporated into the RfD. RfDs can be based on any toxicity endpoint, whereas toxicity reference values (TRVs) selected for ERAs are limited to effects on growth, reproduction or survival. For an ERA, the LOAEL, the dose at which an adverse effect is observed, is used as a TRV. Because the LOAEL-based TRV in an ERA is a dose at which an adverse effect on an ecologically relevant endpoint has been observed, any exceedance of this exposure indicates potential risk.

The Ecological Risk Assessment Guidance for Superfund (ERAGS; U.S. EPA 1997) states that a NOAEL-based HQ less than one (unity) indicates that the contaminant alone is unlikely to cause adverse effects (Section 2.3). An HQ equal to 1 is a pass/fail decision point. This decision point also applies for LOAEL-based HQs. Based on guidance, the following risk categories will be used in this OU-4 BERA Addendum: NOAEL-based $HQ < 1.0$, acceptable risk; NOAEL-based $HQ \geq 1.0$ and LOAEL-based $HQ < 1.0$, indeterminate risk; and LOAEL-based $HQ \geq 1.0$, unacceptable risk. Calculated $HQs > 10.0$ will be identified (high unacceptable); these criteria are summarized in the Table below. Calculated HQs will be evaluated based on the number and magnitude of exceedances. Additionally, the magnitude of the adverse response observed in the critical study that the LOAEL TRV was derived from will be considered when interpreting LOAEL-based $HQs > 1.0$.

Calculated HQ	Risk Conclusion, BERA Addendum	Risk Conclusion, OU-4 BERA ^B
NOAEL-based $HQ < 1.0$	Acceptable	Negligible
NOAEL $HQ \geq 1.0$ and LOAEL $HQ < 1.0$	Indeterminate	Low
LOAEL-based $HQ \geq 1.0$	Unacceptable ^A	Moderate
LOAEL-based $HQ \geq 10.0$	High unacceptable ^A	High

^A Risk interpretation will consider the magnitude and severity of the adverse effect observed in the critical study.

^B The OU-4 BERA differs from the Addendum in the placement of the equal sign, as follows: NOAEL $HQ \leq 1.0$; NOAEL $HQ > 1.0$ and LOAEL $HQ \leq 1.0$; LOAEL $HQs > 1.0$ and ≤ 10 ; and LOAEL $HQs > 10$

If the calculated HQ is less than the NOAEL TRV, there is adequate information available to conclude that ecological risks are negligible and therefore there is no need for remediation based on ecological risk; risk is considered acceptable (U.S. EPA 1997). Based on the design of toxicology experiments, the actual concentration at which an adverse effect will occur falls

somewhere between the NOAEL and LOAEL dose. Because the actual LOAEL is unknown, risk associated with a calculated HQ that falls between the NOAEL and the LOAEL is unknown; that risk is classified as indeterminate in this BERA Addendum. The term “low” was not utilized to classify HQs that fall within this range in this Addendum, as EPA intends to consider taking action if the ERA indicates risk. In an ERA, the LOAEL is the dose at which a statistically significant adverse effect has been observed; a calculated HQ greater than or equal to 1.0 indicates potential unacceptable risk. LOAEL HQs > 10 or LOAEL HQs > 1.0 where the observed adverse effect was significant (e.g., mortality > 50%) were interpreted to indicate high unacceptable risk.

6.3.2 The EPA disagrees with the Effective Concentration (EC) comparison interpretation (Appendix D, issue 2b).

Risk to benthic invertebrates was evaluated on a point-by-point basis, and the risk conclusions were based on the number of samples within an Exposure Unit (EU) (Reach or Assessment Area [AA]) that exceeded the toxicity threshold for the most sensitive endpoint (Table AD-39). As described above for the LOAEL, the EC20 is a sediment concentration where a response/effect 20 percent (%) lower than the control response is expected. For the benthic risk evaluation, the risk categories will be revised similar to those described above: < EC0; ≥ EC0, < EC10; ≥ EC10, < EC20; ≥ EC20. In BERA Table 6-4a, the measured PCB concentration in two sediment samples from Reach C1 is 4.4 mg/kg and the EC20 is 4.4 mg/kg. Table 6-4a from the BERA (Table AD-40) has been revised to reflect the above risk categories (Table AD-39).

Ingersoll et al. (2014) defined the Toxicity Threshold High Risk (TTHR) as the sediment PCB concentration that corresponded to a 10% reduction compared to the lower limit of the reference envelope (equivalent to the EC10* concentration in the OU-4 BERA). Seven percent, 0.7% and 0.4% of the sediment samples collected for the BERA are > EC10* and < EC20* for the *Hyalella azteca* 42-day young per female endpoint, the *Chironomus dilutus* percent emergence endpoint, and the *C. dilutus* survival endpoint, respectively. Five percent and 2% of the sediment samples are > the EC20* for the *H. azteca* reproductive endpoint and the *C. dilutus* % emergence endpoint, respectively. None of the sediment samples exceed the EC20* for the *C. dilutus* survival. Most of the EC20* exceedances are for sediment samples collected in Reaches C1 and C2 (Revised Table AD-39).

For the Weight of Evidence interpretation, risk was identified as unacceptable based on sediment concentration equal to or greater than the EC10* but less than the EC20*, high unacceptable based on sediment concentration equal to or greater than the EC20*, indeterminate based on sediment concentration equal to or greater than the EC0* but less than the EC10*; and acceptable if less than the EC0* (Table AD-39).

The approach used by the EPA to classify contaminated sediments based on elevated sediment concentrations in a limited number of samples is appropriately conservative, because localized areas of PCB contamination in sediments can drive accumulation in aquatic invertebrates and emerging insects, which can transport PCBs in the food web throughout the entire reach (Archer *et al.* 2018). When released to the surface water, PCB contamination from a localized area can wash downstream and affect the entire reach.

The EPA's revised classification scheme also identifies Reaches where a portion of the sediments have an elevated sediment concentration above the comparison value. For Reaches where only one or two samples exceeded the above risk categories, the WOE evaluation was modified to state that sediment concentrations within that Reach were generally acceptable (if most samples were lower than the EC10*), with localized areas of unacceptable risk (Table AD-46).

6.3.3 Exposure Point Concentrations in Riparian Soil in Area C1 (Appendix D, issue 6)

Except for Hg, the use of the maximum soil metal concentration had little impact on the calculated HQs for the spotted sandpiper and exposure to inorganics (Table AD-41); use of the maximum measured Hg concentration in UAA riparian soils (17.4 mg/kg) instead of the 95%UCL (2.809 mg/kg) resulted in a higher calculated LOAEL-based HQ (14.4 versus 8). Use of the maximum measured concentrations of PCBs in "riparian" soils from C1 instead of the 95%UCL for all UAA riparian soils resulted in a calculated HQ almost three times higher for birds exposed to soil in EU C1-West (92 versus 36 in the OU-4 BERA). Use of the maximum measured concentration of PCBs in "riparian" soils from C1 resulted in calculated HQs for omnivorous mammals (raccoon) that indicate unacceptable risk.

In summary, use of the 95%UCL for the UAA instead of the maximum soil concentration in C1 underestimated risk from exposure to PCBs and Hg for aquatic ground-feeding invertivorous birds. Use of the measured concentrations of PCBs in "riparian" soils from C1 instead of the 95%UCL for all UAA riparian soils resulted in calculated unacceptable risk for exposure of omnivorous mammals; whereas the original calculations resulted in an indeterminate risk conclusion. Use of the 95%UCL for UAA riparian soils as the EPC underestimated risk to aquatic ground-feeding invertivorous birds and omnivorous mammals from PCBs, and to aquatic ground-feeding invertivorous birds exposed to Hg.

6.3.4 This section needs to state that the Community Survey Metrics were used as a secondary LOE for each AE (Appendix D, issue 8 and issues 32-37).

The BERA WOE tables were revised to clearly identify the community surveys as a secondary LOE, and discuss the limitations associated with the surveys (Tables AD-42 to AD-44). In addition, a table was created in the addendum (Table AD-46) to visually summarize the WOE results for PCBs using each line of evidence for each assessment endpoint.

Risks were also evaluated for 7 additional secondary contaminants of potential concern (COPCs) (i.e., barium, chromium, cobalt, lead, vanadium, dioxin toxic equivalents [TEQs], and mercury) (Tables AD-47 to AD-53). Although unacceptable risks were identified in some areas of OU-4 for some of these COPCs, overall risks in OU4 are dominated by PCBs.

Revised risk conclusions based on the updated WOE interpretation are summarized in the Conclusion Section.

- 6.3.5 The potential for adverse effects to populations of T&E species that may occur in OU-4 can be qualitatively evaluated based on the risk conclusions for each assessment endpoint that corresponds with the relevant T&E species (Appendix D, issue 11).

The qualitative evaluation of T&E species is summarized below. Each AE described below was evaluated using appropriate surrogate species. The risk conclusions for each AE apply to all species encompassed within that AE.

AE 1: Aquatic and terrestrial plant communities. The U.S. FWS (2014) lists four T&E flowering plant species as potentially occurring within Calhoun County, Alabama. However, no T&E plant species have been recorded during surveys within OU-4. Further, plants do not appear sensitive to PCBs (TRVs for plants are approximately 10-fold greater for plants than soil invertebrates; Table AD-54). No unacceptable risk to local populations of T&E plants in OU-4 is therefore estimated.

AE2: Benthic Invertebrate Community. U.S. FWS (2015) found that bivalves are less sensitive to OU-4 sediment than either the midge or amphipod evaluated under the site-specific sediment toxicity program. This is important, as two T&E mollusc species have been observed within Choccolocco Creek and may be found in OU-4. These include the painted rocksnail and Tulotoma snail. The U.S. FWS (2014) lists eight T&E clam species as potentially occurring within Calhoun County, Alabama. In addition, one sensitive snail species, Wicker Ancyloid limpet, formerly thought to be extinct, has been observed in lower Choccolocco Creek (Zielinski 2011). The presence of these animals in OU-4, particularly in the lower portions of the system, is indicative of improving habitat quality and system health. However, the weight of evidence for benthic invertebrates (Table AD-42) indicates unacceptable risks to the benthic invertebrate community in Reaches C1, C2 and C7 of OU4. Risks in other Reaches were lower, being either acceptable or generally acceptable (with localized unacceptable areas). Taken together, these observations indicate that unacceptable risks to threatened or endangered benthic invertebrates may be present in Reaches C1, C2 and C7 of OU-4, but are either acceptable or generally acceptable in the rest of OU-4.

AE3: Terrestrial Invertebrate Community. There are no known T&E terrestrial invertebrate species potentially occurring within Calhoun County, Alabama. No unacceptable risks to T&E invertebrates in OU-4 is therefore predicted.

AE4: Fish Community. One threatened fish species, the blue shiner, has been observed in Choccolocco Creek and the U.S. FWS (2014) lists the threatened pygmy sculpin as potentially occurring within Calhoun County, Alabama. The weight of evidence for fish (Table AD-42) indicates unacceptable risks to the forage fish community (which would include blue shiner and pygmy sculpin) may be present in the MAA of OU4 based on measured tissue concentrations. Tissue concentration based risks in the UAA and LAA were indeterminate.

AE5: Birds. The U.S. FWS (2014) lists one T&E bird species (Red-cockaded woodpecker) as potentially occurring within Calhoun County, Alabama. No T&E birds have been observed within OU-4. Further, because red-cockaded woodpeckers rely on mature pine forest habitat

(which is limited in OU-4) and forage for insects on tree trunks (Jackson 1994), exposure and risks from PCBs and Hg are unlikely.

AE6: Mammals. The U.S. FWS (2014) lists three T&E mammal species (Indiana bat, grey bat and northern long-eared bat) as potentially occurring within Calhoun County, Alabama. The diet and habitats used by these species greatly overlap with those of the little brown bat, a mammalian surrogate receptor for this AE in the OU-4 BERA. Therefore, the risk conclusions for this AE are directly applicable to the three T&E bats. The weight of evidence for insectivorous aerial mammals, which may include Indiana bats, grey bats, and the northern long-eared bat, (Table AD-44) indicates potential unacceptable risks in exposure units C1 through C4 based on both measured and modeled diet. Measured and modeled risks are acceptable in all downstream exposure units (i.e., C5-C10).

6.3.6 Observed surface water exceedances of the Alabama Department of Environmental Management (ADEM) Water Quality Standards (WQS) and Ambient Water Quality Criteria (AWQC) for PCBs are down-weighted in the BERA using species-specific toxicity values (Appendix D, issue 13).

To resolve this issue, the EPA proposed that the ADEM WQS and AWQC should be identified and weighted as the primary Line of Evidence (LOE). P/S disagreed that the proposed resolution, as the ADEM WQS and AWQC for PCBs are not based on risk to lower trophic level aquatic receptors. WQS and AWQC will be included as an Applicable, Relevant and Appropriate Requirement (ARAR).

The EPA reviewed the WQS and the species-specific toxicity value from Suter and Tsao (1996), and concluded that the species-specific toxicity value used in the BERA is appropriately conservative. The EPA agrees that this issue is better addressed by the ARARs evaluation in the Feasibility Study.

6.3.7 The benthic community surveys were not clearly identified as a secondary LOE and no co-located chemistry data was collected with the benthic community samples (Appendix D, issue 14).

The WOE tables have been revised to clearly state that no conclusions on adverse effects of PCBs or other COPCs can be made based on the community surveys, as chemistry was not measured in samples collected where community survey samples were taken. It has also been revised to clearly identify the community surveys as a secondary LOE.

6.3.8 The BERA compared the benthic community data on-site with reference, but did not evaluate the benthic community on an up-to downstream basis. Also, the BERA utilized the Hilsenhoff (1988) protocols to evaluate the Benthic Invertebrate Community Survey (BICS) data. ADEM protocols (i.e., the Wadeable Multi-Habitat Bioassessment Index (WMB-I)), which include region-specific reference locations, are available and should have been used (Appendix D, issue 15 and 16).

As stated in Section 5, although the portion of Choccolocco Creek that is OU-4 of the Anniston Site does not meet all of the specific stream characteristics specified in the WMB-I protocol, this protocol does indicate differences in benthic macroinvertebrate community structure between the three AAs and the reference locations, particularly in the UAA (Table AD-9, Figures AD-4a and 4b). The index values calculated for each riffle or run are not dependent on the eco-region-specific reference locations, which were developed for streams with drainage areas ≥ 5 square miles and ≤ 75 square miles. The up- to downstream analysis is appropriate to utilize to evaluate and interpret the BICS data. The WMB-I results indicate impacts to the benthic invertebrate community in the UAA, both in riffle and run habitats.

6.3.9 The surface sediment test results for three of the six locations from which sediment samples were collected for the sediment toxicity testing should be discussed (Appendix D, issue 19).

The test results from these three surface sediment samples were evaluated as a separate line of evidence to support the risk evaluation for the benthic invertebrate community assessment endpoint. In the Baseline Problem Formulation, (BB&L 2006), one of the risk questions for the benthic invertebrate assessment endpoint is: “Is the survival, growth or reproduction of aquatic invertebrates exposed to whole sediments from the OU-4 significantly lower than those exposed to reference sediments?” Evaluation of the site-specific toxicity test results from the surface samples was identified as a separate site-specific line of evidence appropriate to support the risk evaluation for the benthic invertebrate community assessment endpoint.

The three locations where surface sediment for toxicity testing were collected were TX10, TX20, and TX50; samples were collected at a depth of 0 to 12 inches (Figure AD-19). The reference sample, TXR1, was also collected from the surface, but represented a depth of 0 to 6 inches. Depths from which bioassay samples were collected are also reported in Ingersoll et al. (2014). These samples represent three different reaches and AAs, TX50: UAA/Reach C2; TX20: middle AA (MAA)/Reach C5; and TX10: LAA/Reach C10. The number of sediment samples tested from each area also varied: 5 samples were tested from the reference location (TXR1), 4 samples from TX50, 2 samples from TX20, and 1 sample from TX10.

Toxicity in all samples was evaluated using both amphipod (*Hyalella azteca*) and midge (*Chironomus dilutus*) bioassays (Ingersoll et al. 2014). The reference envelope approach was used to determine whether bioassay results measured by 13 and 12 test endpoints for the amphipod and midge, respectively, were indicative of toxicity. The bioassay results and total PCBs measured in the surface sediment samples from the Anniston OU-4 BERA as reported in Ingersoll et al. (2014) are summarized in Table AD-55. Although sediment from the reference location were not identified as toxic to either test species in any of the samples tested, toxicity of sediment from the OU-4 surface sediment locations varied by both location and test species. Surface sediment from location TX50 (Upper AA; Reach C2) contained the greatest total PCB concentrations (mean=655,000 micrograms per kilogram [$\mu\text{g/kg}$]) and were most consistently toxic to both test species; samples were identified as highly toxic (i.e., greater than 10% reduction in bioassay response) for 38% to 75% (mean=63%) and 0% to 89% (mean=47%) of test endpoints for amphipods and midges, respectively. Surface sediment from location TX20 (MAA; Reach C5) contained much lower total PCB concentrations (mean=265 $\mu\text{g/kg}$) and

generally displayed little toxicity to both test species; samples were identified as not toxic for 85% to 92% (mean=89%) and 92% to 100% (mean=96%) of test endpoints for amphipods and midges, respectively. Although surface sediment from location TX10 (LAA; Reach C10) possessed the lowest total PCB concentration of any surface sediment location for which bioassays were performed (91.2 µg/kg), toxicity differed greatly between the two test species, however, only one sample from TX10 was tested. Sediment from this location was identified as highly toxic for 54% of test endpoints for the amphipod, no test endpoints were identified as highly toxic for midges.

The results of these bioassays on surface sediment suggest that while total PCBs are contributing to adverse effects to the benthic invertebrate community in Reach C2 of the Upper AA of OU-4, their contribution to adverse effects in Reach C5 or the Middle AA is minimal. The divergence of toxic responses between amphipods and midges, coupled with the low total PCB concentrations, suggests that effects observed in Reach C10 of the LAA are likely not associated with PCBs, but rather some other factor. These conclusions have been integrated into the updated Weight of Evidence analyses (Table AD-42). It is recognized that there are limitations associated with having a single sample location (or single sample, in the LAA) within each Assessment Area; however, the surface sediment toxicity test results do provide another site-specific LOE with which to evaluate the benthic invertebrate community assessment endpoint.

6.3.10 New Issue, Comment 2.1 in the June 4, 2018 P/S comments on the BERA Addendum for OU-4: Small mammal CTC

The OU-4 BERA Addendum placed the highest weight in the WOE evaluation on the LOE for small mammals based on measured dietary exposure, while the OU-4 BERA placed the highest weight on the tissue-based HQ. This was done in the BERA as the CTC for small mammals was taken from the same study from which the dietary TRVs were derived. However, the critical study does not indicate whether the tissue residue concentrations are reported on a dry or wet weight basis. There is high uncertainty associated with and low confidence in the identified CTC; therefore, the tissue-based LOE for small mammals LOE was given lower weight in the WOE in the BERA Addendum (Table AD-44). The uncertainty associated with this LOE is not due to the measured small mammal tissue EPC; it is related to the CTC value reported in the critical study and the fact that its basis is not reported. Section 5.2 discusses the assumptions made when dry or wet weight basis is not stated in a paper.

Using the NOAEL (3.28 mg/kg, assumed to be dw) and the LOAEL (7.52 mg/kg, assumed to be dw) CTC value reported in McCoy *et al.* (1995) and the EPCs for the Upper, Middle and Lower AA reported in BERA Table 6-11 (6.36, 15 and 15 mg/kg dw, respectively) results in a NOAEL HQ > 1 for the UAA, and a LOAEL HQ >1 for the MAA and LAA. This would change the WOE conclusions for the mammalian insectivore/ invertivore in Table AD-46 to unacceptable risk in Reaches C1 to C10. Additionally, the severity of the adverse effect observed at this tissue concentration should be considered in the WOE evaluation (a 75% decrease in the number of offspring surviving to weaning). The WOE interpretation for the terrestrial insectivore/invertivore in the BERA Addendum has the highest confidence in the LOE based on measured dietary exposure (Table AD-44).

6.3.11 Section 6.3, Risk Findings, should include a discussion of pore water data as an additional Line of Evidence (LOE) (Appendix D, issue 22).

Site-specific low-risk (LR) and high-risk (HR) toxicity thresholds (TTs) were developed for 24 COPCs or COPC mixtures in sediment and pore water to assess risks to benthic organisms associated with exposure to sediment located within the Site. TTs were developed for adult emergence and adult biomass of *C. dilutus*, and for reproduction of *H. azteca*. The TT_{LR} is the concentration of a COPC or a COPC mixture that corresponded to the lower limit of the reference envelope for the selected toxicity test endpoint. The TT_{HR} is the concentration of a COPC or COPC mixture that corresponded to a 10% reduction in biomass, emergence, or reproduction compared to the lower limit of the reference envelope. All of the TTs were evaluated to determine if these thresholds would provide a reliable basis for classifying sediment samples from the Anniston Site as toxic or non-toxic. A TT was considered to be reliable if the following conditions were met: if the incidence of toxicity (IOT) below the TT was less than or equal to 20%; if the IOT above the TT was greater than 50%, and; if the overall correct classification rate was greater than or equal to 80%. There were 69 reliable TTs derived for whole sediment, and 32 reliable TTs for pore water. The site-specific TTs for PCBs were compared with and were consistent with chronic TTs that have been estimated for benthic invertebrates using results of spiked-sediment toxicity tests, empirically based sediment quality guidelines (SQGs), and equilibrium-partitioning (EqP) based SQGs, indicating the site-specific TTs likely represent the concentration of PCBs that are sufficient to cause toxicity to benthic invertebrates. In contrast, the TTs for metals, polycyclic aromatic hydrocarbons [PAHs] and pesticides were generally lower than consensus-based SQGs and results from spiked-sediment toxicity tests, indicating these COPCs were not likely the main contributors to the observed toxicity. Importantly, the site-specific TTs for most of the homolog groups and total PCBs (as homologs) were demonstrated to accurately (reliably) classify sediment samples as toxic or not toxic to benthic invertebrates. In contrast, the TTs for metals, polycyclic aromatic hydrocarbons [PAHs] and pesticides were generally lower than consensus-based SQGs and results from spiked-sediment toxicity tests, indicating these COPCs were not likely the main contributors to the observed toxicity. Importantly, the site-specific TTs for most of the homolog groups and total PCBs (as homologs) were demonstrated to accurately (reliably) classify sediment samples as toxic or not toxic to benthic invertebrates.

Although the results of the pore water analysis were not discussed as a separate LOE in the BERA, the correct classification rates for both the TT_{LR} and the TT_{HR} were generally similar for most homolog groups and total PCBs (as homologs) for the reliable TTs for whole sediment and for pore water (Table AD-56). The TT concentrations for pore water are much lower than the TTs for whole sediment. Despite this, the sediment and pore water toxicity analyses done by Ingersoll et al. (2014) are complementary. The TT_{LR} and the TT_{HR} derived for the two matrices generally classify a similar percentage of samples as “toxic” or “not toxic” and result in similar risk conclusions.

6.3.12 Hymenoptera are not aquatic insects, but were included in the emergent insect samples (Appendix D, issue 26).

The WOE tables for potential risks to birds and mammals (Tables AD-43 and AD-44, respectively) have been revised to reflect lower conservatism and moderate confidence in the risk prediction for receptors that consume aquatic insects. Specifically, the weight of evidence for avian aerial insectivores (tree swallows) and mammalian aerial invertivores (brown bats) was revised.

7. CONCLUSIONS

The OU-4 BERA was conducted using a wide range of scientific data and information to develop various LOEs for characterizing risks. To complete the OU-4 BERA, chemical data were collected from abiotic media (surface water, sediment and soil) and a range of biotic tissue; ecological community data were collected; and habitat studies were conducted over the course of 15 years. Site-specific sediment toxicity and bioaccumulation studies were also conducted. These studies and data collection activities provide extensive site-specific data with which to perform a robust risk assessment. The site-specific data, complemented with relevant literature-based information, were incorporated into the OU-4 BERA to support a range of conclusions regarding potential risks to ecological receptors that may reside or forage within OU-4.

Multiple MEs and LOEs were evaluated along with uncertainties associated with each to evaluate each AE identified for the OU-4 BERA. In many cases, identified uncertainties were mitigated by using conservative assumptions. Risk conclusions were developed based on comparison of measured COPC concentrations in Site media or estimated dietary exposure concentrations with toxicity benchmarks or TRVs.

EPA received the first draft of the BERA for OU-4 of the Anniston PCB Site in October 2015, and provided comments on that draft in June of 2016. In early 2017, the U.S. EPA reviewed the revised draft OU-4 BERA. As a result of this review, and a subsequent May 2017 meeting with P/S, EPA concluded that although some comments and concerns were adequately addressed in the revised draft BERA, EPA's interpretation of the data collected for the BERA differed significantly from the P/S interpretation of the data for some issues. EPA therefore decided to develop their own evaluation of the data, WOE evaluation, risk conclusions. These are presented in this BERA Addendum Report. RGOs will be calculated for the all AEs evaluated in the BERA, for which potential risk was identified, for inclusion in the Feasibility Study (FS).

The BERA Addendum addressed a number of issues which fell into four broad categories:

- Global issues that impacted risk interpretation or conclusions (i.e., HQ rounding, HQ/effective concentration [EC_x] interpretation, data quality issues, community survey metrics, threatened or endangered species, etc.);
- Assessment endpoint (AE) specific issues (i.e., interpretation of site-specific sediment bioassays, interpretation of benthic invertebrate community surveys, avian dietary exposure to dioxins, etc.);
- TRV selection (i.e., selection of toxicity threshold values based on the site-specific sediment bioassays, use of CTCs recommended by EPA, etc.); and
- WOE interpretation (i.e., using field survey data to down-weight risks based on chemistry-based LOEs, risk underestimation due to HQ rounding, etc.).

Each specific issue was evaluated in detail and a revised conclusion based upon EPA's interpretation of the data was developed. These revised conclusions were then integrated into an updated WOE evaluation. In some cases, additional analysis resulted in similar conclusions as presented in the BERA. Based on the risk findings, PCBs are the primary risk driver in OU-4.

For each AE, the EPA team evaluated each LOE and the levels of confidence and conservatism associated with that LOE (Tables AD-42 to AD-44). If all LOEs evaluated for an AE resulted in similar conclusions, that conclusion was the WOE conclusion. If LOEs resulted in divergent results, the greatest weight was given to the LOEs with the highest level of confidence to develop potential risk estimates for each exposure area. If several LOEs were assigned the highest level of confidence, the overall WOE was based on the most frequent conclusions for each Reach or AA.

For example, for the benthic invertebrate assessment endpoint, the three LOEs with the highest confidence were: comparison of individual sediment samples to site-specific dry weight reproduction-based toxicity thresholds for *Hyalella azteca*; comparison of individual sediment samples to site-specific dw growth-based toxicity thresholds for *Chironomus dilutus*; and evaluation of the site-specific toxicity testing results from the three surface sediments collected (Reaches C2, C5 and C10 only; see Table AD-42). Reach C2 was classified as unacceptable by all three above LOEs. Reach C1 and C7 were classified unacceptable by at least one LOE, and numerous samples exceeded the EC10*. Reaches C3, C4, C5, and C8 were classified as unacceptable by at least one LOE, but only one or two samples exceeded the EC10*. The WOE evaluation was modified to state that sediment concentrations within Reaches C3, C4, C5, C8 and C10 were generally acceptable, with localized areas of unacceptable risk (Section 6.3.2, Revised Table AD-39). Two LOEs, classified Reaches C6 and C9 as acceptable.

A summary table based on the updated WOE evaluation was compiled that shows calculated risk by Reach and Assessment Area (AA) (Table AD-57). The level of conservatism (higher conservatism was associated with the use of generic exposure and effects information that have a higher potential to overestimate risk) and confidence in the risk conclusions were identified for each WOE conclusion. Increased use of site-specific information in the risk evaluation is assumed to result in more realistic, less conservative, and less uncertain risk estimates. For some of the LOEs, especially field survey data, a potential for underestimation of risk was identified.

The approach EPA used to interpret risk calculation results was similar to the approach used by P/S in the draft BERA, but with two critical differences:

- The risk categories used in the draft BERA were defined as follows: NOAEL HQ $\leq$ 1.0, risk is negligible; NOAEL HQ $>$ 1.0 and LOAEL HQ $\leq$ 1.0; low risk. LOAEL HQs $>$ 1.0 and $\leq$ 10, indicate moderate risk; and LOAEL HQs $>$ 10 were interpreted to indicate high risk. ERAGS (U.S. EPA 1997) defines a HQ equal to 1 as a pass/fail decision point. Based on guidance, EPA defined the following risk categories in the OU-4 BERA addendum: NOAEL-based HQ $<$ 1.0, acceptable risk; NOAEL-based HQ $\geq$ 1.0 and LOAEL-based HQ $<$ 1.0, indeterminate risk; and LOAEL-based HQ $\geq$ 1.0, unacceptable risk.
- In the draft BERA, calculated HQs were rounded to a single digit. When this is done in concert with using the above defined risk categories, the risk conclusion for calculated LOAEL HQs between 1.0 and 1.49 becomes indeterminate (or low, as per the draft BERA), rather than unacceptable. EPA presented calculated HQs to one decimal place (Tables AD-10 to AD-24).

The potential risks predicted for ecological receptors exposed to PCBs in OU-4, based on the LOEs with the highest confidence (most site-specific and least uncertain), are summarized below.

Lower Trophic Level Receptors

A total of six lower trophic level receptors were evaluated, including four aquatic receptor groups and two terrestrial receptor groups (Table AD-42). Risks based on the WOE for plants, fish and terrestrial invertebrates are summarized in Table AD-58 (below, embedded in text), and risk to benthic invertebrates are summarized in Figures AD-20a and AD-20b (below). For benthic invertebrates, the LOE with the highest confidence is a comparison of individual sample concentrations to the site-specific reproduction sediment toxicity thresholds.

Table AD-58. Predicted Risk for Lower Trophic Level Receptors Exposed to PCBs in OU-4 based on the WOE

Receptors	OU-4 Reaches									
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
		UAA			MAA		LAA			
Aquatic Plants	U	A			A		A			
Forage Fish ^a		I			U		I			
Bottom Fish ^a		U			U		U			
Predator Fish ^a		U			U		U			
Terrestrial Plants	U ^b	A			A		A			
Benthic Invertebrates	U	U	GA	GA	GA	A	U	GA	A	GA
Terrestrial Invertebrates	U ^b	I	I	I	A	A	A	A	A	I

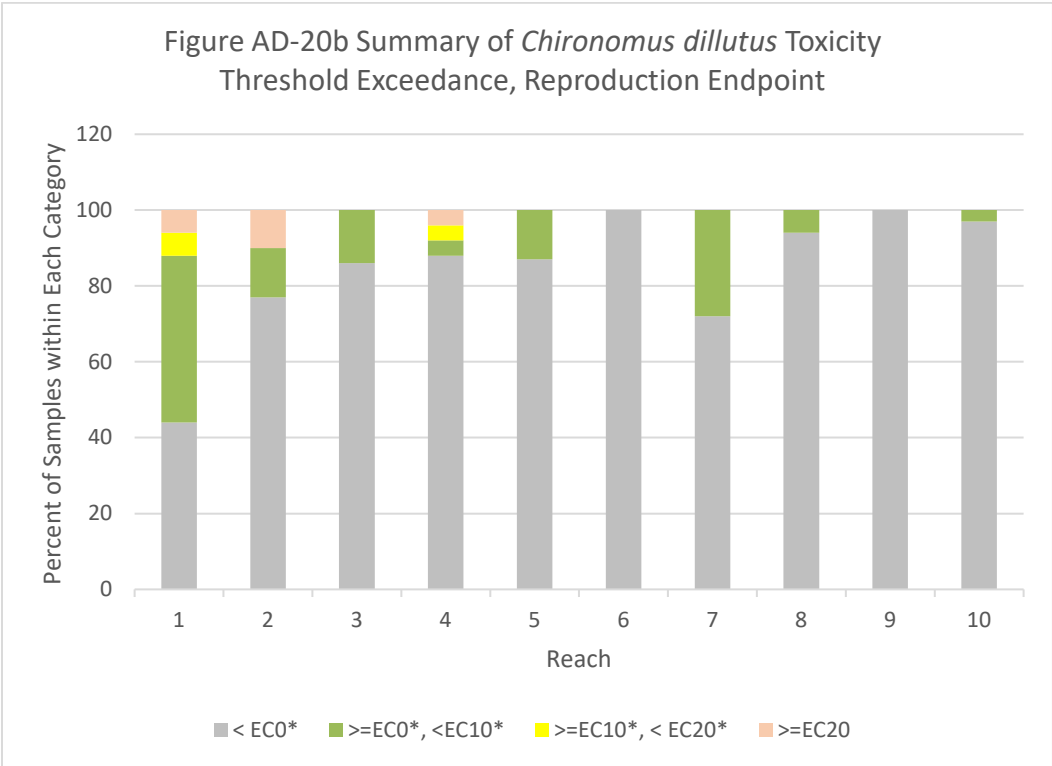
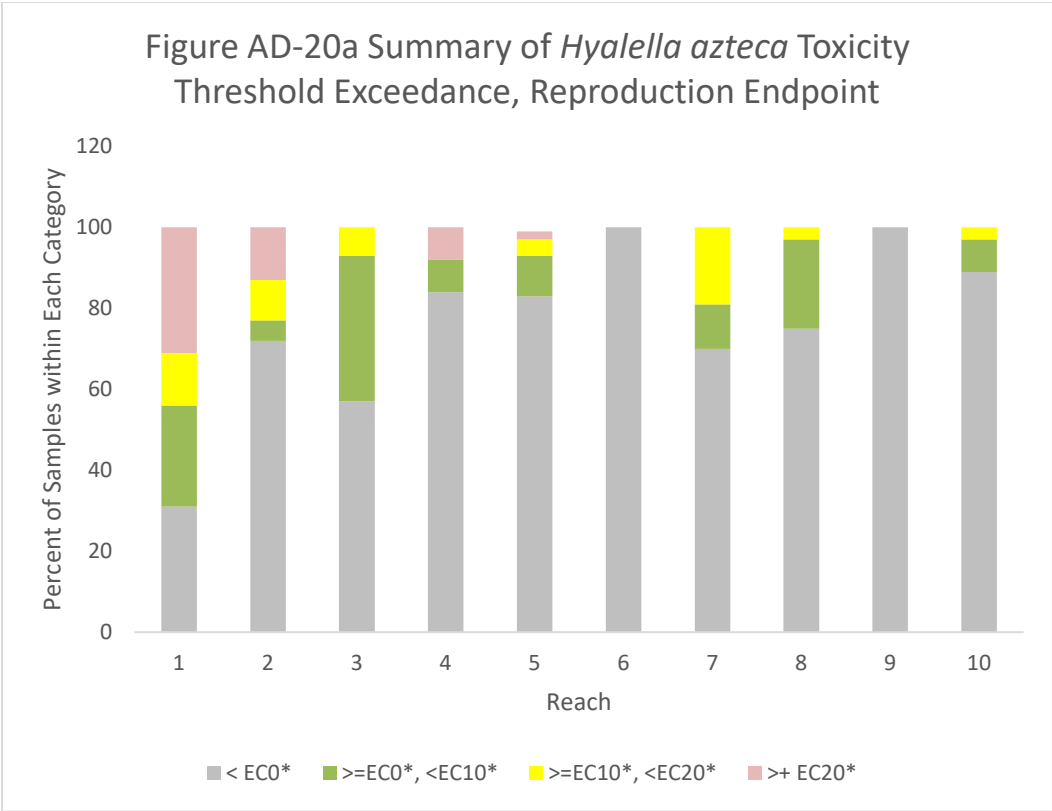
^a Results based on Assessment Area rather than individual reaches

^b C1 West only

A = Acceptable; I = Indeterminate; U= Unacceptable; GA = Generally Acceptable, Local Areas Unacceptable

LAA = Lower Assessment Area; MAA = Middle Assessment Area; UAA = Upper Assessment Area

NA = Not applicable



Birds

Potential risks to nine surrogate receptor bird species were evaluated as part of the OU-4 BERA—five aquatic foraging birds (including piscivores, aquatic insectivores/invertivores, and aerial insectivores), and four terrestrial foraging birds (including herbivores, terrestrial insectivores/invertivores, omnivores, and carnivores). In addition, two scenarios for mixed aquatic and terrestrial diets were evaluated. Predicted risks based on the WOE (Table AD-43) are summarized in Table AD-59 (below, embedded in text).

Table AD-59. Predicted Risk for Birds Exposed to PCBs in OU-4 Based on the WOE

Receptors	OU-4 Reaches									
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
Aquatic Birds										
Piscivores (heron, kingfisher, osprey)	U	U	U	U	U	U	U	U	U	U
Insectivores/ invertivores (spotted sandpiper)	HU	HU	U	U	U	U	U	U	U	U
Aerial Invertivores (tree swallow)	U	U	U	U	A	A	A	A	A	A
Terrestrial Birds										
Herbivores (mourning dove)	U ^a	A	I	A	A	A	A	A	A	A
Terrestrial insectivores/ invertivores (Carolina wren)	U	U	U	U	I	I	I	I	I	—
Omnivores (Blue jay)	U	I	I	I	A	A	A	A	A	—
Carnivores (red-tailed hawk)	HU	U	U	U	I	A	A	I	A	—
Birds with mixed Aquatic and Terrestrial Diets										
Mixed diet omnivores (spotted sandpiper, Carolina wren)	HU	U	U	U	I	I	I	I	I	—

A = Acceptable (NOAEL HQ < 1.0); I = Indeterminate (NOAEL HQ ≥ 1.0, LOAEL HQ < 1.0); U= Unacceptable (LOAEL HQ ≥ 1.0, < 10.0); HU = High Unacceptable, LOAEL HQ ≥ 10.0)

LAA = Lower Assessment Area; MAA = Middle Assessment Area; UAA = Upper Assessment Area

^a C1 West

Mammals

Potential risks to eight surrogate receptor mammal species were assessed by evaluating three aquatic foraging species (piscivores and aerial insectivores) and five terrestrial foraging mammals (including herbivores, terrestrial insectivores/invertivores, and carnivores). In addition, two scenarios for mixed aquatic and terrestrial diets were evaluated. Predicted risks based on the WOE (Table AD-44) are summarized in Table AD-60 (below, embedded in text).

As with birds, the LOE with the highest confidence for all mammals except carnivores is the dietary HQ based on measured prey tissue EPCs. For carnivores, the dietary HQ based on modeled prey tissue had slightly higher confidence.

Table AD-60. Predicted Risk for Mammals Exposed to PCBs in OU-4 Based on the WOE

Receptors	OU-4 Reaches									
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10 ^a
Aquatic Mammals										
Piscivores (otter, mink)	HU	HU	HU	HU	HU	HU	HU	HU	HU	HU
Aerial Insectivores (bat)	U	U	U	U	A	A	A	A	A	A
Terrestrial Mammals										
Herbivores (deer)	A	A	A	A	A	A	A	A	A	—
Insectivores/ invertivores (Shrew)	U	U	U	U	I	I	I	I	I	—
Carnivores (weasel, red fox)	U ^a	A	U ^c	I	A	A	A	A	A	—
	I ^b		I ^d							
Mammals with mixed Aquatic and Terrestrial Diets										
Mixed diet omnivores (raccoon)	I	I	I	I	I	I	I	I	I	I
Mixed diet omnivores (mink)	HU	HU	HU	HU	HU	HU	HU	HU	HU	HU

^a Floodplain soil/riparian soil was not evaluated in Reach C10, as the former floodplain and riparian zones are now part of sediment exposure. Dam operation prevents overbank flooding along Reach C10.

A = Acceptable (NOAEL HQ < 1.0); I = Indeterminate (NOAEL HQ ≥ 1.0, LOAEL HQ < 1.0); U= Unacceptable (LOAEL HQ ≥ 1.0, < 10.0); HU = High Unacceptable, LOAEL HQ ≥ 10.0)

^a C1 West

^b C1 East

^c C3 South

^d C3 North

Amphibians and Reptiles

Toxicity data for evaluation of effects of PCB exposure on reptiles and amphibians are limited, therefore HQs were not calculated for these receptors. Section 6.2.3.8 of the BERA states that toxicity benchmarks protective of other receptors are protective of amphibians and reptiles. Comparison of site-wide sediment and surface water EPC concentrations of PCBs measured in OU-4 media to the limited toxicity data for herptiles available indicate that on-Site PCB concentrations are similar to or below the low effect concentrations (Section 6.2.3.8 of the BERA; Table AD-61, embedded below). The only tissue TRVs available on the environmental residue effect database (ERED) for reptiles are for a non-ecologically relevant endpoint

(metabolic rate). Concentrations of PCBs measured in frogs collected in the UAA are similar to tissue concentrations measured in forage fish, and concentrations of PCBs measured in reptiles are similar to tissue concentrations measured in predator fish site-wide; some fish tissue concentrations do exceed tissue TRVs (Table AD-24). The risk evaluation for these receptors is highly uncertain, and no conclusions can be made regarding risk to amphibians and reptiles exposed to PCBs in OU-4.

Table AD-61. TRVs for Amphibians and Reptiles and OU-4 EPCs

Medium	TRV (LOEC)	EPC
Sediment	325 mg/kg	16 mg/kg, Reach C1 ^a
Surface Water	0.5 µg/L	0.5 µg/L, Reach C1; 0.16 µg/L, Site-wide ^b
Fish Tissue	34 mg/kg ww	38 mg/kg, frogs collected in the UAA ^c
Fish Tissue	34 mg/kg ww	167 mg/kg, snakes collected in the UAA ^c

^a Table AD-1

^b Table AD-62 (BERA Table 4-14)

^c Table AD-24

Summary

Based on the assessment completed for a wide range of COPCs and receptors, PCBs are the primary risk driver in OU-4. Risk findings are based on site-specific data, supplemented by literature-based inputs when necessary. The highest concentrations of PCBs in sediment and several biotic tissue types are present in Reaches C1 and C2, and there is an upstream to downstream decreasing trend in most cases with fish tissue concentrations being a notable exception. EPA made the following risk conclusions for total PCBs based on the WOE (Table AD-57):

- Risk to aquatic plants throughout OU-4 is considered acceptable except for Reach C1, however the LOEs used to evaluate this endpoint produced divergent results and are highly uncertain.
- Risk to terrestrial plants is acceptable in all AAs and Exposure Units (EUs) except Reach C1 West, where risk to terrestrial plants is unacceptable.
- Risk to benthic invertebrates is unacceptable in Reaches C1, C2 and C7; generally acceptable with localized areas of unacceptable risk in Reaches C3, C4, C5, C8 and C10, and acceptable in Reaches C6 and C9. The lines of evidence with the highest confidence in the risk predictions (comparison of individual sediment samples with site-specific growth or reproduction-based toxicity thresholds and evaluation of the toxicity testing results from the surface samples) were given the highest weight in the WOE evaluation.
- Risk to terrestrial invertebrates is unacceptable in Reach C1 West; indeterminate in Reaches C2, C3, C4 and C10; and acceptable in Reaches C5 through C9. Most LOEs

used to evaluate this AE had moderate to high conservatism and low confidence in the risk predictions.

- Risk to fish is unacceptable throughout OU-4, with predicted risk to predator and bottom fish higher than for forage fish.
- For all birds, risk is unacceptable or high unacceptable in Reach C1. For piscivorous and aquatic insectivorous birds, risk is unacceptable throughout OU-4 (risk is high unacceptable in Reaches C1 and C2 for aquatic insectivorous birds). For aquatic aerial insectivores, terrestrial insectivores, terrestrial carnivores, and mixed diet omnivores, risk is high unacceptable in Reach C1 and unacceptable in Reaches C2 through C4, and indeterminate or acceptable in Reaches C5 through C10. For terrestrial herbivores, risk is unacceptable in Reach C1 West and acceptable or indeterminate in Reaches C2 through C10, and for terrestrial omnivorous birds, risk is unacceptable in Reach C1 and acceptable or indeterminate in Reaches C2 through C9.
- Risk to piscivorous mammals is highly unacceptable throughout OU-4. Risk to aerial insectivores and terrestrial insectivores and invertivores is unacceptable in Reaches C1 through C4, and indeterminate or acceptable in Reaches C5 through C9 or C10. Risk to herbivorous mammals is acceptable throughout OU-4. There is unacceptable calculated risk to carnivorous mammals feeding in Reach C1 West and C3 South, indeterminate risk in Reach C4, and acceptable risk in Reaches C2 and C5 through C9. For omnivorous mammals with mixed terrestrial and aquatic diets, risk is indeterminate throughout OU-4 when the raccoon is the surrogate receptor species, and highly unacceptable when the mink is used as the surrogate receptor species.

Risks were also evaluated for 7 additional secondary contaminants of potential concern (COPCs) (i.e., mercury, dioxin toxic equivalents [TEQs], barium, chromium, cobalt, lead, and vanadium), and are reported for completeness (Tables AD-47 to AD-53). Although unacceptable risks were identified in some areas of OU-4 for some of these COPCs, overall risks in OU4 are dominated by PCBs.

For most issues, the inclusion of conservative assumptions in the risk analysis was lower and the overall uncertainty was generally greater in the revised draft BERA for OU-4 (Arcadis 2016) as compared to the EPA analysis. Consequently, EPA concludes the risks from PCBs and other COPCs to ecological receptors to be somewhat greater than estimated in the revised draft BERA for OU-4.

8. REMEDIAL GOAL OPTION CALCULATIONS

Note: In this section, discussion about the contents of the “BERA” refers to the October 2016 Baseline Ecological Risk Assessment for Operable Unit 4 produced for P/S, and discussion about the contents of the “BERA Addendum” refer to the 2018 BERA Addendum produced by the EPA that supersedes certain findings or conclusions of the P/S BERA.

The BERA included remedial goal options (RGOs) protective of ecological receptors for those COPCs and receptors for which potential risk was indicated. RGOs are needed to support the Feasibility Study and risk management discussions for OU-4. The BERA provided RGO tables for total PCBs, mercury, and lead in soils and for total PCBs, mercury, lead, chromium, and vanadium in sediments.

The BERA used measured prey tissue data to predict aquatic and wildlife RGOs because they were given the highest weight of evidence. The RGO was simply calculated as the EPC divided by the soil or sediment HQ. The BERA did not include RGOs for receptors categorized as mixed diet receptors (Carolina wren–2, spotted sandpiper–1, raccoon–1 and -2, and mink–1), and egg-based exposures for birds because of the added uncertainty associated with calculations for mixed diet receptors and egg-based exposure models. The RGOs for all aquatic and all terrestrial dietary exposure scenarios for the range of bird and mammal receptors evaluated in the OU-4 BERA were considered protective of mixed diet or egg-based exposures.

The BERA did not include RGOs for fish. The BERA determined that piscivorous wildlife HQs were higher than fish tissue HQs in almost every case. Therefore, the piscivorous wildlife RGOs in the BERA were determined to be protective of fish, and fish-specific RGOs were not calculated.

The EPA noted several issues with the RGOs calculated in the BERA:

- measured tissue RGOs were incorrectly calculated using the exposure point concentrations (EPCs) for soil and sediment in characterization area 2 (CA2) for soil and reach C2 for sediment of the upper assessment area (UAA) divided by the site-wide risk (the EPC and HQ must have the same basis);
- the EPA would prefer to show RGO values for all assessment endpoints, instead of filtering the results to remove receptors with borderline risk;
- RGO values were not calculated for dioxin and dioxin-like compounds, and no attempt was made to confirm that they are collocated with PCBs; and
- the EPA showed RGOs values for measured tissue for most assessment endpoints. RGOs were modelled only for receptors consuming small mammals, as was done in the OU-4 BERA.

Like the BERA, the BERA Addendum includes a range of ecological RGOs based on both NOAEL and LOAEL (or equivalent) levels of protection for each AE using the site-wide EPCs based on 95 percent UCLs. The complete set of RGOs is provided in Tables AD-63 through AD-65. RGOs are rounded to whole numbers when 10 or greater and to one decimal place or one significant figure when less than 10. Description of specific RGO values is provided below.

In the BERA Addendum, the EPA calculated measured tissue RGOs for all wildlife receptors including mixed terrestrial and aquatic diet receptors. RGOs were calculated for all COPCs in soil. Dioxin was added to the measured tissue RGO calculations. The RGO calculations for dioxins addressed measured tissue RGOs the same as for other COPCs. The modelled tissue RGOs for PCDD/PCDF TEQs and dioxin-like PCB TEQs were based on the sum of TEQs from both dioxin and dioxin-like compounds. The data for dioxin toxicity equivalents came from Appendix F of the BERA.

The EPA did not change the PCB and mercury RGOs for benthic invertebrates because they were based on the results of the OU-4 sediment toxicity tests (Table AD-63a). As stated in the BERA, the PCB RGO values for reproduction and survival ranged from 1.4 to 152 mg/kg for effects from 0 and 20% after accounting for reference sediment toxicity (i.e., EC0* to EC20*) for two species. The mercury RGO values for reproduction and survival ranged from 0.4 to 11 mg/kg for effects from 0 and 20% after accounting for reference sediment toxicity (i.e., EC0* to EC20*) for two species.

In the BERA Addendum, fish and aquatic life RGOs were calculated for PCBs, dioxin and dioxin-like compounds, mercury, and vanadium in sediment (Table AD-63b). For the dioxin-like compound sediment RGO for fish in Table AD-63b, the CTC from Steevens et al. (2005) (discussed in Section 6.2.12) was used as it was presented on a lipid-normalized basis. As above, the PCDD/PCDF TEQs and dioxin-like PCB TEQs were based on the sum of TEQs from both dioxin and dioxin-like compounds in fish tissue (on a lipid-normalized basis) and sediment. The data for dioxin toxicity equivalents came from Appendix F of the BERA (Table AD-63c). A 95UCL EPC for lipid-normalized DLC in fish tissue and for fish TEQ in sediment was calculated using ProUCL; these EPCs were used to calculate a BAF. Data were insufficient to develop robust CTCs for barium, chromium, and cobalt in fish. Lead in fish was below the no observable effects concentration, so no RGOs for lead were calculated.

The EPA agreed with non-mercury metals RGO calculations for benthic invertebrates (Table AD-64) because the RGOs are simply the media-based toxicity benchmarks selected for the BERA screening. These values are not site-specific and are considered to have high associated uncertainty.

The BERA Addendum includes piscivorous wildlife RGOs for PCBs and metals in sediment (Table AD-64a). Non-mercury metal COPCs tend to be detected at highest concentrations in Snow Creek and at Station 071-C1-SED in Characterization Area C1. It is unclear whether the non-mercury metal COPCs in C1 are co-located with PCBs, since PCBs were not measured in sediment near Station 071-C1-SED. A description of how the mixed diet was handled is provided below.

The range of RGOs for soil are provided in revised Table AD-65a. Measured tissue RGOs were calculated in the BERA for the following receptors with predominately aquatic diets: tree swallow, sandpiper-2, kingfisher-1, kingfisher-2, osprey, bat, and river otter. In the BERA Addendum, the great blue heron and mink were added to the calculations of aquatic measured tissue RGOs. The toxicity reference values for mammals other than mink used McCoy et al.

(1995) for medium sensitivity mammals and Restum et al. (1998), i.e., TRVs for mink, for high-sensitivity mammals that were not mink. This was done to provide a medium and high sensitivity RGO for each receptor.

RGOs for terrestrial receptors consuming small mammals, such as the weasel and fox, were provided in the BERA by back-calculating the food-chain models to solve for the soil concentration of total PCBs or mercury producing a hazard quotient of 1. The BERA Addendum did not change the modelled RGO calculations for mammals provided in the BERA. RGOs calculated by solving the food-chain models for an exposure point concentration yielding a hazard quotient of 1 are called modelled tissue RGOs. Modelled tissue RGOs were calculated in the BERA for the weasel and foxes (fox-1 and fox-2).

The measured tissue RGOs do not rely on the derivation of BAFs. They assume direct proportionality between the abiotic media concentration and risk. The measured tissue RGO was calculated by substituting the site-wide 95% UCL exposure point concentrations measured in tissues into the food-chain model to calculate the measured tissue HQ. The measured RGO was calculated by dividing the site-wide 95% UCL exposure point concentration in soils or sediments by the site-wide 95% UCL measured tissue HQ. The BERA RGO calculations used as the exposure point concentration from Reach C2 (the backwater area) in the measured tissue RGO calculation. When estimating the RGO from measured tissues concentrations, it is important to pair the 95% UCL HQ with the 95% UCL exposure point concentration from the same portion of the site. Normally this exercise would be performed for each reach to produce an array of RGOs. However, for simplicity the EPA chose to base the measured tissue HQs and RGOs on the site-wide 95% UCL exposure point concentrations.

Measured tissue RGOs are included in the BERA for receptors with predominately terrestrial or predominately aquatic diets. When it came to receptors with predominately terrestrial diets, the BERA included measured tissue RGOs for the mourning dove, blue jay, and Carolina wren-1. The BERA Addendum included the measured tissue RGOs for all the terrestrial receptors in the BERA plus shrew-1, shrew-2, fox-1, fox-2, deer, weasel, and hawk.

Mixed terrestrial and aquatic receptors were assessed to consider how receptors foraging along the riparian corridor could be exposed to the higher COPC concentrations. The measured tissue RGOs for mixed terrestrial and aquatic receptors used the 95% UCL for riparian soils as their exposure point concentration in soil. Mixed terrestrial and aquatic receptors had exposure to both soil and sediment based on dietary composition. Dietary components were considered related to soil when the bioaccumulation factor was from soil.

The receptors chosen to be modelled as mixed terrestrial/aquatic receptors had exposure to soil, riparian soil, and sediment based on the dietary composition and bioaccumulation factors described in BERA Table 4-17. The EPA treated mink-1 as a mixed terrestrial and aquatic receptor because its diet came from both terrestrial and aquatic sources in roughly equal proportion. Forty-four percent of mink-1's diet was small mammals with a bioaccumulation factor between small mammals and soils. Mink-1 had 21% forage fish in its diet with a bioaccumulation factor between forage fish and sediment. On the contrary, mink-2 was treated as an aquatic receptor because its diet was 86% fish with a bioaccumulation factor between fish

and sediment. This was a change from the original BERA calculations that considered mink-2 and the great blue heron to be mixed aquatic and terrestrial receptors. Mink 2 and great blue heron, which had been modeled as mixed terrestrial and aquatic receptors in the BERA, were treated as aquatic receptors by the EPA. Carolina wren-2, spotted sandpiper-1, red-tailed hawk, mink-1, shrew-2, raccoon-1 and raccoon-2 were modeled as mixed terrestrial/aquatic by EPA.

The RGO calculations treated the aquatic and terrestrial components of the diet separately. When calculating the HQs, the BERA Addendum paired the sum of the aquatic exposures with the 95% UCL for the site-wide sediments and paired the sum of the terrestrial exposures with the 95% UCL for riparian soils. The BERA Addendum calculated the measured tissue RGO for the aquatic component of mixed terrestrial and aquatic receptor by dividing the site-wide 95% UCL for sediments by the HQ for the aquatic component. The BERA Addendum calculated the measured tissue RGO for the terrestrial component of mixed terrestrial and aquatic receptor by dividing the site-wide 95% UCL for riparian soils by the HQ for the terrestrial component. Hence, mixed terrestrial and aquatic receptors received two RGOs, one for sediments and one for riparian soils. The approach for mixed terrestrial and aquatic receptors used in the BERA Addendum was the same as in spreadsheets provided by P/S and used in the BERA.

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Table AD-1. Comparison of 95% UCL of the measured sediment PCB concentrations by Reach and by Assessment Area (AA) to the 95% UCLs of the Surface Water Average Concentration¹.

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AA	Reach	PCBs (mg/kg)					
		AA			Reach		
		95% UCL of measured PCBs	95%UCL of SWAC	Ratio 95% UCL of Measured / 95% UCL of SWAC	95% UCL of measured PCBs	95% UCL of SWAC	Ratio 95% UCL of Measured / 95% UCL of SWAC
C1 ²	C1 ²	16	16	1	16	16	1
Upper	C2	5.61	4.09	1.37	16.8	10	1.68
Upper	C3				1.80	1.1	1.64
Upper	C4				2.94	2.42	1.21
Middle	C5	1.46	0.758	1.926	1.54	0.826	1.86
Middle	C6				0.17 ³	0.17 ³	1.00
Lower	C7	0.919	1.11	0.83	1.71	0.897	1.91
Lower	C8				1.08	1.02	1.06
Lower	C9				0.357	0.254	1.41
Lower	C10				0.775	0.735	1.05
Site overall mean ratio				1.28			1.38

Notes

1. SWAC: Surface Weighted Average Concentration. Presented in Table 4-4 of Baseline Ecological Risk Assessment (BERA).
2. Not spatially weighted. Standard 95% Upper Confidence Limit (UCL) was selected as the reach and AA Exposure Point Concentration (EPC).
3. Insufficient data (< 8 samples), weighted maximum used for Reach C6.

Table AD-2. Comparison of 95% UCLs of the measured sediment mercury concentrations by Reach and by Assessment Area (AA) to the 95% UCLs of the SWAC¹.

**OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama**

AA	Reach	Mercury (mg/kg)					
		AA			Reach		
		95% UCL of measured PCBs	95% UCL of SWAC	Ratio 95% UCL of Measured/ 95% UCL of SWAC	95% UCL of measured PCBs	95% UCL of SWAC	Ratio 95% UCL of Measured/ 95% UCL of SWAC
C1 ²	C1 ²	0.58	0.58	1.00	0.58	0.58	1.00
Upper	C2	11	4.48	2.46	126.7 ³	27.4	4.62
Upper	C3				0.819	0.959	0.85
Upper	C4						
Middle	C5	0.827	0.845	0.979	0.907	0.815	1.11
Middle	C6						
Lower	C7	1.01	1.07	0.94	0.863	0.822	1.05
Lower	C8						
Lower	C9						
Lower	C10						
Site overall mean ratio				1.34			1.73

Notes

1. SWAC: Surface Weighted Average Concentration. Presented in Table 4-4 of Baseline Ecological Risk Assessment (BERA).
2. Not spatially weighted. Exposure Point Concentration (EPC) based on the maximum concentration.
3. Dataset is small; Upper Confidence Limit (UCL) may be unreliable.

Table AD-3. Summary of PCB Risks to Aquatic+Terrestrial Birds (Mid-Sensitivity HQs)

Anniston PCB Site, Anniston, Alabama

Reach	HQ Type	Carolina Wren - 2	Spotted Sandpiper - 1
	TRV/CTC Type	mid sens	mid sens
C1 East	Modeled HQ	6	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
C1 West	Modeled HQ	37	--
	Measured HQ	9	--
	Tissue HQ	≤ 1	--
C1 Riparian	Modeled HQ	--	4
	Measured HQ	--	3
	Tissue HQ	--	≤ 1
C2 North	Modeled HQ	3	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
C2 South	Modeled HQ	3	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
C2 Central	Modeled HQ	3	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
C2 Riparian	Modeled HQ	--	11
	Measured HQ	--	4
	Tissue HQ	--	≤ 1
C3 North	Modeled HQ	2	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
C3 South	Modeled HQ	5	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
C3 Riparian	Modeled HQ	--	7
	Measured HQ	--	3
	Tissue HQ	--	≤ 1
C4 North	Modeled HQ	2	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
C4 South	Modeled HQ	2	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
C4 Riparian	Modeled HQ	--	3
	Measured HQ	--	3
	Tissue HQ	--	≤ 1
UAA Soil	Modeled HQ	3	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
UAA Riparian	Modeled HQ	--	3
	Measured HQ	--	3
	Tissue HQ	--	≤ 1

Notes:

LOAEL HQ values presented

Tissue HQs for birds based on modeled egg concentrations.

If available HQs (modeled, measured, tissue) are less than 1, the EU/Reach/AA/COPC/Receptor is not shown.

Gray shading indicates NOAEL HQ ≤ 1

Green shading indicates NOAEL HQ > 1 and LOAEL HQ ≤ 1

Yellow shading indicates LOAEL HQ > 1

Orange shading indicates LOAEL HQ > 10

AA: assessment area

COPC: constituent of potential concern

CTC: critical tissue concentration

EU: exposure unit

HQ: hazard quotient

LAA: lower assessment area

LOAEL: lowest observed adverse effect level

MAA: middle assessment area

NOAEL: no observed adverse effect level

TRV: toxicity threshold value

UAA: upper assessment area

**Table AD-4. Summary of PCB Risks to Aquatic+Terrestrial
Mammals Anniston PCB Site, Anniston, Alabama**

Reach	HQ Type	Raccoon - 1	Raccoon - 2	Mink - 1	Mink - 1
	TRV/CTC Type	Mammal	Mammal	Mink, repro	Mink, growth
C1 East	Modeled HQ	2	--	--	--
	Measured HQ	< 1	--	--	--
C1 West	Modeled HQ	12	--	--	--
	Measured HQ	< 1	--	--	--
C1 Riparian	Modeled HQ	2	5	48	97
	Measured HQ	≤ 1	≤ 1	9	18
C2 Riparian	Modeled HQ	3	4	32	64
	Measured HQ	≤ 1	≤ 1	9	18
C3 South	Modeled HQ	2	--	--	--
	Measured HQ	≤ 1	--	--	--
C3 Riparian	Modeled HQ	≤ 1	≤ 1	6	12
	Measured HQ	≤ 1	≤ 1	9	18
C4 Riparian	Modeled HQ	≤ 1	≤ 1	9	17
	Measured HQ	≤ 1	≤ 1	9	18
C5 Riparian	Modeled HQ	≤ 1	≤ 1	3	6
	Measured HQ	≤ 1	≤ 1	8	15
C6 Riparian	Modeled HQ	≤ 1	≤ 1	≤ 1	2
	Measured HQ	≤ 1	≤ 1	8	15
C7 Riparian	Modeled HQ	≤ 1	≤ 1	3	6
	Measured HQ	≤ 1	≤ 1	8	15
C8 Riparian	Modeled HQ	≤ 1	≤ 1	3	6
	Measured HQ	≤ 1	≤ 1	8	15
C9 Riparian	Modeled HQ	≤ 1	≤ 1	≤ 1	3
	Measured HQ	≤ 1	≤ 1	8	15
C10 Riparian	Modeled HQ	≤ 1	≤ 1	2	5
	Measured HQ	≤ 1	≤ 1	8	15
UAA Riparian	Modeled HQ	≤ 1	≤ 1	14	27
	Measured HQ	≤ 1	≤ 1	9	18
MAA Riparian	Modeled HQ	≤ 1	≤ 1	3	6
	Measured HQ	≤ 1	≤ 1	8	15
LAA Riparian	Modeled HQ	≤ 1	≤ 1	3	6
	Measured HQ	≤ 1	≤ 1	8	15

Table AD-5. Summary of PCB Risks to Aquatic+Terrestrial Birds (Mid-Sensitivity HQs) Anniston PCB Site, Anniston, Alabama

Reach	HQ Type	Carolina Wren - 2	Spotted Sandpiper - 1
	TRV/CTC Type	mid sens	mid sens
C1 East	Modeled HQ	6	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
C1 West	Modeled HQ	37	--
	Measured HQ	9	--
	Tissue HQ	≤ 1	--
C1 Riparian	Modeled HQ	--	4
	Measured HQ	--	3
	Tissue HQ	--	≤ 1
C2 North	Modeled HQ	3	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
C2 South	Modeled HQ	3	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
C2 Central	Modeled HQ	3	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
C2 Riparian	Modeled HQ	--	11
	Measured HQ	--	4
	Tissue HQ	--	≤ 1
C3 North	Modeled HQ	2	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
C3 South	Modeled HQ	5	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
C3 Riparian	Modeled HQ	--	7
	Measured HQ	--	3
	Tissue HQ	--	≤ 1
C4 North	Modeled HQ	2	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
C4 South	Modeled HQ	2	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
C4 Riparian	Modeled HQ	--	3
	Measured HQ	--	3
	Tissue HQ	--	≤ 1
UAA Soil	Modeled HQ	3	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
UAA Riparian	Modeled HQ	--	3
	Measured HQ	--	3
	Tissue HQ	--	≤ 1

Notes:

LOAEL HQ values presented

Tissue HQs for birds based on modeled egg concentrations.

If available HQs (modeled, measured, tissue) are less than 1, the EU/Reach/AA/COPC/Receptor is not shown.

Gray shading indicates NOAEL HQ ≤ 1

Green shading indicates NOAEL HQ > 1 and LOAEL HQ ≤ 1

Yellow shading indicates LOAEL HQ > 1

Orange shading indicates LOAEL HQ > 10

AA: assessment area

COPC: constituent of potential concern

CTC: critical tissue concentration

EU: exposure unit

HQ: hazard quotient

LAA: lower assessment area

LOAEL: lowest observed adverse effect level

MAA: middle assessment area

NOAEL: no observed adverse effect level

TRV: toxicity threshold value

UAA: upper assessment area

**Table AD-6. Dietary Exposure Models Calculated using the Maximum or 95%UCL Measured PCB concentration in Reach C1 East and C1 West Sediment and “Riparian” Soil for the Sandpiper-1 Exposure Scenario
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama**

Maximum concentration, C1
Spotted Sandpiper - 1
INITIAL SETTINGS

INITIAL SETTINGS		0.0162			0.0162			0.17			50	
Location	Type	Conc. In Sediment B	Sediment Ingestion Rate	Conc. In Soil ^C	Soil Ingestion Rate	Total Intake through Sediment	Conc. In Surface Water	Water Ingestion Rate	Total Intake through Water	Conc. In Ews ^A	Percent of Diet Ews	
		mg/kg dw	kg/day dw	mg/kg dw	kg/day dw	mg/day	mg/L	L/kg BW/day	mg/kg BW/day	mg/kg dw		
C1	Mercury	0.58	0.0162	17.4	0.0162	0.291276	0.000430	0.17	0.0000731	7.362	50	
C1	Chromium	46	0.0162	46	0.0162	1.4904	0.032900	0.17	0.005593	19.43	50	
C1	Lead	110	0.0162	89.1	0.0162	3.22542	0.096400	0.17	0.016388	115.7	50	
C1	Vanadium	53	0.0162	22.8	0.0162	1.22796	0.033900	0.17	0.005763	9.408	50	
C1-W -- High sensitivity TRV	PCBs	41	0.0162	206.5	0.0162	4.0095	0.000498	0.17	0.00008466	84.64	50	
C1-W -medium sensitivity TRV	PCBs	41	0.0162	206.5	0.0162	4.0095	0.000498	0.17	0.00008466	84.64	50	
C1-W -- High sensitivity TRV	PCBs	41	0.0162	59	0.0162	1.62	0.000498	0.17	0.00008466	84.64	50	
C1-W -medium sensitivity TRV	PCBs	41	0.0162	59	0.0162	1.62	0.000498	0.17	0.00008466	84.64	50	

95% UCL, C1
Spotted Sandpiper - 1
INITIAL SETTINGS

INITIAL SETTINGS		0.0162		0.0162		0.17		50			
Location	Analyte	Conc. In Sediment	Sediment Ingestion Rate	Conc. In Soil	Soil Ingestion Rate	Total Intake through Sediment	Conc. in Surface Water	Water Ingestion Rate	Total Intake through Water	Conc. In Soil Inverts	Percent of Diet Soil Inverts
		mg/kg dw	kg/day dw	mg/kg dw	kg/day dw	mg/day	mg/L	L/day	mg/L	mg/kg dw	
C1	Mercury	0.58	0.0162	2.8	0.0162	0.054756	0.000430	0.17	0.0000731	5.583	50
C1	Chromium	46	0.0162	27.5	0.0162	1.1907	0.032900	0.17	0.005593	19.43	50
C1	Lead	110	0.0162	56.5	0.0162	2.6973	0.096400	0.17	0.016388	115.7	50
C1	Vanadium	53	0.0162	20.2	0.0162	1.18584	0.033900	0.17	0.005763	9.408	50
C1-W -- High sensitivity TRV	PCBs	15.98	0.0162	206.5	0.0162	3.604176	0.000498	0.17	0.00008466	45.15	50
C1-W -medium sensitivity TRV	PCBs	15.98	0.0162	206.5	0.0162	3.604176	0.000498	0.17	0.00008466	45.15	50
C1-W -- High sensitivity TRV	PCBs	15.98	0.0162	59	0.0162	1.214676	0.000498	0.17	0.00008466	45.15	50
C1-W -medium sensitivity TRV	PCBs	15.98	0.0162	59	0.0162	1.214676	0.000498	0.17	0.00008466	45.15	50
C1 UAA abiotic mean-med sensitivity TRV	PCBs	4.09	0.0162	10.22	0.0162	0.066258	0.000498	0.17	0.00008466	45.15	50
C1 UAA abiotic mean-hi Sensitivity TRV	PCBs	4.09	0.0162	10.22	0.0162	0.066258	0.000498	0.17	0.00008466	45.15	50

Soil invertebrate tissue concentrations from Table 4-16 of BERA
Aquatic invertebrate tissue concentrations from Table 4-15 of BERA

^A Earthworm concentrations are the max and 95UCL in earthworms from the UAA (Table 4-16)

^B Chromium, lead and vanadium concentrations in sediment are the maximum measured in Reach C-1, n =2 (Table 4-6)

^C Mercury, chromium, lead and vanadium concentrations in soil are the Max and 95% UCL measured in riparian soils for the UAA (Tables 4-8, 4-9, 4-10, and 4-11)

^D Chromium, lead and vanadium concentrations in benthic invertebrates are the maximum measured site-wide (Table 4-15)

mg/kg d.w. = milligrams per kilogram dry weight

mg/kg w.w. = milligrams per kilogram wet weight

kg = kilogram

mg/kg/day = milligrams per kilogram body weight per day

µg/L = micrograms per liter

dw = dry weight

ww = wet weight

AUF = Area Use Factor

LOAEL = Lowest observed adverse effect level

NOAEL = No observed adverse effect level

HQ = Hazard Quotient

mg/L = milligrams per liter

Table AD-6 (cont.). Dietary Exposure Models Calculated using the Maximum or 95%UCL Measured PCB concentration in Reach C1 East and C1 West Sediment and “Riparian” Soil for the Sandpiper-1 Exposure Scenario
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

0.18	50	0.18	0	0.18	1	0.043									
Food Ingestion Rate	Conc. In aquatic Inverts ^D	Percent of Diet Aquatic Inverts	Food Ingestion Rate	Conc. in <i>Lumbriculus</i>	Percent of Diet <i>Lumbriculus</i>	Food Ingestion Rate	Total Intake through Food	Total Intake	AUF	Body Weight	Dose	LOAEL	HQ LOAEL	NOAEL	HQ NOAEL
kg/kg BW/day dw	mg/kg dw		kg/kg BW/day dw	mg/kg dw.		kg/kg BW/day dw	mg/day ww	mg/day		kg	mg/kg/day	mg/kg/day		mg/kg/day	
0.18	0.311	50	0.18		0	0.18	0.6905700	0.98192	1	0.043	0.9819191	0.068	14.44	0.023	42.69
0.18	3.87	50	0.18		0	0.18	2.0970000	3.59299	1	0.043	3.5929930	2.8	1.28	2.7	1.33
0.18	6	50	0.18		0	0.18	10.9530000	14.19481	1	0.043	14.1948080	3.3	4.30	1.6	8.87
0.18	2.556	50	0.18		0	0.18	1.0767600	2.31048	1	0.043	2.3104830	0.7	3.30	0.34	6.80
0.18	3.511	50	0.18	882	0	0.18	7.9335900	11.94317	1	0.043	11.9431747	0.13	91.87	0.043	277.75
0.18	3.511	50	0.18	882	0	0.18	7.9335900	11.94317	1	0.043	11.9431747	1.4	8.53	0.47	25.41
0.18	3.511	50	0.18	882	0	0.18	7.9335900	9.55367	1	0.043	9.5536747	0.13	73.49	0.043	222.18
0.18	3.511	50	0.18	882	0	0.18	7.9335900	9.55367	1	0.043	9.5536747	1.4	6.82	0.47	20.33

0.18	50	0.18	0	0.18	1	0.043									
Food Ingestion Rate	Conc. In aquatic invert	Percent of Diet aquatic inverts	Food Ingestion Rate	Conc. in <i>Lumbriculus</i>	Percent of Diet <i>Lumbriculus</i>	Food Ingestion Rate	Total Intake through Food	Total Intake	AUF	Body Weight	Dose	LOAEL	HQ LOAEL	NOAEL	HQ NOAEL
kg/kg BW/day dw	mg/kg dw		kg/kg BW/day dw	mg/kg dw.		kg/kg BW/day dw	mg/day ww	mg/day		kg	mg/kg/day	mg/kg/day		mg/kg/day	
0.18	0.232	50	0.18		0	0.18	0.5233500	0.57818	1	0.043	0.5781791	0.068	8.50	0.023	25.14
0.18	3.87	50	0.18		0	0.18	2.0970000	3.29329	1	0.043	3.2932930	2.8	1.18	2.7	1.22
0.18	6	50	0.18		0	0.18	10.9530000	13.66669	1	0.043	13.6666880	3.3	4.14	1.6	8.54
0.18	2.556	50	0.18		0	0.18	1.0767600	2.26836	1	0.043	2.2683630	0.7	3.24	0.34	6.67
0.18	2.653	50	0.18	383.4	0	0.18	4.3022700	7.90653	1	0.043	7.9065307	0.13	60.82	0.043	183.87
0.18	2.653	50	0.18	383.4	0	0.18	4.3022700	7.90653	1	0.043	7.9065307	1.4	5.65	0.47	16.82
0.18	2.653	50	0.18	383.4	0	0.18	4.3022700	5.51703	1	0.043	5.5170307	0.13	42.44	0.043	128.30
0.18	2.653	50	0.18	383.4	0	0.18	4.3022700	5.51703	1	0.043	5.5170307	1.4	3.94	0.47	11.74
0.18	2.653	50	0.18	383.4	0	0.18	4.3022700	4.36861	1	0.043	4.3686127	1.4	3.12	0.47	9.29
0.18	2.653	50	0.18	383.4	0	0.18	4.3022700	4.36861	1	0.043	4.3686127	0.13	33.60	0.043	101.60

Soil invertebrate tissue concentrations from Table 4-16 of BERA

Aquatic invertebrate tissue concentrations from Table 4-15 of BERA

^A Earthworm concentrations are the max and 95UCL in earthworms from the UAA (Table 4-16)

^B Chromium, lead and vanadium concentrations in sediment are the maximum measured in Reach C-1, n =2 (Table 4-6)

^C Mercury, chromium, lead and vanadium concentrations in soil are the Max and 95% UCL measured in riparian soils for the UAA (Tables 4-8, 4-9, 4-10, and 4-11)

^D Chromium, lead and vanadium concentrations in benthic invertebrates are the maximum measured site-wide (Table 4-15)

mg/kg d.w. = milligrams per kilogram dry weight

mg/kg w.w. = milligrams per kilogram wet weight

kg = kilogram

mg/kg/day = milligrams per kilogram body weight per day

µg/L = micrograms per liter

dw = dry weight

ww = wet weight

AUF = Area Use Factor

LOAEL = Lowest observed adverse effect level

NOAEL = No observed adverse effect level

HQ = Hazard Quotient

mg/L = milligrams per liter

Table AD-7. Dietary Exposure Models Calculated using the Maximum or 95%UCL Measured PCB concentration in Reach C1 East and C1 West Sediment and “Riparian” Soil for the Raccoon-2 Exposure Scenario
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

Maximum concentration, C1

Raccoon -2

INITIAL SETTINGS

0.00126

0.00126

0.083

17

0.0268

Location	Type	Conc. In Sediment ^B	Sediment Ingestion Rate	Conc. In Soil ^C	Soil Ingestion Rate	Total Intake through Sediment	Conc. In Surface Water	Water Ingestion Rate	Total Intake through Water	Conc. In Aquatic Plants ^A	Percent of Diet	Food Ingestion Rate	Conc. In mammals/birds ^D
		mg/kg dw	kg/day dw	mg/kg dw	kg/day dw	mg/day	mg/L	L/kgBW/day	mg/kgBW/day	mg/kg dw		kg/kgBW/day dw	mg/kg dw
C1 (UAA data)	Mercury	0.58	0.00126	17.4	0.00126	0.0227	0.000430	0.083	0.0000357	0.11	17	0.0268	0.09
C1 (UAA data)	Chromium	46	0.00126	46	0.00126	0.116	0.0329	0.083	0.00273	3.125	17	0.0268	4.688
C1 (UAA data)	Lead	110	0.00126	89.1	0.00126	0.251	0.0964	0.083	0.008	7.054	17	0.0268	5.313
C1 (UAA data)	Vanadium	53	0.00126	22.8	0.00126	0.0955	0.0339	0.083	0.00281	1.944	17	0.0268	6.2
C1-West	PCBs	41	0.00126	206.5	0.00126	0.312	0.000498	0.083	4.13E-05	1.19	17	0.0268	13.53
C1-East	PCBs	41	0.00126	59	0.00126	0.126	0.000498	0.083	4.13E-05	1.19	17	0.0268	13.53

95% UCL, C1

Raccoon-2

INITIAL SETTINGS

0.00126

0.00126

0.083

17

0.0268

Location	Analyte	Conc. In Sediment	Sediment Ingestion Rate	Conc. In Soil	Soil Ingestion Rate	Total Intake through Sediment	Conc. In Surface Water	Water Ingestion Rate	Total Intake through Water	Conc. In Aquatic Plants ^A	Percent of Diet	Food Ingestion Rate	Conc. In mammals/birds ^D
		mg/kg dw	kg/day dw	mg/kg dw	kg/day dw	mg/day	mg/L	L/day	mg/L	mg/kg dw		kg/kgBW/day dw	mg/kg dw
C1 (UAA data)	Mercury	0.58	0.00126	2.8	0.00126	0.00426	0.00043	0.083	0.0000357	0.0859	17	0.0268	0.0468
C1 (UAA data)	Chromium	46	0.00126	27.5	0.00126	0.0926	0.0329	0.083	0.00273	3.125	17	0.0268	4.688
C1 (UAA data)	Lead	110	0.00126	56.5	0.00126	0.210	0.0964	0.083	0.008	7.054	17	0.0268	5.313
C1 (UAA data)	Vanadium	53	0.00126	20.2	0.00126	0.0922	0.0339	0.083	0.00281	1.944	17	0.0268	6.2
C1-West	PCBs	15.98	0.00126	206.5	0.00126	0.280	0.000498	0.083	4.13E-05	0.978	17	0.0268	6.357
C1-East	PCBs	15.98	0.00126	59	0.00126	0.0945	0.000498	0.083	4.13E-05	0.978	17	0.0268	6.357

Soil invertebrate tissue concentrations from Table 4-16 of BERA

Aquatic invertebrate tissue concentrations from Table 4-15 of BERA

^A Aquatic tissue concentrations are the max and 95% UCL from the UAA (Table 4-15)

^B Chromium, lead and vanadium concentrations in sediment are the maximum measured in Reach C-1, n =2 (Table 4-6)

^C Mercury, chromium, lead and vanadium concentrations in soil are the Max and 95% UCL measured in riparian soils for the UAA (Tables 4-8, 4-9, 4-10, and 4-11)

^D Terrestrial tissue concentrations are the max and 95% UCL from the UAA (Table 4-16)

^E *Lumbriculus* tissue concentrations calculated from data in Appendix E. Data are wet weight, converted to dry weight using 17% solids for *Lumbriculus* cited in Section 5.5.4.1.1

mg/kg d.w. = milligrams per kilogram dry weight

mg/kg w.w. = milligrams per kilogram wet weight

kg = kilogram

mg/kg/day = milligrams per kilogram body weight per day

µg/L = micrograms per liter

dw = dry weight

ww = wet weight

AUF = Area Use Factor

LOAEL = Lowest observed adverse effect level

NOAEL = No observed adverse effect level

HQ = Hazard Quotient

mg/L = milligrams per liter

Table AD-7. (cont.) Dietary Exposure Models Calculated using the Maximum or 95%UCL Measured PCB concentration in Reach C1 East and C1 West Sediment and “Riparian” Soil for the Raccoon-2 Exposure Scenario
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

19	0.0268		12	0.0268		23	0.0268		13	0.0268		3
Percent of Diet	Food Ingestion Rate	Conc. In Amphibians ^A	Percent of Diet	Food Ingestion Rate	Conc. In All Fish ^A	Percent of Diet	Food Ingestion Rate	Conc. In Crayfish ^A	Percent of Diet	Food Ingestion Rate	Conc. in <i>Lumbriculus</i> ^E	Percent of Diet
	g/kgBW/day dw	mg/kg dw		kg/kgBW/day dw	mg/kg dw		kg/kg BW/day dw	mg/kg dw		kg/kg BW/day dw	mg/kg dw	
0.19	0.0268	10.3	0.12	0.0268	1.95	0.23	0.0268	0.19	0.13	0.0268		0.03
0.19	0.0268	18.06	0.12	0.0268	11.11	0.23	0.0268	1.387	0.13	0.0268		0.03
0.19	0.0268	4.12	0.12	0.0268	2.07	0.23	0.0268	3.285	0.13	0.0268		0.03
0.19	0.0268	1.62	0.12	0.0268	1.19	0.23	0.0268	1.387	0.13	0.0268		0.03
0.19	0.0268	38.45	0.12	0.0268	175.2	0.23	0.0268	3.8	0.13	0.0268	882	0.03
0.19	0.0268	38.45	0.12	0.0268	175.2	0.23	0.0268	3.8	0.13	0.0268	882	0.03

19	0.0268		12	0.0268		23	0.0268		13	0.0268		3
Percent of Diet	Food Ingestion Rate	Conc. In Amphibians	Percent of Diet	Food Ingestion Rate	Conc. In All Fish	Percent of Diet	Food Ingestion Rate	Conc. In Crayfish	Percent of Diet	Food Ingestion Rate	Conc. in <i>Lumbriculus</i>	Percent of Diet
	g/kgBW/day dw	mg/kg dw		kg/kg BW/day dw	mg/kg dw		kg/kgBW/day dw	mg/kg dw		kg/kg BW/day dw	mg/kg dw	
0.19	0.0268	1.03	0.12	0.0268	0.736	0.23	0.0268	0.19	0.13	0.0268		0.03
0.19	0.0268	18.06	0.12	0.0268	4.556	0.23	0.0268	1.387	0.13	0.0268		0.03
0.19	0.0268	4.12	0.12	0.0268	0.547	0.23	0.0268	3.285	0.13	0.0268		0.03
0.19	0.0268	1.62	0.12	0.0268	1.19	0.23	0.0268	1.387	0.13	0.0268		0.03
0.19	0.0268	38.45	0.12	0.0268	50.11	0.23	0.0268	3.8	0.13	0.0268	383.4	0.03
0.19	0.0268	38.45	0.12	0.0268	50.11	0.23	0.0268	3.8	0.13	0.0268	383.4	0.03

Soil invertebrate tissue concentrations from Table 4-16 of BERA

Aquatic invertebrate tissue concentrations from Table 4-15 of BERA

^A Aquatic tissue concentrations are the max and 95UCL from the UAA (Table 4-15)

^B Chromium, lead and vanadium concentrations in sediment are the maximum measured in Reach C-1, n =2 (Table 4-6)

^C Mercury, chromium, lead and vanadium concentrations in soil are the Max and 95UCL measured in riparian soils for the UAA (Tables 4-8, 4-9, 4-10, and 4-11)

^D Terrestrial tissue concentrations are the max and 95UCL from the UAA (Table 4-16)

^E *Lumbriculus* tissue concentrations calculated from data in Appendix E. Data are wet weight, converted to dry weight using 17% solids for *Lumbriculus* cited in Section 5.5.4.1.1

mg/kg d.w. = milligrams per kilogram dry weight

mg/kg w.w. = milligrams per kilogram wet weight

kg = kilogram

mg/kg/day = milligrams per kilogram body weight per day

µg/L = micrograms per liter

dw = dry weight

ww = wet weight

AUF = Area Use Factor

LOAEL = Lowest observed adverse effect level

NOAEL = No observed adverse effect level

HQ = Hazard Quotient

mg/L = milligrams per liter

Table AD-7. (cont.) Dietary Exposure Models Calculated using the Maximum or 95%UCL Measured PCB concentration in Reach C1 East and C1 West Sediment and “Riparian” Soil for the Raccoon-2 Exposure Scenario
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

0.0268	13	0.0268	1	5.6								
Food Ingestion Rate	Conc. In Mollusks ^A	Percent of Diet	Food Ingestion Rate	Total Intake through Food	Total Intake	AUF	Body Weight	Dose	LOAEL	HQ LOAEL	NOAEL	HQ NOAEL
kg/kg BW/day dw	mg/kg dw		kg/kg BW/day dw	mg/day ww	mg/day		kg	mg/kg/day	mg/kg/day		mg/kg/day	
0.0268	0.38	0.13	0.0268	0.0977	0.120	1	5.6	0.120	0.15	0.80	0.075	1.61
0.0268	13.41	0.13	0.0268	1.63	1.74	1	5.6	1.74	2.8	0.62	2.4	0.73
0.0268	4.471	0.13	0.0268	3.29	3.55	1	5.6	3.55	8.9	0.40	4.7	0.76
0.0268	1.882	0.13	0.0268	0.941	1.04	1	5.6	1.04	8.3	0.13	4.2	0.25
0.0268	16.89	0.13	0.0268	2.60	2.91	1	5.6	2.91	0.68	4.28	0.23	12.64
0.0268	16.89	0.13	0.0268	2.60	2.72	1	5.6	2.72	0.68	4.00	0.23	11.83

0.0268	13	0.0268	1	5.6								
Food Ingestion Rate	Conc. In Mollusks	Percent of Diet	Food Ingestion Rate	Total Intake through Food	Total Intake	AUF	Body Weight	Dose	LOAEL	HQ LOAEL	NOAEL	HQ NOAEL
kg/kg BW/day dw	mg/kg dw		kg/kg BW/day dw	mg/day ww	mg/day		kg	mg/kg/day	mg/kg/day		mg/kg/day	
0.0268	0.292	0.13	0.0268	0.0489	0.0532	1	5.6	0.0532	0.15	0.35	0.075	0.71
0.0268	13.41	0.13	0.0268	1.59	1.68	1	5.6	1.68	2.8	0.60	2.4	0.70
0.0268	4.471	0.13	0.0268	3.28	3.50	1	5.6	3.50	8.9	0.39	4.7	0.75
0.0268	1.882	0.13	0.0268	0.941	1.04	1	5.6	1.04	8.3	0.12	4.2	0.25
0.0268	14.3	0.13	0.0268	1.28	1.56	1	5.6	1.56	0.68	2.30	0.23	6.79
0.0268	14.3	0.13	0.0268	1.28	1.38	1	5.6	1.38	0.68	2.02	0.23	5.98

Soil invertebrate tissue concentrations from Table 4-16 of BERA

Aquatic invertebrate tissue concentrations from Table 4-15 of BERA

^A Aquatic tissue concentrations are the max and 95UCL from the UAA (Table 4-15)

^B Chromium, lead and vanadium concentrations in sediment are the maximum measured in Reach C-1, n =2 (Table 4-6)

^C Mercury, chromium, lead and vanadium concentrations in soil are the Max and 95UCL measured in riparian soils for the UAA (Tables 4-8, 4-9, 4-10, and 4-11)

^D Terrestrial tissue concentrations are the max and 95UCL from the UAA (Table 4-16)

^E *Lumbriculus* tissue concentrations calculated from data in Appendix E. Data are wet weight, converted to dry weight using 17% solids for *Lumbriculus* cited in Section 5.5.4.1.1

mg/kg d.w. = milligrams per kilogram dry weight

mg/kg w.w. = milligrams per kilogram wet weight

kg = kilogram

mg/kg/day = milligrams per kilogram body weight per day

µg/L = micrograms per liter

dw = dry weight

ww = wet weight

AUF = Area Use Factor

LOAEL = Lowest observed adverse effect level

NOAEL = No observed adverse effect level

HQ = Hazard Quotient

mg/L = milligrams per liter

Table AD-8. Mammalian Exposure
Parameters Anniston PCB Site, Anniston,
Alabama

Parameter	Mammalian Aerial-feeding Insectivore		Mammalian Ground-feeding Invertivore		Mammalian Omnivore		Herbivore		Piscivore		Piscivore		Aquatic-dependent Carnivore		Mammalian Terrestrial-dependent Carnivore		
	Little Brown Bat		Short-tailed Shrew		Raccoon		White-tailed Deer		Mink		River Otter		Long-tailed Weasel		Red Fox		
	Data	Source	Data	Source	Data	Source	Data	Source	Data	Source	Data	Source	Data	Source	Data	Source	
Composition of Diet (%)																	
Riparian Soil	0%	--	3%	riparian soil assumed whensed EPC also used.	0%	--	0%	--	0%	--	0%	--	0%	--	0%	--	
Soil/Sediment	0%	Assumed to be negligible for aerial-feeding insectivores	3%	Beyer et al. (1994), as cited in USEPA (2007)	9.4%	Beyer et al. (1994)	2%	Sample and Suter (1994)	0%	Hamilton (1940), as cited in Sample and Suter (1994)	0%	Assumed to be negligible for piscivores	4.3%	Beyer et al. (1994), as cited in USEPA (2007)	2.8%	Beyer et al. (1994)	
Soil Invertebrates (Worms)	0%	--	See Table 2b for values for each scenario	--	See Table 2b for values for each scenario	--	0%	--	See Table 2b for values for each scenario	--	0%	--	0%	--	See Table 2b for values for each scenario	--	
Terrestrial Insects (Grasshoppers)	0%	--		--		0%	--	--		0%	--						
Terrestrial Invertebrates, Spiders, Detritivores	0%	--		--		0%	--	--		0%	--						
Aquatic Emergent and Flying Insects	100%	Belwood and Fenton (1976), as cited in Sample and Suter (1994)		--		--	0%	--		--	0%	--					
Aquatic Invertebrates, Spiders, Detritivores	0%	--		--		--	0%	--		--	0%	--					
Terrestrial Plants	0%	--		--		100%	Smith 1991, as cited in Sample and Suter (1994)	--		0%	--						
Aquatic Plants	0%	--		--		--	0%	--		--	0%	--					
Mammals	0%	--		--		--	0%	--		--	0%	--					
Reptiles	0%	--		--		--	0%	--		--	0%	--					
Amphibians	0%	--		--		--	0%	--		--	0%	--					
All Fish	0%	--		--		--	0%	--		--	48%	1-(%forage fish+%predator fish)	0%	--			
Predator Fish Only	0%	--		--		--	0%	--		--	22%	Stearns and Serfassi 2011	0%	--			
Forage Fish Only (4-15cm)	0%	--		--		--	0%	--		--	30%	Stearns and Serfassi 2011	0%	--			
Aquatic Invertebrates	0%	--		--		--	0%	--		--	0%	--	0%	--			
Aquatic Oligochaetes (Lumbriculus)	0%	--		--		--	0%	--		--	0%	--	0%	--			
Crayfish	0%	--		--		--	0%	--		--	0%	--	0%	--			
Mollusc	0%	--		--		--	0%	--		--	0%	--	0%	--			
Body Weight (kg)	0.009	Nagy (2001), allometric equation for little brown bat.	0.017	USEPA (1993) [Average of all mean values]	5.6	USEPA (1993) [average of adult and juvenile means values]	57	Smith (1991), as cited in Sample and Suter (1994) [average of male and female values]	0.90	USEPA (1993) [average of all adult and juvenile values]	7.4	USEPA (1993) [average of all adult and yearling values]	0.30	USEPA (2007)	4.5	USEPA (1993) [mean of all adult values]	
Food Ingestion Rate (kg/kg bw-d)																	
Food Ingestion Rate (kg/kw bw-d dw)	0.18	Nagy (2001), allometric equation for little brown bat.	0.1278	Nagy (2001), allometric equation for insectivores	0.0268	Nagy (2001), allometric equation for Omnivores.	0.0147	Nagy (2001), allometric equation for herbivores	0.05	Nagy (2001), allometric equation for carnivores	0.03	Nagy (2001), allometric equation for carnivores	0.06	Nagy (2001), allometric equation for carnivores	0.04	Nagy (2001), allometric equation for carnivores	
Drinking Water Ingestion (kg/kg bw-d)		0.16	Calder and Braun (1983), as cited in USEPA (1993)	0.15	Calder and Braun (1983), as cited in USEPA (1993)	0.083	Calder and Braun (1983), as cited in USEPA (1993)	0.066	Calder and Braun (1983), as cited in USEPA (1993)	0.10	Calder and Braun (1983), as cited in USEPA (1993)	0.081	Calder and Braun (1983), as cited in USEPA (1993)	0.11	Calder and Braun (1983), as cited in USEPA (1993)	0.085	Calder and Braun (1983), as cited in USEPA (1993)
Home Range (acres)																	
Lower Bound	0.1 Km	Bulcher (1976); Hudson River BE	0.25	Blair (1940), as cited in USEPA (1993)	48	Urban (1970); Hudson River BERA	146	Marchinton and Hirth (1984), as cited in Sample and Suter (1994)	1.9 Km	Gerell (1970) and Mitchell (1961) as cited in USEPA (1993)	10 Km	Spinola et al (1999); Hudson River BERA	30-40	Svendsen 1982	141	Ables (1969), as cited in USEPA (1993)	
Central Tendency	42	Henry et al. (2002)	0.96	Buckner (1966) as cited in USEPA (1993)	270	Prange et al. (2004)	715	Marchinton and Hirth (1984), as cited in Sample and Suter (1994)	2.15 Km	in USEPA (1993)	31 Km	Melquist and Hornocker (1983) , as cited in USEPA (1993)	96-338	Gehring and Swihart (2004)	2563	USEPA (1993) [mean of all reported values]	
Upper Bound	74	Henry et al. (2002)	4.4	Blair (1940), as cited in USEPA (1993)	12217	Fritzell (1978), as cited in USEPA (1993)	1284	Marchinton and Hirth (1984), as cited in Sample and Suter (1994)	3.4	Gerell (1970) and Mitchell (1961) as cited in USEPA (1993)			79-395	Quick 1944-1951	8447	Jones and Theberge (1982), as cited in USEPA (1993)	

Notes:

Full references provided in Table 4-2c.

%: percent

--: not applicable

BERA: Baseline Ecological Risk Assessment

cm: centimeters

dw: dry weight

EPC: exposure point concentration

kg: kilograms

kg/kg bw-d: kilograms per kilogram of body weight per day

kg/kg bw-d dw: kilograms per kilogram of body weight be day dry weight

PCB: polychlorinated biphenyl

USEPA: United States Environmental Protection Agency

**Table AD-9. Multimetric Index Score for Riffles and Runs
Reference Locations and OU-4 Assessment Areas
Benthic Invertebrate Community Surveys**

Area	Rifle Index Score		Run Index Score	
	Score	Area Average	Score	Area Average
Reference 1	36.7	44.4	48.3	44.7
Reference 2	52.1		41.1	
Upper AA 1	11.1	13.4	14.3	17.0
Upper AA 2	15.7		19.6	
Middle AA 1	30.8	30.9	27.8	32.8
Middle AA 2	30.9		37.8	
Lower AA 1	27.4	31.0	43.1	37.3
Lower AA 2	34.6		31.5	

Table AD-10. Summary of Aquatic Receptors NOAEL Hazard Quotients by Exposure Unit (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1	C2	C3	C4	Upper AA	C5	C6 ¹	Middle AA	C7	C8 ¹	C9	C10	Lower AA
Exposure Subarea→		Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
Receptors↓														
Aquatic Birds		NOAEL HQs												
Tree Swallow	tPCB-mid	165.8	103.2	11.4	25.1	42.4	0.2	0.0	0.2	0.3	0.3	0.1	0.2	0.3
	tPCB-high	1785.6	1111.8	122.4	270.4	457.0	2.4	0.5	2.2	2.8	3.2	0.8	2.3	3.5
	Barium	0.1	0.1	0.1	0.0	0.1	0.2	0.2	0.2	0.0	0.0	0.1	0.1	0.1
	Chromium	4.6	1.6	2.1	1.8	1.7	5.4	5.4	5.4	1.3	1.3	2.3	2.8	2.4
	Cobalt	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
	Lead	0.3	0.2	0.0	0.0	0.1	0.2	0.2	0.2	0.0	0.0	0.1	0.1	0.1
	Mercury	2.0	95.7	3.4	3.4	15.6	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.5
	Vanadium	3.0	0.8	1.0	0.4	0.7	2.4	2.4	2.4	0.4	0.4	0.9	1.2	1.1
Spotted Sandpiper - 2	tPCB-mid	64.7	47.5	11.5	19.1	26.7	9.6	3.5	9.1	10.0	10.9	4.5	8.8	11.5
	tPCB-high	696.5	511.6	123.9	205.6	288.0	103.5	37.7	98.0	108.1	117.3	48.7	95.3	123.7
	Barium	2.1	1.6	0.8	0.4	1.0	2.3	2.3	2.3	0.3	0.3	0.8	1.0	0.9
	Chromium	1.6	0.6	0.7	0.6	0.6	2.0	2.0	2.0	0.5	0.5	0.8	1.0	0.9
	Cobalt	0.7	0.3	0.4	0.1	0.3	1.1	1.1	1.1	0.1	0.1	0.3	0.3	0.3
	Lead	11.7	5.4	1.5	1.4	3.2	7.6	7.6	7.6	1.0	1.0	2.6	2.8	2.4
	Mercury	4.1	149.8	6.4	6.4	25.9	5.5	5.5	5.7	5.5	5.5	5.6	5.6	7.0
	Vanadium	16.9	4.4	5.5	2.4	4.1	13.8	13.8	13.8	2.4	2.4	5.2	7.1	6.0

Table AD-10. Summary of Aquatic Receptors NOAEL Hazard Quotients by Exposure Unit (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1	C2	C3	C4	Upper AA	C5	C6 ¹	Middle AA	C7	C8 ¹	C9	C10	Lower AA
Exposure Subarea→		Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
Receptors↓														
Kingfisher - 1	tPCB-mid	89.9	56.0	6.2	13.6	23.0	6.1	1.2	5.6	5.9	6.7	1.7	4.8	7.2
	tPCB-high	968.5	603.0	66.4	146.7	247.9	66.2	13.5	60.7	63.1	71.7	17.8	51.7	78.0
	Barium	1.6	1.2	0.6	0.3	0.7	1.8	1.8	1.8	0.2	0.2	0.6	0.8	0.7
	Chromium	1.7	0.6	0.8	0.7	0.6	2.0	2.0	2.0	0.5	0.5	0.8	1.0	0.9
	Cobalt	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
	Lead	0.4	0.2	0.1	0.1	0.1	0.3	0.3	0.3	0.0	0.0	0.1	0.1	0.1
	Mercury	0.6	30.5	1.1	1.1	5.0	2.6	2.6	2.7	2.7	2.7	2.7	2.7	3.6
	Vanadium	4.4	1.1	1.4	0.6	1.1	3.6	3.6	3.6	0.6	0.6	1.3	1.8	1.6
Kingfisher - 2	tPCB-mid	72.7	45.3	5.0	11.0	18.6	4.8	1.0	4.4	4.5	5.1	1.3	3.7	5.6
	tPCB-high	782.7	487.3	53.7	118.5	200.3	51.5	10.5	47.2	48.7	55.3	13.8	39.9	60.2
	Barium	3.1	2.4	1.2	0.7	1.5	3.6	3.6	3.6	0.4	0.4	1.3	1.6	1.3
	Chromium	1.5	0.5	0.7	0.6	0.5	1.7	1.7	1.7	0.4	0.4	0.7	0.9	0.8
	Cobalt	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
	Lead	0.9	0.4	0.1	0.1	0.2	0.6	0.6	0.6	0.1	0.1	0.2	0.2	0.2
	Mercury	0.9	25.5	1.3	1.3	4.7	2.5	2.5	2.5	2.5	2.5	2.5	2.5	3.2
	Vanadium	4.5	1.2	1.5	0.6	1.1	3.7	3.7	3.7	0.6	0.6	1.4	1.9	1.6
Great Blue Heron ²	tPCB-mid	128.4	80.0	8.8	19.5	32.9	7.0	1.4	6.4	7.2	8.2	2.0	5.9	8.9
	tPCB-high	1383.0	861.5	95.3	209.7	354.2	75.4	15.5	69.2	77.4	87.9	22.0	63.4	95.6
	Barium	0.8	0.6	0.3	0.2	0.4	0.9	0.9	0.9	0.1	0.1	0.3	0.4	0.3
	Chromium	0.7	0.2	0.3	0.3	0.3	0.8	0.8	0.8	0.2	0.2	0.4	0.4	0.4
	Cobalt	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
	Lead ⁷	0.7	0.3	0.1	0.1	0.2	0.5	0.5	0.5	0.1	0.1	0.2	0.2	0.2
	Mercury	1.4	57.7	2.2	2.2	9.7	3.1	3.1	3.2	3.6	3.7	3.6	3.7	4.7
	Vanadium	2.1	0.6	0.7	0.3	0.5	1.7	1.7	1.7	0.3	0.3	0.7	0.9	0.8
Osprey	tPCB-mid	53.8	33.5	3.7	8.1	13.8	3.0	0.6	2.7	3.0	3.5	0.9	2.5	3.8
	tPCB-high	579.5	360.8	39.7	87.8	148.3	31.9	6.5	29.3	32.8	37.3	9.3	26.9	40.6
	Barium	0.2	0.2	0.1	0.0	0.1	0.3	0.3	0.3	0.0	0.0	0.1	0.1	0.1
	Chromium	0.2	0.1	0.1	0.1	0.1	0.3	0.3	0.3	0.1	0.1	0.1	0.1	0.1
	Cobalt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
	Mercury	0.5	22.4	0.8	0.8	3.7	1.2	1.2	1.2	1.4	1.4	1.4	1.4	1.8
	Vanadium	0.5	0.1	0.2	0.1	0.1	0.4	0.4	0.4	0.1	0.1	0.2	0.2	0.2

Table AD-10. Summary of Aquatic Receptors NOAEL Hazard Quotients by Exposure Unit (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1	C2	C3	C4	Upper AA	C5	C6 ¹	Middle AA	C7	C8 ¹	C9	C10	Lower AA
Exposure Subarea→		Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
Receptors↓														
Aquatic Mammals		NOAEL HQs												
Bat	tPCB	248.3	154.6	17.0	37.6	63.6	0.3	0.1	0.3	0.4	0.4	0.1	0.3	0.5
	Barium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Chromium	3.7	1.3	1.7	1.5	1.4	4.4	4.4	4.4	1.1	1.1	1.9	2.3	2.0
	Cobalt	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
	Lead	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
	Mercury	0.5	21.3	0.7	0.7	3.5	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3
	Vanadium	0.2	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.1
Mink - 2 ²	tPCB-mink	232.2	145.1	16.6	35.5	59.7	15.8	3.4	14.5	15.0	17.0	4.4	12.3	18.5
	Barium	0.2	0.2	0.1	0.1	0.1	0.3	0.3	0.3	0.0	0.0	0.1	0.1	0.1
	Chromium	0.5	0.2	0.2	0.2	0.2	0.6	0.6	0.6	0.2	0.2	0.3	0.3	0.3
	Cobalt	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Lead ⁷	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mercury	0.1	2.3	0.1	0.1	0.4	0.2	0.2	0.2	0.2	0.3	0.2	0.3	0.3
	Vanadium	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Otter	tPCB-mink	372.2	231.8	25.5	56.4	95.3	16.3	3.3	14.9	18.9	21.5	5.3	15.5	23.4
	Barium	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
	Chromium	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
	Cobalt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mercury	0.1	6.0	0.2	0.2	1.0	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.4
	Vanadium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Notes:

NOAEL HQ* ≤ 1
NOAEL HQ* > 1 and ≤ 10
NOAEL HQ* > 10

* All HQs rounded to the nearest whole number

¹ Sediment data unavailable for this reach for non-mercury metals. Non-mercury metal EPCs from the upstream reach were conservatively used to estimate exposure.

² Great blue heron and Mink-2 are exposed to sediment and riparian soil.

AA: assessment area

HQ: hazard quotient

mg/kg-day: milligrams per kilogram per day

NOAEL: no observed adverse effect level

PCB: polychlorinated biphenyl

tPCB: total polychlorinated biphenyl

--: not available

Exposure Units:

C1: Oxford Lake Park

C2: Backwater Area

C3: Friendship Road to Highway 21

C4: Hwy 21 to Silver Run Road

C5: Silver Run Road to Mitchell Matson Road

C6: Mitchell Matson Road to 2,000 feet upstream of Curry Station Road

C7: Upstream of Curry Station Road to Eastaboga Creek

C8: Eastaboga Creek to Jackson Shoals Dam

C9: Jackson Shoals Dam to Highway 77

C10: Highway 77 Bridge to Lake Logan Martin

Sediment: Instream Sediment

Table AD-11. Summary of Aquatic Receptors LOAEL Hazard Quotients by Exposure Unit (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1	C2	C3	C4	Upper AA	C5	C6 ²	Middle AA	C7	C8 ²	C9	C10	Lower AA
Exposure Subarea→		Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
Receptors ⁵ ↓														
Aquatic Birds		LOAEL HQs												
Tree Swallow	tPCB-mid	55.3	34.4	3.8	8.4	14.1	0.1	0.0	0.1	0.1	0.1	0.0	0.1	0.1
	tPCB-high	595.2	370.6	40.8	90.1	152.3	0.8	0.2	0.7	0.9	1.1	0.3	0.8	1.2
	Barium	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
	Chromium	4.3	1.5	2.0	1.7	1.6	5.1	5.1	5.1	1.3	1.3	2.2	2.6	2.3
	Cobalt	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
	Lead	0.2	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
	Mercury	0.7	31.9	1.1	1.1	5.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5
	Vanadium	1.5	0.4	0.5	0.2	0.4	1.2	1.2	1.2	0.2	0.2	0.4	0.6	0.5
Spotted Sandpiper - 2	tPCB-mid	21.6	15.8	3.8	6.4	8.9	3.2	1.2	3.0	3.3	3.6	1.5	2.9	3.8
	tPCB-high	232.2	170.5	41.3	68.5	96.0	34.5	12.6	32.7	36.0	39.1	16.2	31.8	41.2
	Barium	1.0	0.8	0.4	0.2	0.5	1.2	1.2	1.2	0.1	0.1	0.4	0.5	0.4
	Chromium	1.6	0.5	0.7	0.6	0.6	1.9	1.9	1.9	0.5	0.5	0.8	1.0	0.8
	Cobalt	0.7	0.3	0.3	0.1	0.2	1.1	1.1	1.1	0.1	0.1	0.3	0.3	0.3
	Lead	5.9	2.7	0.7	0.7	1.6	3.8	3.8	3.8	0.5	0.5	1.3	1.4	1.2
	Mercury	1.4	49.9	2.1	2.1	8.6	1.8	1.8	1.9	1.8	1.8	1.9	1.9	2.3
	Vanadium	8.3	2.2	2.7	1.2	2.0	6.8	6.8	6.8	1.2	1.2	2.5	3.5	3.0
Kingfisher - 1	tPCB-mid	30.0	18.7	2.1	4.5	7.7	2.0	0.4	1.9	2.0	2.2	0.6	1.6	2.4
	tPCB-high	322.8	201.0	22.1	48.9	82.6	22.1	4.5	20.2	21.0	23.9	5.9	17.2	26.0
	Barium	0.8	0.6	0.3	0.2	0.4	0.9	0.9	0.9	0.1	0.1	0.3	0.4	0.3
	Chromium	1.6	0.6	0.7	0.6	0.6	1.9	1.9	1.9	0.5	0.5	0.8	1.0	0.8
	Cobalt	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
	Lead	0.2	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.0
	Mercury	0.2	10.2	0.4	0.4	1.7	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.2
	Vanadium	2.2	0.6	0.7	0.3	0.5	1.8	1.8	1.8	0.3	0.3	0.7	0.9	0.8
Kingfisher - 2	tPCB-mid	24.2	15.1	1.7	3.7	6.2	1.6	0.3	1.5	1.5	1.7	0.4	1.2	1.9
	tPCB-high	260.9	162.4	17.9	39.5	66.8	17.2	3.5	15.7	16.2	18.4	4.6	13.3	20.1
	Barium	1.6	1.2	0.6	0.3	0.7	1.8	1.8	1.8	0.2	0.2	0.6	0.8	0.7
	Chromium	1.4	0.5	0.6	0.5	0.5	1.7	1.7	1.7	0.4	0.4	0.7	0.9	0.7
	Cobalt	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
	Lead	0.4	0.2	0.1	0.1	0.1	0.3	0.3	0.3	0.0	0.0	0.1	0.1	0.1
	Mercury	0.3	8.5	0.4	0.4	1.6	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.1
	Vanadium	2.2	0.6	0.7	0.3	0.5	1.8	1.8	1.8	0.3	0.3	0.7	0.9	0.8
Great Blue Heron ³	tPCB-mid	42.8	26.7	2.9	6.5	11.0	2.3	0.5	2.1	2.4	2.7	0.7	2.0	3.0
	tPCB-high	461.0	287.2	31.8	69.9	118.1	25.1	5.2	23.1	25.8	29.3	7.3	21.1	31.9
	Barium	0.4	0.3	0.1	0.1	0.2	0.4	0.4	0.4	0.0	0.0	0.2	0.2	0.2
	Chromium	0.7	0.2	0.3	0.3	0.2	0.8	0.8	0.8	0.2	0.2	0.3	0.4	0.4
	Cobalt	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
	Lead	0.4	0.2	0.0	0.0	0.1	0.2	0.2	0.2	0.0	0.0	0.1	0.1	0.1
	Mercury	0.5	19.2	0.7	0.7	3.2	1.0	1.0	1.1	1.2	1.2	1.2	1.2	1.6
	Vanadium	1.0	0.3	0.3	0.2	0.3	0.8	0.8	0.8	0.2	0.2	0.3	0.4	0.4
Osprey	tPCB-mid	17.9	11.2	1.2	2.7	4.6	1.0	0.2	0.9	1.0	1.2	0.3	0.8	1.3
	tPCB-high	193.2	120.3	13.2	29.3	49.4	10.6	2.2	9.8	10.9	12.4	3.1	9.0	13.5
	Barium	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.0
	Chromium	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
	Cobalt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mercury	0.2	7.5	0.3	0.3	1.2	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.6
	Vanadium	0.3	0.1	0.1	0.0	0.1	0.2	0.2	0.2	0.0	0.0	0.1	0.1	0.1

Table AD-11. Summary of Aquatic Receptors LOAEL Hazard Quotients by Exposure Unit (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1	C2	C3	C4	Upper AA	C5	C6 ²	Middle AA	C7	C8 ²	C9	C10	Lower AA
Exposure Subarea→		Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
Receptors ⁵ ↓														
Aquatic Mammals		LOAEL HQs												
Bat	tPCB	84.0	52.3	5.8	12.7	21.5	0.1	0.0	0.1	0.1	0.1	0.0	0.1	0.2
	Barium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Chromium	3.2	1.1	1.4	1.2	1.2	3.8	3.8	3.8	0.9	0.9	1.6	1.9	1.7
	Cobalt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mercury	0.2	10.7	0.4	0.4	1.7	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
	Vanadium	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Mink - 2 ³	tPCB-mink	116.1	72.5	8.3	17.8	29.9	7.9	1.7	7.2	7.5	8.5	2.2	6.2	9.3
Mink - 2 (Alternate TRV) ¹	tPCB-mink	232.2	145.1	16.6	35.5	59.7	15.8	3.4	14.5	15.0	17.0	4.4	12.3	18.5
	Barium	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
	Chromium	0.5	0.2	0.2	0.2	0.2	0.5	0.5	0.5	0.1	0.1	0.2	0.3	0.2
	Cobalt	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Lead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mercury	0.0	1.1	0.0	0.0	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
	Vanadium	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Otter	tPCB-mink	186.1	115.9	12.8	28.2	47.6	8.1	1.7	7.5	9.5	10.8	2.7	7.7	11.7
Otter (Alternate TRV) ¹	tPCB-mink	372.2	231.8	25.5	56.4	95.3	16.3	3.3	14.9	18.9	21.5	5.3	15.5	23.4
	Barium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Chromium	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.0	0.0	0.1	0.1	0.1
	Cobalt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mercury	0.1	3.0	0.1	0.1	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
	Vanadium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Notes:

NOAEL HQ* ≤ 1
LOAEL HQ* ≤ 1
LOAEL HQ* > 1 and ≤ 10
LOAEL HQ* > 10

* All HQs rounded to the nearest whole number

¹ Alternate TRVs were selected from Restum et al. (1998) based on growth. The LOAEL TRV is 0.05 mg/kg-day.

² Sediment data unavailable for this reach for non-mercury metals. Non-mercury metal EPCs from the upstream reach were conservatively used to estimate exposure.

³ Great blue heron and Mink-2 are exposed to riparian soil.

AA: assessment area

HQ: hazard quotient

LOAEL: lowest-observed adverse effect level

mg/kg-day: milligrams per kilogram per day

tPCB: total polychlorinated biphenyl

TRV: toxicity reference value

--: not available

Exposure Units:

C1: Oxford Lake Park

C2: Backwater Area

C3: Friendship Road to Highway 21

C4: Hwy 21 to Silver Run Road

C5: Silver Run Road to Mitchell Matson Road

C6: Mitchell Matson Road to 2,000 feet upstream of Curry Station Road

C7: Upstream of Curry Station Road to Eastaboga Creek

C8: Eastaboga Creek to Jackson Shoals Dam

C9: Jackson Shoals Dam to Highway 77

C10: Highway 77 Bridge to Lake Logan Martin

Sediment: Instream Sediment

References:

Restum, J., S. Bursian, J. Giesy, J. Render, W. Helferich, E. Shipp, D. Verbrugge, and R. Aulerich. 1998. Multigenerational study of the effects of consumption of PCB-contaminated carp from Saginaw Bay, Lake Huron, on mink: 1. Effects on mink reproduction, kit growth, and survival, and selected biological parameters. J. Toxicol. Environ. Health Part A 54: 343 375.

Table AD-12. Summary of Terrestrial Receptors NOAEL-based Hazard Quotients by Exposure Unit (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1 ^{1,2}	C1 ^{1,2}	C2	C2	C2	C2	C3	C3	C3	C4	C4	C4	Upper AA	Upper AA	C5	C5	C5
Exposure Subarea→		East	West	North	South	Central	Riparian	North	South	Riparian	North	South	Riparian	Combined Soil	Riparian	North	South	Riparian
Receptors↓		NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ
Lower Trophic Receptors																		
Terrestrial Plants ³	PCB	0.3	5.2	0.1	0.0	0.0	0.8	0.3	0.7	0.6	0.2	0.2	0.2	0.2	0.3	0.0	0.0	0.1
	Chromium	--	--	34.4	11.2	13.4	13.4	17.9	55.2	16.2	43.8	26.2	46.0	28.2	27.5	19.9	25.0	41.9
	Lead	--	--	0.3	0.2	0.4	0.4	0.4	0.9	0.3	0.5	0.4	0.7	0.4	0.5	0.2	0.4	0.4
	Mercury	--	--	4.7	0.2	0.5	1.6	10.5	11.2	19.7	7.5	7.9	12.1	7.3	9.4	2.4	3.0	4.6
	Vanadium	--	--	11.5	11.4	9.7	11.4	9.8	12.4	7.9	11.6	11.3	11.1	10.1	10.1	14.0	16.0	7.9
Terrestrial Invertebrates ³	PCB	3.2	5.7	1.5	0.1	0.5	8.9	3.8	7.9	6.7	2.6	1.7	2.7	2.6	2.8	0.3	0.4	0.8
	Chromium	--	--	86.0	28.0	33.5	33.5	44.8	138.0	40.5	109.5	65.5	115.0	70.4	68.8	49.7	62.5	104.8
	Lead	--	--	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
	Mercury	--	--	14.2	0.7	1.6	4.9	31.6	33.6	59.1	22.4	23.8	36.3	21.9	28.1	7.3	9.1	13.8
	Vanadium	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Terrestrial Birds																		
Mourning Dove	tPCB-mid	2.2	39.6	1.1	0.1	0.4	--	2.6	5.5	--	1.8	1.2	--	1.9	--	0.2	0.3	--
	tPCB-high	23.9	426.5	11.8	1.2	4.0	--	28.3	58.8	--	19.7	13.3	--	20.0	--	2.5	3.4	--
	Mercury	--	--	1.7	0.1	0.2	--	3.7	4.0	--	2.6	2.8	--	2.6	--	0.9	1.1	--
	Chromium	--	--	0.4	0.1	0.2	--	0.2	0.7	--	0.5	0.3	--	0.3	--	0.2	0.3	--
	Lead	--	--	0.4	0.3	0.6	--	0.5	1.3	--	0.8	0.6	--	0.6	--	0.3	0.7	--
Blue Jay	Vanadium	--	--	1.4	1.4	1.2	--	1.2	1.5	--	1.4	1.4	--	1.2	--	1.7	1.9	--
	tPCB-mid	4.0	71.8	1.9	0.1	0.6	--	4.7	9.9	--	3.3	2.2	--	3.3	--	0.4	0.5	--
	tPCB-high	42.7	773.6	20.9	1.5	6.7	--	50.9	106.1	--	35.2	23.6	--	35.8	--	3.9	5.6	--
	Mercury	--	--	3.6	0.7	0.9	--	7.4	7.9	--	5.4	5.7	--	5.3	--	2.1	2.5	--
	Chromium	--	--	0.7	0.2	0.3	--	0.4	1.0	--	0.8	0.5	--	0.6	--	0.4	0.5	--
Carolina Wren - 1	Lead	--	--	0.6	0.5	0.9	--	0.9	2.1	--	1.3	1.0	--	0.9	--	0.4	1.1	--
	Vanadium	--	--	2.2	2.2	1.9	--	1.9	2.4	--	2.2	2.2	--	1.9	--	2.7	3.1	--
	tPCB-mid	14.3	261.3	6.9	0.3	2.1	--	17.0	35.7	--	11.7	7.8	--	11.9	--	1.1	1.7	--
	tPCB-high	153.8	2813.8	74.3	3.7	22.6	--	183.4	384.4	--	126.4	84.0	--	128.3	--	12.4	18.4	--
	Mercury	--	--	14.9	4.0	4.7	--	29.0	30.6	--	21.5	22.6	--	21.1	--	9.3	10.7	--
Hawk	Chromium	--	--	2.1	0.9	1.0	--	1.2	3.2	--	2.6	1.7	--	1.8	--	1.3	1.6	--
	Lead	--	--	2.0	1.5	3.0	--	2.9	7.1	--	4.2	3.3	--	3.0	--	1.5	3.6	--
	Vanadium	--	--	7.0	7.0	5.9	--	6.0	7.6	--	7.1	6.9	--	6.2	--	8.6	9.8	--
	tPCB-mid	31.2	37.5	19.4	18.8	19.0	--	3.5	4.2	--	5.7	5.4	--	8.8	--	1.5	1.6	--
	tPCB-high	335.5	404.3	209.4	202.3	205.1	--	37.3	45.6	--	61.0	58.4	--	94.7	--	16.0	16.8	--
Terrestrial Mammals	Chromium	--	--	0.4	0.2	0.2	--	0.2	0.6	--	0.5	0.3	--	0.3	--	0.3	0.4	--
	Lead	--	--	0.4	0.3	0.5	--	0.3	0.8	--	0.5	0.4	--	0.4	--	0.4	0.6	--
	Mercury	--	--	6.9	6.6	6.6	--	1.4	1.5	--	1.2	1.3	--	2.1	--	1.0	1.1	--
	Vanadium	--	--	2.0	2.0	2.0	--	2.0	2.1	--	1.9	1.9	--	2.0	--	2.5	2.5	--
Shrew - 1	tPCB	19.2	352.3	9.3	0.5	2.8	--	22.9	48.1	--	15.8	10.5	--	16.1	--	1.5	2.3	--
	Mercury	--	--	2.8	0.8	1.0	--	5.3	5.6	--	4.0	4.2	--	3.9	--	1.8	2.1	--
	Chromium	--	--	1.2	0.5	0.5	--	0.7	1.9	--	1.5	1.0	--	1.0	--	0.8	0.9	--
	Lead	--	--	0.4	0.3	0.5	--	0.5	1.3	--	0.8	0.6	--	0.5	--	0.3	0.7	--
	Vanadium	--	--	0.3	0.3	0.3	--	0.3	0.3	--	0.3	0.3	--	0.3	--	0.4	0.4	--
Shrew - 2	tPCB	26.8	341.5	14.2	5.7	8.0	--	22.4	46.3	--	16.4	11.3	--	17.5	--	1.8	2.6	--
	Chromium	--	--	1.2	0.5	0.5	--	0.7	1.9	--	1.5	0.9	--	1.0	--	0.8	1.0	--
	Lead	--	--	0.4	0.3	0.6	--	0.5	1.2	--	0.7	0.6	--	0.6	--	0.3	0.7	--
	Mercury	--	--	4.1	2.3	2.4	--	5.1	5.4	--	3.8	4.0	--	4.0	--	1.8	2.0	--
	Vanadium	--	--	0.3	0.3	0.3	--	0.3	0.3	--	0.3	0.3	--	0.3	--	0.4	0.4	--

Table AD-12. Summary of Terrestrial Receptors NOAEL-based Hazard Quotients by Exposure Unit (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1 ^{1,2}	C1 ^{1,2}	C2	C2	C2	C2	C3	C3	C3	C4	C4	C4	Upper AA	Upper AA	C5	C5	C5
Exposure Subarea→		East	West	North	South	Central	Riparian	North	South	Riparian	North	South	Riparian	Combined Soil	Riparian	North	South	Riparian
Receptors↓		NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ
Deer	tPCB	0.4	6.8	0.2	0.0	0.1	--	0.5	0.9	--	0.3	0.2	--	0.3	--	0.0	0.1	--
	Mercury	--	--	0.0	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	--	0.0	0.0	--
	Chromium	--	--	0.0	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	--	0.0	0.0	--
	Lead	--	--	0.0	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	--	0.0	0.0	--
	Vanadium	--	--	0.0	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	--	0.0	0.0	--
Weasel	tPCB	2.1	12.0	1.4	0.3	0.7	--	2.4	3.6	--	1.9	1.5	--	1.9	--	0.5	0.7	--
	Mercury	--	--	0.1	0.0	0.0	--	0.1	0.1	--	0.1	0.1	--	0.1	--	0.1	0.1	--
	Chromium	--	--	0.3	0.1	0.1	--	0.2	0.5	--	0.4	0.2	--	0.2	--	0.2	0.2	--
	Lead	--	--	0.1	0.0	0.1	--	0.1	0.2	--	0.1	0.1	--	0.1	--	0.0	0.1	--
	Vanadium	--	--	0.1	0.1	0.1	--	0.1	0.1	--	0.1	0.1	--	0.1	--	0.1	0.1	--
Fox - 1	tPCB	1.6	15.1	1.0	0.2	0.5	--	1.8	3.1	--	1.4	1.0	--	1.4	--	0.3	0.4	--
	Mercury	--	--	0.1	0.0	0.0	--	0.2	0.2	--	0.1	0.1	--	0.1	--	0.1	0.1	--
	Chromium	--	--	0.2	0.1	0.1	--	0.1	0.3	--	0.2	0.1	--	0.1	--	0.1	0.1	--
	Lead	--	--	0.0	0.0	0.0	--	0.0	0.1	--	0.1	0.1	--	0.0	--	0.0	0.1	--
	Vanadium	--	--	0.1	0.1	0.1	--	0.1	0.1	--	0.1	0.1	--	0.1	--	0.1	0.1	--
Fox - 2	tPCB	1.3	7.7	0.9	0.2	0.5	--	1.5	2.2	--	1.2	0.9	--	1.2	--	0.3	0.4	--
	Mercury	--	--	0.0	0.0	0.0	--	0.1	0.1	--	0.0	0.0	--	0.0	--	0.0	0.0	--
	Chromium	--	--	0.2	0.1	0.1	--	0.1	0.3	--	0.2	0.1	--	0.1	--	0.1	0.1	--
	Lead	--	--	0.0	0.0	0.0	--	0.0	0.1	--	0.1	0.0	--	0.0	--	0.0	0.1	--
	Vanadium	--	--	0.1	0.1	0.1	--	0.1	0.1	--	0.1	0.1	--	0.1	--	0.1	0.1	--

Table AD-12. Summary of Terrestrial Receptors NOAEL-based Hazard Quotients by Exposure Unit (Modeled Tissue) Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C6	C6	C6	Middle AA	Middle AA	C7	C7	C7	C8	C8	C8	C9	C9	C9	C10 ²	Lower AA	Lower AA
Exposure Subarea→		North	South	Riparian	Combined Soil	Riparian	North	South	Riparian	North	South	Riparian	North	South	Riparian	Sediment	Combined Soil	Riparian
Receptors↓		NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ
Lower Trophic Receptors																		
Terrestrial Plants ³	PCB	0.0	0.1	0.1	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.1	--	0.0	0.0
	Chromium	18.4	10.0	18.4	19.0	41.9	22.2	29.5	27.8	23.7	18.8	23.7	14.4	14.1	14.4	--	20.2	19.6
	Lead	0.2	0.1	0.2	0.3	0.4	0.3	0.2	0.3	0.2	0.3	0.3	0.1	0.2	0.1	--	0.2	0.2
	Mercury	5.2	9.2	6.7	2.8	4.7	1.8	5.8	10.1	15.5	2.5	15.5	5.5	1.7	5.7	--	3.1	12.9
	Vanadium	13.6	6.5	6.7	12.6	7.9	14.4	14.9	7.7	11.4	14.2	14.2	6.1	13.5	4.9	--	11.9	10.3
Terrestrial Invertebrates ³	PCB	0.5	0.8	0.7	0.4	0.7	0.2	0.4	0.7	0.5	0.4	0.6	0.4	0.1	0.6	--	0.2	0.5
	Chromium	46.0	25.0	46.0	47.4	104.8	55.5	73.8	69.5	59.3	46.9	59.3	36.0	35.3	36.0	--	50.6	49.1
	Lead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	0.0	0.0
	Mercury	15.6	27.5	20.1	8.3	14.2	5.4	17.5	30.2	46.5	7.5	46.5	16.6	5.2	17.2	--	9.4	38.7
	Vanadium	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Terrestrial Birds																		
Mourning Dove	tPCB-mid	0.4	0.6	--	0.3	--	0.2	0.3	--	0.4	0.3	--	0.3	0.1	--	--	0.2	--
	tPCB-high	4.2	6.0	--	3.3	--	1.9	3.2	--	4.3	3.1	--	3.7	1.1	--	--	2.1	--
	Mercury	1.8	3.2	--	1.0	--	0.6	2.1	--	5.5	0.9	--	2.0	0.6	--	--	1.1	--
	Chromium	0.2	0.1	--	0.2	--	0.3	0.4	--	0.3	0.2	--	0.2	0.2	--	--	0.2	--
	Lead	0.3	0.2	--	0.5	--	0.5	0.3	--	0.4	0.4	--	0.2	0.2	--	--	0.3	--
Blue Jay	Vanadium	1.6	0.8	--	1.5	--	1.7	1.8	--	1.4	1.7	--	0.7	1.6	--	--	1.4	--
	tPCB-mid	0.6	1.0	--	0.5	--	0.3	0.5	--	0.7	0.5	--	0.6	0.1	--	--	0.3	--
	tPCB-high	7.0	10.3	--	5.4	--	2.9	5.1	--	7.3	4.9	--	6.2	1.3	--	--	3.2	--
	Mercury	3.9	6.5	--	2.3	--	1.7	4.4	--	10.8	2.2	--	4.2	1.7	--	--	2.6	--
	Chromium	0.4	0.2	--	0.4	--	0.4	0.6	--	0.5	0.4	--	0.3	0.3	--	--	0.4	--
Carolina Wren - 1	Lead	0.5	0.3	--	0.8	--	0.8	0.5	--	0.6	0.6	--	0.3	0.4	--	--	0.5	--
	Vanadium	2.6	1.2	--	2.4	--	2.8	2.9	--	2.2	2.7	--	1.2	2.6	--	--	2.3	--
	tPCB-mid	2.2	3.3	--	1.7	--	0.8	1.6	--	2.3	1.5	--	1.9	0.3	--	--	0.9	--
	tPCB-high	23.5	35.8	--	17.8	--	8.7	16.9	--	24.7	16.2	--	20.6	3.1	--	--	9.8	--
	Mercury	16.0	25.7	--	10.1	--	7.9	18.0	--	42.1	9.6	--	17.2	7.7	--	--	11.2	--
Hawk	Chromium	1.3	0.8	--	1.3	--	1.5	1.8	--	1.5	1.3	--	1.1	1.0	--	--	1.4	--
	Lead	1.7	1.0	--	2.8	--	2.6	1.7	--	2.0	2.0	--	1.0	1.2	--	--	1.6	--
	Vanadium	8.3	4.0	--	7.7	--	8.8	9.2	--	7.0	8.7	--	3.7	8.3	--	--	7.3	--
	tPCB-mid	0.7	0.8	--	1.5	--	0.8	0.9	--	1.0	0.9	--	0.6	0.3	--	--	0.9	--
	tPCB-high	7.4	8.6	--	15.7	--	8.3	9.4	--	11.1	10.1	--	6.0	3.4	--	--	9.7	--
Terrestrial Mammals	Chromium	0.3	0.2	--	0.3	--	0.3	0.3	--	0.3	0.2	--	0.2	0.2	--	--	0.3	--
	Lead	0.4	0.3	--	0.5	--	0.3	0.2	--	0.2	0.2	--	0.2	0.2	--	--	0.2	--
	Mercury	1.3	1.9	--	1.0	--	1.0	1.8	--	3.6	1.1	--	1.7	1.0	--	--	1.3	--
	Vanadium	2.5	2.3	--	2.4	--	2.0	2.0	--	1.9	2.0	--	1.9	2.1	--	--	2.1	--
Terrestrial Mammals																		
Shrew - 1	tPCB	2.9	4.5	--	2.2	--	1.1	2.1	--	3.1	2.0	--	2.6	0.4	--	--	1.2	--
	Mercury	3.0	4.7	--	1.9	--	1.5	3.3	--	7.6	1.8	--	3.2	1.5	--	--	2.1	--
	Chromium	0.7	0.4	--	0.7	--	0.8	1.1	--	0.9	0.7	--	0.6	0.6	--	--	0.8	--
	Lead	0.3	0.2	--	0.5	--	0.5	0.3	--	0.4	0.4	--	0.2	0.2	--	--	0.3	--
	Vanadium	0.4	0.2	--	0.3	--	0.4	0.4	--	0.3	0.4	--	0.2	0.4	--	--	0.3	--
Shrew - 2	tPCB	2.9	4.4	--	2.4	--	1.2	2.2	--	3.2	2.1	--	2.5	0.4	--	--	1.4	--
	Chromium	0.8	0.5	--	0.8	--	0.8	1.0	--	0.9	0.7	--	0.6	0.6	--	--	0.8	--
	Lead	0.4	0.2	--	0.5	--	0.5	0.3	--	0.3	0.4	--	0.2	0.2	--	--	0.3	--
	Mercury	2.9	4.5	--	1.9	--	1.5	3.2	--	7.2	1.8	--	3.1	1.5	--	--	2.1	--
	Vanadium	0.4	0.2	--	0.4	--	0.4	0.4	--	0.3	0.4	--	0.2	0.4	--	--	0.3	--

Table AD-12. Summary of Terrestrial Receptors NOAEL-based Hazard Quotients by Exposure Unit (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C6	C6	C6	Middle AA	Middle AA	C7	C7	C7	C8	C8	C8	C9	C9	C9	C10 ²	Lower AA	Lower AA
Exposure Subarea→		North	South	Riparian	Combined Soil	Riparian	North	South	Riparian	North	South	Riparian	North	South	Riparian	Sediment	Combined Soil	Riparian
Receptors↓		NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ
Deer	tPCB	0.1	0.1	--	0.1	--	0.0	0.1	--	0.1	0.0	--	0.1	0.0	--	--	0.0	--
	Mercury	0.0	0.0	--	0.0	--	0.0	0.0	--	0.1	0.0	--	0.0	0.0	--	--	0.0	--
	Chromium	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	--	0.0	--
	Lead	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	--	0.0	--
	Vanadium	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	--	0.0	--
Weasel	tPCB	0.8	1.0	--	0.7	--	0.5	0.6	--	0.8	0.6	--	0.7	0.3	--	--	0.5	--
	Mercury	0.1	0.3	--	0.1	--	0.1	0.3	--	0.7	0.1	--	0.2	0.1	--	--	0.1	--
	Chromium	0.2	0.1	--	0.2	--	0.2	0.2	--	0.2	0.2	--	0.1	0.1	--	--	0.2	--
	Lead	0.0	0.0	--	0.1	--	0.1	0.0	--	0.1	0.1	--	0.0	0.0	--	--	0.0	--
	Vanadium	0.1	0.1	--	0.1	--	0.1	0.1	--	0.1	0.1	--	0.1	0.1	--	--	0.1	--
Fox - 1	tPCB	0.5	0.6	--	0.4	--	0.3	0.4	--	0.5	0.4	--	0.4	0.2	--	--	0.3	--
	Mercury	0.1	0.2	--	0.1	--	0.1	0.2	--	0.5	0.1	--	0.2	0.1	--	--	0.1	--
	Chromium	0.1	0.0	--	0.1	--	0.1	0.1	--	0.1	0.1	--	0.1	0.1	--	--	0.1	--
	Lead	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	--	0.0	--
	Vanadium	0.1	0.1	--	0.1	--	0.1	0.1	--	0.1	0.1	--	0.1	0.1	--	--	0.1	--
Fox - 2	tPCB	0.5	0.6	--	0.4	--	0.3	0.4	--	0.5	0.4	--	0.4	0.2	--	--	0.3	--
	Mercury	0.1	0.1	--	0.0	--	0.0	0.1	--	0.4	0.1	--	0.1	0.0	--	--	0.1	--
	Chromium	0.1	0.0	--	0.1	--	0.1	0.1	--	0.1	0.1	--	0.1	0.1	--	--	0.1	--
	Lead	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	--	0.0	--
	Vanadium	0.1	0.1	--	0.1	--	0.1	0.1	--	0.1	0.1	--	0.1	0.1	--	--	0.1	--

Notes:

NOAEL HQ* ≤ 1
NOAEL HQ* > 1 and ≤ 10
NOAEL HQ* > 10

- * All HQs rounded to the nearest whole number
- ¹ Soil in C1 was not sampled for metals. Hawk and shrew-2 are exposed to both soil and sediment, therefore, the HQs presented for metals in C1 are based on exposures to sediment only.
- ² Riparian soil in reaches C1 and C10 is based on the applicable assessment area (i.e., Upper for C1 and Lower for C10). Reach C10 was not evaluated for terrestrial receptors due to lack of floodplain soil.
- ³ NOAEL TRV for terrestrial invertebrates and plants was not available for vanadium.
- AA: assessment area
- HQ: hazard quotient
- NOAEL: no observed adverse effect level
- tPCB: total polychlorinated biphenyl
- TRV: toxicity reference value
- : not available

Exposure Units:

- C1: Oxford Lake Park
- C2: Backwater Area
- C3: Friendship Road to Highway 21
- C4: Hwy 21 to Silver Run Road
- C5: Silver Run Road to Mitchell Matson Road
- C6: Mitchell Matson Road to 2,000 feet upstream of Curry Station Road
- C7: Upstream of Curry Station Road to Eastaboga Creek
- C8: Eastaboga Creek to Jackson Shoals Dam

- C9: Jackson Shoals Dam to Highway 77
- C10: Hwy 77 Bridge to Lake Logan Martin
- Exposure Subareas:
- East: East Subarea Floodplain Soil
- West: West Subarea Floodplain Soil
- North: North Subarea Floodplain Soil
- South: South Subarea Floodplain Soil
- Central: Central Subarea Floodplain Soil

Table AD-13. Summary of Terrestrial Receptors LOAEL-based Hazard Quotients by Exposure Unit (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1 ^{1,2}	C1 ^{1,2}	C2	C2	C2	C2	C3	C3	C3	C4	C4	C4	Upper AA
Exposure Subarea→		East	West	North	South	Central	Riparian	North	South	Riparian	North	South	Riparian	Combined Soil
Receptors↓ ³		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Lower Trophic Receptors														
Terrestrial Plants ³	PCB	--	--	--	--	--	--	--	--	--	--	--	--	--
	Chromium	--	--	--	--	--	--	--	--	--	--	--	--	--
	Lead	--	--	--	--	--	--	--	--	--	--	--	--	--
	Mercury	--	--	--	--	--	--	--	--	--	--	--	--	--
	Vanadium	--	--	--	--	--	--	--	--	--	--	--	--	--
Terrestrial Invertebrates ³	PCB	0.3	5.7	0.2	0.0	0.0	0.9	0.4	0.8	0.7	0.3	0.2	0.3	0.3
	Chromium	--	--	--	--	--	--	--	--	--	--	--	--	--
	Lead	--	--	--	--	--	--	--	--	--	--	--	--	--
	Mercury	--	--	6.2	0.3	0.7	2.1	13.8	14.6	25.7	9.7	10.3	15.8	9.5
	Vanadium	--	--	--	--	--	--	--	--	--	--	--	--	--
Terrestrial Birds														
Mourning Dove	tPCB-mid	0.7	13.2	0.4	0.0	0.1	--	0.9	1.8	--	0.6	0.4	--	0.6
	tPCB-high	8.0	142.2	3.9	0.4	1.3	--	9.4	19.6	--	6.6	4.4	--	6.7
	Mercury	--	--	0.6	0.0	0.1	--	1.2	1.3	--	0.9	0.9	--	0.9
	Chromium	--	--	0.4	0.1	0.2	--	0.2	0.6	--	0.5	0.3	--	0.3
	Lead	--	--	0.2	0.1	0.3	--	0.3	0.7	--	0.4	0.3	--	0.3
Blue Jay	Vanadium	--	--	0.7	0.7	0.6	--	0.6	0.7	--	0.7	0.7	--	0.6
	tPCB-mid	1.3	23.9	0.6	0.0	0.2	--	1.6	3.3	--	1.1	0.7	--	1.1
	tPCB-high	14.2	257.9	7.0	0.5	2.2	--	17.0	35.4	--	11.7	7.9	--	11.9
	Mercury	--	--	1.2	0.2	0.3	--	2.5	2.6	--	1.8	1.9	--	1.8
	Chromium	--	--	0.6	0.2	0.3	--	0.3	1.0	--	0.8	0.5	--	0.5
Carolina Wren	Lead	--	--	0.3	0.2	0.5	--	0.4	1.1	--	0.6	0.5	--	0.5
	Vanadium	--	--	1.1	1.1	0.9	--	0.9	1.2	--	1.1	1.1	--	1.0
	tPCB-mid	4.8	87.1	2.3	0.1	0.7	--	5.7	11.9	--	3.9	2.6	--	4.0
	tPCB-high	51.3	937.9	24.8	1.2	7.5	--	61.1	128.1	--	42.1	28.0	--	42.8
	Mercury	--	--	5.0	1.3	1.6	--	9.7	10.2	--	7.2	7.5	--	7.0
Hawk	Chromium	--	--	2.0	0.8	1.0	--	1.2	3.0	--	2.5	1.6	--	1.7
	Lead	--	--	1.0	0.8	1.5	--	1.4	3.6	--	2.1	1.7	--	1.5
	Vanadium	--	--	3.5	3.4	2.9	--	3.0	3.7	--	3.5	3.4	--	3.0
	tPCB-mid	10.4	12.5	6.5	6.3	6.3	--	1.2	1.4	--	1.9	1.8	--	2.9
	tPCB-high	111.8	134.8	69.8	67.4	68.4	--	12.4	15.2	--	20.3	19.5	--	31.6
	Chromium	--	--	0.4	0.2	0.2	--	0.2	0.6	--	0.5	0.3	--	0.3
	Lead	--	--	0.2	0.2	0.2	--	0.2	0.4	--	0.2	0.2	--	0.2
	Mercury	--	--	2.3	2.2	2.2	--	0.5	0.5	--	0.4	0.4	--	0.7
	Vanadium	--	--	1.0	1.0	1.0	--	1.0	1.0	--	1.0	1.0	--	1.0

Table AD-13. Summary of Terrestrial Receptors LOAEL-based Hazard Quotients by Exposure Unit (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1 ^{1,2}	C1 ^{1,2}	C2	C2	C2	C2	C3	C3	C3	C4	C4	C4	Upper AA
Exposure Subarea→		East	West	North	South	Central	Riparian	North	South	Riparian	North	South	Riparian	Combined Soil
Receptors↓ ³		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Terrestrial Mammals														
Shrew - 1	tPCB	6.5	119.1	3.1	0.2	1.0	--	7.8	16.3	--	5.3	3.6	--	5.4
	Mercury	--	--	1.4	0.4	0.5	--	2.7	2.8	--	2.0	2.1	--	2.0
	Chromium	--	--	1.0	0.4	0.5	--	0.6	1.6	--	1.3	0.8	--	0.9
	Lead	--	--	0.2	0.1	0.3	--	0.3	0.7	--	0.4	0.3	--	0.3
	Vanadium	--	--	0.1	0.1	0.1	--	0.1	0.2	--	0.2	0.1	--	0.1
Shrew - 2	tPCB	9.1	115.5	4.8	1.9	2.7	--	7.6	15.7	--	5.5	3.8	--	5.9
	Chromium	--	--	1.0	0.4	0.5	--	0.6	1.6	--	1.3	0.8	--	0.9
	Lead	--	--	0.2	0.2	0.3	--	0.3	0.7	--	0.4	0.3	--	0.3
	Mercury	--	--	2.1	1.1	1.2	--	2.6	2.7	--	1.9	2.0	--	2.0
	Vanadium	--	--	0.2	0.2	0.1	--	0.1	0.2	--	0.2	0.1	--	0.1
Deer	tPCB	0.1	2.3	0.1	0.0	0.0	--	0.2	0.3	--	0.1	0.1	--	0.1
	Mercury	--	--	0.0	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0
	Chromium	--	--	0.0	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0
	Lead	--	--	0.0	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0
	Vanadium	--	--	0.0	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0
Weasel	tPCB	0.7	4.1	0.5	0.1	0.3	--	0.8	1.2	--	0.6	0.5	--	0.7
	Mercury	--	--	0.0	0.0	0.0	--	0.1	0.1	--	0.0	0.0	--	0.0
	Chromium	--	--	0.2	0.1	0.1	--	0.1	0.4	--	0.3	0.2	--	0.2
	Lead	--	--	0.0	0.0	0.0	--	0.0	0.1	--	0.1	0.0	--	0.0
	Vanadium	--	--	0.1	0.1	0.1	--	0.1	0.1	--	0.1	0.1	--	0.1
Fox - 1	tPCB	0.5	5.1	0.3	0.1	0.2	--	0.6	1.0	--	0.5	0.4	--	0.5
	Mercury	--	--	0.0	0.0	0.0	--	0.1	0.1	--	0.1	0.1	--	0.1
	Chromium	--	--	0.1	0.0	0.1	--	0.1	0.2	--	0.2	0.1	--	0.1
	Lead	--	--	0.0	0.0	0.0	--	0.0	0.1	--	0.0	0.0	--	0.0
	Vanadium	--	--	0.0	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0
Fox - 2	tPCB	0.4	2.6	0.3	0.1	0.2	--	0.5	0.8	--	0.4	0.3	--	0.4
	Mercury	--	--	0.0	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0
	Chromium	--	--	0.1	0.0	0.1	--	0.1	0.2	--	0.2	0.1	--	0.1
	Lead	--	--	0.0	0.0	0.0	--	0.0	0.1	--	0.0	0.0	--	0.0
	Vanadium	--	--	0.0	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0

Table AD-13. Summary of Terrestrial Receptors LOAEL-based Hazard Quotients by Exposure Unit (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		Upper AA	C5	C5	C5	C6	C6	C6	Middle AA	Middle AA	C7	C7	C7	C8
Exposure Subarea→		Riparian	North	South	Riparian	North	South	Riparian	Combined Soil	Riparian	North	South	Riparian	North
Receptors↓ ³		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Lower Trophic Receptors														
Terrestrial Plants ³	PCB	--	--	--	--	--	--	--	--	--	--	--	--	--
	Chromium	--	--	--	--	--	--	--	--	--	--	--	--	--
	Lead	--	--	--	--	--	--	--	--	--	--	--	--	--
	Mercury	--	--	--	--	--	--	--	--	--	--	--	--	--
	Vanadium	--	--	--	--	--	--	--	--	--	--	--	--	--
Terrestrial Invertebrates ³	PCB	0.3	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.1	0.1
	Chromium	--	--	--	--	--	--	--	--	--	--	--	--	--
	Lead	--	--	--	--	--	--	--	--	--	--	--	--	--
	Mercury	12.2	3.2	3.9	6.0	6.8	12.0	8.7	3.6	6.2	2.3	7.6	13.1	20.2
	Vanadium	--	--	--	--	--	--	--	--	--	--	--	--	--
Terrestrial Birds														
Mourning Dove	tPCB-mid	--	0.1	0.1	--	0.1	0.2	--	0.1	--	0.1	0.1	--	0.1
	tPCB-high	--	0.8	1.1	--	1.4	2.0	--	1.1	--	0.6	1.1	--	1.4
	Mercury	--	0.3	0.4	--	0.6	1.1	--	0.3	--	0.2	0.7	--	1.8
	Chromium	--	0.2	0.3	--	0.2	0.1	--	0.2	--	0.3	0.3	--	0.3
	Lead	--	0.1	0.3	--	0.2	0.1	--	0.3	--	0.2	0.2	--	0.2
Blue Jay	Vanadium	--	0.8	0.9	--	0.8	0.4	--	0.7	--	0.8	0.9	--	0.7
	tPCB-mid	--	0.1	0.2	--	0.2	0.3	--	0.2	--	0.1	0.2	--	0.2
	tPCB-high	--	1.3	1.9	--	2.3	3.4	--	1.8	--	1.0	1.7	--	2.4
	Mercury	--	0.7	0.8	--	1.3	2.2	--	0.8	--	0.6	1.5	--	3.6
	Chromium	--	0.4	0.5	--	0.4	0.2	--	0.4	--	0.4	0.5	--	0.4
Carolina Wren	Lead	--	0.2	0.5	--	0.3	0.1	--	0.4	--	0.4	0.3	--	0.3
	Vanadium	--	1.3	1.5	--	1.3	0.6	--	1.2	--	1.4	1.4	--	1.1
	tPCB-mid	--	0.4	0.6	--	0.7	1.1	--	0.6	--	0.3	0.5	--	0.8
	tPCB-high	--	4.1	6.1	--	7.8	11.9	--	5.9	--	2.9	5.6	--	8.2
	Mercury	--	3.1	3.6	--	5.3	8.6	--	3.4	--	2.6	6.0	--	14.0
Hawk	Chromium	--	1.3	1.5	--	1.2	0.8	--	1.2	--	1.4	1.8	--	1.5
	Lead	--	0.7	1.8	--	0.9	0.5	--	1.4	--	1.3	0.8	--	1.0
	Vanadium	--	4.2	4.8	--	4.1	1.9	--	3.8	--	4.3	4.5	--	3.4
	tPCB-mid	--	0.5	0.5	--	0.2	0.3	--	0.5	--	0.3	0.3	--	0.3
	tPCB-high	--	5.3	5.6	--	2.5	2.9	--	5.2	--	2.8	3.1	--	3.7
	Chromium	--	0.3	0.3	--	0.3	0.2	--	0.3	--	0.3	0.3	--	0.3
	Lead	--	0.2	0.3	--	0.2	0.2	--	0.3	--	0.2	0.1	--	0.1
	Mercury	--	0.3	0.4	--	0.4	0.6	--	0.3	--	0.3	0.6	--	1.2
	Vanadium	--	1.2	1.2	--	1.2	1.1	--	1.2	--	1.0	1.0	--	1.0

Table AD-13. Summary of Terrestrial Receptors LOAEL-based Hazard Quotients by Exposure Unit (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		Upper AA	C5	C5	C5	C6	C6	C6	Middle AA	Middle AA	C7	C7	C7	C8
Exposure Subarea→		Riparian	North	South	Riparian	North	South	Riparian	Combined Soil	Riparian	North	South	Riparian	North
Receptors↓ ³		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Terrestrial Mammals														
Shrew - 1	tPCB	--	0.5	0.8	--	1.0	1.5	--	0.7	--	0.4	0.7	--	1.0
	Mercury	--	0.9	1.0	--	1.5	2.4	--	1.0	--	0.8	1.7	--	3.8
	Chromium	--	0.6	0.8	--	0.6	0.4	--	0.6	--	0.7	0.9	--	0.7
	Lead	--	0.1	0.3	--	0.2	0.1	--	0.3	--	0.3	0.2	--	0.2
	Vanadium	--	0.2	0.2	--	0.2	0.1	--	0.2	--	0.2	0.2	--	0.1
Shrew - 2	tPCB	--	0.6	0.9	--	1.0	1.5	--	0.8	--	0.4	0.7	--	1.1
	Chromium	--	0.7	0.8	--	0.7	0.4	--	0.7	--	0.7	0.9	--	0.7
	Lead	--	0.2	0.4	--	0.2	0.1	--	0.3	--	0.2	0.2	--	0.2
	Mercury	--	0.9	1.0	--	1.5	2.3	--	1.0	--	0.8	1.6	--	3.6
	Vanadium	--	0.2	0.2	--	0.2	0.1	--	0.2	--	0.2	0.2	--	0.1
Deer	tPCB	--	0.0	0.0	--	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0
	Mercury	--	0.0	0.0	--	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0
	Chromium	--	0.0	0.0	--	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0
	Lead	--	0.0	0.0	--	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0
	Vanadium	--	0.0	0.0	--	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0
Weasel	tPCB	--	0.2	0.2	--	0.3	0.3	--	0.2	--	0.2	0.2	--	0.3
	Mercury	--	0.0	0.0	--	0.1	0.1	--	0.0	--	0.0	0.1	--	0.3
	Chromium	--	0.1	0.2	--	0.1	0.1	--	0.1	--	0.2	0.2	--	0.2
	Lead	--	0.0	0.1	--	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0
	Vanadium	--	0.1	0.1	--	0.1	0.0	--	0.1	--	0.1	0.1	--	0.1
Fox - 1	tPCB	--	0.1	0.1	--	0.2	0.2	--	0.1	--	0.1	0.1	--	0.2
	Mercury	--	0.0	0.0	--	0.1	0.1	--	0.0	--	0.0	0.1	--	0.2
	Chromium	--	0.1	0.1	--	0.1	0.0	--	0.1	--	0.1	0.1	--	0.1
	Lead	--	0.0	0.0	--	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0
	Vanadium	--	0.0	0.0	--	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0
Fox - 2	tPCB	--	0.1	0.1	--	0.2	0.2	--	0.1	--	0.1	0.1	--	0.2
	Mercury	--	0.0	0.0	--	0.0	0.1	--	0.0	--	0.0	0.1	--	0.2
	Chromium	--	0.1	0.1	--	0.1	0.0	--	0.1	--	0.1	0.1	--	0.1
	Lead	--	0.0	0.0	--	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0
	Vanadium	--	0.0	0.0	--	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0

Table AD-13. Summary of Terrestrial Receptors LOAEL-based Hazard Quotients by Exposure Unit (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C8	C8	C9	C9	C9	C10 ¹	Lower AA	Lower AA
Exposure Subarea→		South	Riparian	North	South	Riparian	Sediment	Combined Soil	Riparian
Receptors↓ ³		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Lower Trophic Receptors									
Terrestrial Plants³	PCB	--	--	--	--	--	--	--	--
	Chromium	--	--	--	--	--	--	--	--
	Lead	--	--	--	--	--	--	--	--
	Mercury	--	--	--	--	--	--	--	--
	Vanadium	--	--	--	--	--	--	--	--
Terrestrial Invertebrates³	PCB	0.0	0.1	0.0	0.0	0.1	--	0.0	0.1
	Chromium	--	--	--	--	--	--	--	--
	Lead	--	--	--	--	--	--	--	--
	Mercury	3.3	20.2	7.2	2.3	7.5	--	4.1	16.8
	Vanadium	--	--	--	--	--	--	--	--
Terrestrial Birds									
Mourning Dove	tPCB-mid	0.1	--	0.1	0.0	--	--	0.1	--
	tPCB-high	1.0	--	1.2	0.4	--	--	0.7	--
	Mercury	0.3	--	0.7	0.2	--	--	0.4	--
	Chromium	0.2	--	0.2	0.2	--	--	0.2	--
	Lead	0.2	--	0.1	0.1	--	--	0.1	--
Blue Jay	Vanadium	0.8	--	0.4	0.8	--	--	0.7	--
	tPCB-mid	0.2	--	0.2	0.0	--	--	0.1	--
	tPCB-high	1.6	--	2.1	0.4	--	--	1.1	--
	Mercury	0.7	--	1.4	0.6	--	--	0.9	--
	Chromium	0.4	--	0.3	0.3	--	--	0.4	--
Carolina Wren	Lead	0.3	--	0.2	0.2	--	--	0.2	--
	Vanadium	1.3	--	0.6	1.3	--	--	1.1	--
	tPCB-mid	0.5	--	0.6	0.1	--	--	0.3	--
	tPCB-high	5.4	--	6.9	1.0	--	--	3.3	--
	Mercury	3.2	--	5.7	2.6	--	--	3.7	--
Hawk	Chromium	1.2	--	1.0	1.0	--	--	1.3	--
	Lead	1.0	--	0.5	0.6	--	--	0.8	--
	Vanadium	4.3	--	1.8	4.1	--	--	3.6	--
	tPCB-mid	0.3	--	0.2	0.1	--	--	0.3	--
	tPCB-high	3.4	--	2.0	1.1	--	--	3.2	--
	Chromium	0.2	--	0.2	0.2	--	--	0.3	--
	Lead	0.1	--	0.1	0.1	--	--	0.1	--
	Mercury	0.4	--	0.6	0.3	--	--	0.4	--
	Vanadium	1.0	--	0.9	1.0	--	--	1.0	--

Table AD-13. Summary of Terrestrial Receptors LOAEL-based Hazard Quotients by Exposure Unit (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C8	C8	C9	C9	C9	C10 ¹	Lower AA	Lower AA
Exposure Subarea→		South	Riparian	North	South	Riparian	Sediment	Combined Soil	Riparian
Receptors↓ ³		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Terrestrial Mammals									
Shrew - 1	tPCB	0.7	--	0.9	0.1	--	--	0.4	--
	Mercury	0.9	--	1.6	0.8	--	--	1.1	--
	Chromium	0.6	--	0.5	0.5	--	--	0.6	--
	Lead	0.2	--	0.1	0.1	--	--	0.2	--
	Vanadium	0.2	--	0.1	0.2	--	--	0.2	--
Shrew - 2	tPCB	0.7	--	0.9	0.1	--	--	0.5	--
	Chromium	0.6	--	0.5	0.5	--	--	0.7	--
	Lead	0.2	--	0.1	0.1	--	--	0.2	--
	Mercury	0.9	--	1.5	0.7	--	--	1.0	--
	Vanadium	0.2	--	0.1	0.2	--	--	0.2	--
Deer	tPCB	0.0	--	0.0	0.0	--	--	0.0	--
	Mercury	0.0	--	0.0	0.0	--	--	0.0	--
	Chromium	0.0	--	0.0	0.0	--	--	0.0	--
	Lead	0.0	--	0.0	0.0	--	--	0.0	--
	Vanadium	0.0	--	0.0	0.0	--	--	0.0	--
Weasel	tPCB	0.2	--	0.2	0.1	--	--	0.2	--
	Mercury	0.1	--	0.1	0.0	--	--	0.1	--
	Chromium	0.1	--	0.1	0.1	--	--	0.1	--
	Lead	0.0	--	0.0	0.0	--	--	0.0	--
	Vanadium	0.1	--	0.0	0.1	--	--	0.1	--
Fox - 1	tPCB	0.1	--	0.1	0.1	--	--	0.1	--
	Mercury	0.0	--	0.1	0.0	--	--	0.1	--
	Chromium	0.1	--	0.1	0.1	--	--	0.1	--
	Lead	0.0	--	0.0	0.0	--	--	0.0	--
	Vanadium	0.0	--	0.0	0.0	--	--	0.0	--
Fox - 2	tPCB	0.1	--	0.1	0.1	--	--	0.1	--
	Mercury	0.0	--	0.1	0.0	--	--	0.0	--
	Chromium	0.1	--	0.1	0.1	--	--	0.1	--
	Lead	0.0	--	0.0	0.0	--	--	0.0	--
	Vanadium	0.0	--	0.0	0.0	--	--	0.0	--

Notes:
NOAEL HQ* ≤ 1
LOAEL HQ* ≤ 1
LOAEL HQ* > 1 and ≤ 10
LOAEL HQ* > 10

* All HQs rounded to the nearest whole number

¹ Riparian soil in reaches C1 and C10 is based on the applicable assessment area (i.e., Upper for C1 and Lower for C10). Reach C10 was not evaluated for terrestrial receptors due to lack of floodplain soil.

² Soil in C1 was not sampled for metals. Hawk and shrew-2 are exposed to both soil and sediment, therefore, the HQs presented for metals in C1 are based on exposures to sediment only.

³ LOAEL TRVs were only available for PCBs and mercury for terrestrial plants and invertebrates, therefore LOAEL-equivalent HQs could not be calculated for the remaining metals.

AA: assessment area

HQ: hazard quotient

LOAEL: lowest-observed adverse effect level

tPCB: total polychlorinated biphenyl

TRV: toxicity reference value

--: not available

Exposure Units:

C1: Oxford Lake Park

C2: Backwater Area

C3: Friendship Road to Highway 21

C4: Hwy 21 to Silver Run Road

C5: Silver Run Road to Mitchell Matson Road

C6: Mitchell Matson Road to 2,000 feet upstream of Curry Station Road

C7: Upstream of Curry Station Road to Eastaboga Creek

C8: Eastaboga Creek to Jackson Shoals Dam

C9: Jackson Shoals Dam to Highway 77

C10: Highway 77 Bridge to Lake Logan Martin

Exposure Subareas:

East: East Subarea Floodplain Soil

West: West Subarea Floodplain Soil

North: North Subarea Floodplain Soil

South: South Subarea Floodplain Soil

Central: Central Subarea Floodplain Soil

Table AD-14. Summary of NOAEL Hazard Quotients by Exposure Unit for Receptors Exposed to Terrestrial + Aquatic Media (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1 ¹	C1 ¹	C1 ¹	C2	C2	C2	C2	C3	C3	C3	C4	C4	C4
Exposure Subarea→		East Floodplain Soil, Riparian Soil & Sediment	West Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Central Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment
Receptors↓		NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ
Aquatic+Terrestrial Birds														
Carolina Wren - 2	tPCB-mid	18.0	111.9	--	10.4	7.9	8.6	--	7.3	14.4	--	6.3	4.8	--
	tPCB-high	193.5	1205.1	--	111.9	85.1	92.3	--	78.1	154.6	--	67.7	51.6	--
	Barium ²	--	--	--	1.1	1.2	1.2	--	0.8	0.9	--	0.7	0.7	--
	Chromium	--	--	--	1.6	1.0	1.1	--	1.3	2.3	--	1.9	1.5	--
	Cobalt ²	--	--	--	0.5	0.5	0.5	--	0.5	0.6	--	0.5	0.5	--
	Lead	--	--	--	3.0	2.7	3.5	--	2.1	4.4	--	2.8	2.3	--
	Mercury	--	--	--	130.1	125.1	125.4	--	19.3	20.1	--	15.9	16.4	--
	Vanadium	--	--	--	6.0	6.0	5.4	--	6.0	6.9	--	5.1	5.0	--
Spotted Sandpiper - 1	tPCB-mid	--	--	13.4	--	--	--	32.2	--	--	22.5	--	--	9.6
	tPCB-high	--	--	144.5	--	--	--	346.7	--	--	242.0	--	--	103.7
	Barium ²	--	--	1.6	--	--	--	1.4	--	--	0.9	--	--	1.0
	Chromium	--	--	1.8	--	--	--	0.8	--	--	1.0	--	--	2.0
	Cobalt ²	--	--	0.5	--	--	--	0.3	--	--	0.3	--	--	0.2
	Lead	--	--	8.5	--	--	--	4.7	--	--	2.4	--	--	4.8
	Mercury	--	--	20.5	--	--	--	28.4	--	--	39.1	--	--	25.7
	Vanadium	--	--	12.7	--	--	--	6.9	--	--	6.0	--	--	5.8
Aquatic+Terrestrial Mammals														
Mink - 1	tPCB-mink	--	--	96.8	--	--	--	64.2	--	--	11.5	--	--	17.3
	Barium ²	--	--	0.2	--	--	--	0.2	--	--	0.1	--	--	0.1
	Chromium	--	--	0.5	--	--	--	0.2	--	--	0.2	--	--	0.3
	Cobalt ²	--	--	0.1	--	--	--	0.1	--	--	0.1	--	--	0.1
	Lead	--	--	0.2	--	--	--	0.1	--	--	0.0	--	--	0.1
	Mercury	--	--	0.1	--	--	--	1.0	--	--	0.1	--	--	0.1
	Vanadium	--	--	0.1	--	--	--	0.0	--	--	0.1	--	--	0.0
Raccoon - 1	tPCB	6.7	35.8	6.7	3.9	3.1	3.4	8.4	2.4	4.6	4.3	2.2	1.7	2.4
	Barium ²	--	--	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Chromium	--	--	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.2	0.1	0.2
	Cobalt ²	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	--	--	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Mercury	--	--	0.5	0.4	0.2	0.2	0.2	0.5	0.5	0.9	0.4	0.4	0.6
	Vanadium	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Raccoon - 2	tPCB	--	--	16.1	--	--	--	10.4	--	--	1.5	--	--	2.7
	Barium ²	--	--	0.2	--	--	--	0.1	--	--	0.1	--	--	0.0
	Chromium	--	--	0.3	--	--	--	0.1	--	--	0.1	--	--	0.1
	Cobalt ²	--	--	0.1	--	--	--	0.1	--	--	0.1	--	--	0.0
	Lead	--	--	0.3	--	--	--	0.1	--	--	0.0	--	--	0.0
	Mercury	--	--	0.1	--	--	--	2.5	--	--	0.1	--	--	0.1
	Vanadium	--	--	0.1	--	--	--	0.0	--	--	0.0	--	--	0.0

Table AD-14. Summary of NOAEL Hazard Quotients by Exposure Unit for Receptors Exposed to Terrestrial + Aquatic Media (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		Upper AA	Upper AA	C5	C5	C5	C6	C6	C6	Middle AA	Middle AA
Exposure Subarea→		Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment
Receptors↓		NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	
Aquatic+Terrestrial Birds											
Carolina Wren - 2	tPCB-mid	7.7	--	1.0	1.2	--	0.9	1.3	--	1.1	--
	tPCB-high	82.7	--	10.7	13.0	--	9.4	14.1	--	12.2	--
	Barium ²	0.9	--	1.5	1.4	--	1.4	1.4	--	1.4	--
	Chromium	1.5	--	2.4	2.5	--	2.3	2.1	--	2.3	--
	Cobalt ²	0.5	--	0.7	0.7	--	0.7	0.7	--	0.7	--
	Lead	2.8	--	3.5	4.6	--	3.6	3.2	--	4.2	--
	Mercury	31.3	--	9.7	10.4	--	12.8	17.2	--	10.2	--
	Vanadium	5.4	--	11.6	12.2	--	11.4	9.0	--	11.1	--
Spotted Sandpiper - 1	tPCB-mid	--	10.4	--	--	2.8	--	--	2.3	--	2.4
	tPCB-high	--	112.4	--	--	30.0	--	--	25.3	--	25.7
	Barium ²	--	1.1	--	--	1.8	--	--	1.5	--	1.8
	Chromium	--	1.3	--	--	2.5	--	--	1.7	--	2.5
	Cobalt ²	--	0.3	--	--	0.7	--	--	0.7	--	0.7
	Lead	--	4.2	--	--	6.2	--	--	5.0	--	6.2
	Mercury	--	24.2	--	--	12.5	--	--	16.1	--	12.7
	Vanadium	--	6.3	--	--	10.2	--	--	9.7	--	10.2
Aquatic+Terrestrial Mammals											
Mink - 1	tPCB-mink	--	27.2	--	--	6.0	--	--	2.4	--	5.5
	Barium ²	--	0.1	--	--	0.3	--	--	0.2	--	0.3
	Chromium	--	0.2	--	--	0.6	--	--	0.5	--	0.6
	Cobalt ²	--	0.1	--	--	0.1	--	--	0.1	--	0.1
	Lead	--	0.1	--	--	0.1	--	--	0.1	--	0.1
	Mercury	--	0.3	--	--	0.2	--	--	0.2	--	0.2
	Vanadium	--	0.0	--	--	0.1	--	--	0.1	--	0.1
Raccoon - 1	tPCB	0.0	3.0	0.4	0.4	0.7	0.3	0.5	0.5	0.0	0.6
	Barium ²	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1
	Chromium	0.0	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.0	0.2
	Cobalt ²	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.1
	Mercury	0.0	0.5	0.2	0.2	0.3	0.3	0.5	0.3	0.0	0.3
	Vanadium	0.0	0.0	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0
Raccoon - 2	tPCB	--	4.4	--	--	0.9	--	--	0.3	--	0.8
	Barium ²	--	0.1	--	--	0.2	--	--	0.2	--	0.2
	Chromium	--	0.1	--	--	0.3	--	--	0.3	--	0.3
	Cobalt ²	--	0.1	--	--	0.1	--	--	0.1	--	0.1
	Lead	--	0.1	--	--	0.2	--	--	0.2	--	0.2
	Mercury	--	0.4	--	--	0.1	--	--	0.1	--	0.1
	Vanadium	--	0.0	--	--	0.1	--	--	0.1	--	0.1

Table AD-14. Summary of NOAEL Hazard Quotients by Exposure Unit for Receptors Exposed to Terrestrial + Aquatic Media (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C7	C7	C7	C8	C8	C8	C9	C9	C9	C10 ¹	Lower AA	Lower AA
Exposure Subarea→		North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	Riparian Soil & Sediment	Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment
Receptors↓		NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ
Aquatic+Terrestrial Birds													
Carolina Wren - 2	tPCB-mid	0.9	1.2	--	1.6	1.3	--	0.8	0.2	--	--	1.1	--
	tPCB-high	9.9	13.0	--	17.0	13.8	--	9.0	2.4	--	--	12.1	--
	Barium ²	0.6	0.5	--	0.5	0.6	--	0.6	0.8	--	--	0.8	--
	Chromium	1.3	1.4	--	1.3	1.2	--	1.3	1.3	--	--	1.5	--
	Cobalt ²	0.6	0.5	--	0.5	0.5	--	0.5	0.5	--	--	0.5	--
	Lead	1.8	1.2	--	1.4	1.5	--	1.5	1.6	--	--	1.7	--
	Mercury	9.1	13.9	--	25.3	10.0	--	13.6	9.1	--	--	11.8	--
	Vanadium	6.1	6.2	--	5.0	6.0	--	4.6	7.1	--	--	7.0	--
Spotted Sandpiper - 1	tPCB-mid	--	--	2.5	--	--	2.1	--	--	2.0	1.7	--	1.8
	tPCB-high	--	--	26.5	--	--	23.1	--	--	22.1	18.3	--	18.9
	Barium ²	--	--	0.6	--	--	0.7	--	--	0.7	1.0	--	0.9
	Chromium	--	--	1.3	--	--	1.1	--	--	0.9	1.2	--	1.2
	Cobalt ²	--	--	0.2	--	--	0.2	--	--	0.2	0.3	--	0.3
	Lead	--	--	2.0	--	--	1.9	--	--	2.0	2.6	--	2.4
	Mercury	--	--	22.0	--	--	31.5	--	--	14.5	27.0	--	27.3
	Vanadium	--	--	4.4	--	--	7.1	--	--	4.6	7.8	--	7.3
Aquatic+Terrestrial Mammals													
Mink - 1	tPCB-mink	--	--	5.7	--	--	6.1	--	--	2.6	4.7	--	6.4
	Barium ²	--	--	0.0	--	--	0.0	--	--	0.1	0.1	--	0.1
	Chromium	--	--	0.2	--	--	0.2	--	--	0.2	0.3	--	0.3
	Cobalt ²	--	--	0.1	--	--	0.1	--	--	0.1	0.1	--	0.1
	Lead	--	--	0.0	--	--	0.0	--	--	0.0	0.0	--	0.0
	Mercury	--	--	0.3	--	--	0.3	--	--	0.2	0.3	--	0.3
	Vanadium	--	--	0.0	--	--	0.0	--	--	0.1	0.1	--	0.1
Raccoon - 1	tPCB	0.2	0.3	0.6	0.4	0.3	0.5	0.3	0.1	0.4	0.4	0.0	0.5
	Barium ²	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1
	Chromium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1
	Cobalt ²	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mercury	0.1	0.3	0.5	0.7	0.2	0.7	0.3	0.1	0.3	0.6	0.0	0.6
	Vanadium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Raccoon - 2	tPCB	--	--	0.9	--	--	1.1	--	--	0.3	0.8	--	1.1
	Barium ²	--	--	0.0	--	--	0.0	--	--	0.1	0.1	--	0.1
	Chromium	--	--	0.1	--	--	0.1	--	--	0.1	0.2	--	0.1
	Cobalt ²	--	--	0.0	--	--	0.0	--	--	0.1	0.1	--	0.1
	Lead	--	--	0.0	--	--	0.0	--	--	0.1	0.1	--	0.1
	Mercury	--	--	0.2	--	--	0.2	--	--	0.2	0.2	--	0.2
	Vanadium	--	--	0.0	--	--	0.0	--	--	0.0	0.0	--	0.0

Table AD-14. Summary of NOAEL Hazard Quotients by Exposure Unit for Receptors Exposed to Terrestrial + Aquatic Media (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Notes:

NOAEL HQ* ≤ 1
NOAEL HQ* > 1 and ≤ 10
NOAEL HQ* > 10

* All HQs rounded to the nearest whole number

¹ Riparian soil in reaches C1 and C10 is based on the applicable assessment area (i.e., Upper for C1 and Lower for C10). Reach C10 was not evaluated for terrestrial receptors due to lack of floodplain soil

² Barium and cobalt are COPCs in sediment only. Soil exposures were estimated for these metals so that the complete aquatic + terrestrial dose could be estimated.

AA: assessment area

COPCs: constituent of potential concern

HQ: hazard quotient

mg/kg-day: milligrams per kilogram per day

NOAEL: no observed adverse effect level

tPCB: total polychlorinated biphenyl

TRV: toxicity reference value

--: not available

Exposure Units:

C1: Oxford Lake Park

C2: Backwater Area

C3: Friendship Road to Highway 21

C4: Hwy 21 to Silver Run Road

C5: Silver Run Road to Mitchell Matson Road

C6: Mitchell Matson Road to 2,000 feet upstream of Curry Station Road

C7: Upstream of Curry Station Road to Eastaboga Creek

C8: Eastaboga Creek to Jackson Shoals Dam

C9: Jackson Shoals Dam to Highway 77

C10: Highway 77 Bridge to Lake Logan Martin

Exposure Subareas:

East: East Subarea Floodplain Soil

West: West Subarea Floodplain Soil

North: North Subarea Floodplain Soil

South: South Subarea Floodplain Soil

Central: Central Subarea Floodplain Soil

Table AD-15. Summary of LOAEL Hazard Quotients by Exposure Unit for Aquatic and Terrestrial Mixed Diet Receptors (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1 ¹	C1 ¹	C1 ¹	C2	C2	C2	C2	C3	C3	C3	C4	C4	C4	Upper AA
Exposure Subarea→		East Floodplain Soil, Riparian Soil & Sediment	West Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Central Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	Floodplain Soil, Riparian Soil & Sediment
Receptors↓		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Aquatic+Terrestrial Birds															
Carolina Wren - 2	tPCB-mid	6.0	37.3	--	3.5	2.6	2.9	--	2.4	4.8	--	2.1	1.6	--	2.6
	tPCB-high	64.5	401.7	--	37.3	28.4	30.8	--	26.0	51.5	--	22.6	17.2	--	27.6
	Barium ³	--	--	--	0.5	0.6	0.6	--	0.4	0.5	--	0.4	0.3	--	0.4
	Chromium	--	--	--	1.6	1.0	1.0	--	1.3	2.2	--	1.8	1.4	--	1.4
	Cobalt ³	--	--	--	0.5	0.5	0.5	--	0.5	0.6	--	0.5	0.5	--	0.5
	Lead	--	--	--	1.5	1.4	1.8	--	1.0	2.2	--	1.4	1.1	--	1.4
	Mercury	--	--	--	43.4	41.7	41.8	--	6.4	6.7	--	5.3	5.5	--	10.4
	Vanadium	--	--	--	3.0	3.0	2.7	--	3.0	3.4	--	2.5	2.4	--	2.7
Spotted Sandpiper - 1	tPCB-mid	--	--	4.5	--	--	--	10.7	--	--	7.5	--	--	3.2	--
	tPCB-high	--	--	48.2	--	--	--	115.6	--	--	80.7	--	--	34.6	--
	Barium ³	--	--	0.8	--	--	--	0.7	--	--	0.4	--	--	0.5	--
	Chromium	--	--	1.7	--	--	--	0.7	--	--	0.9	--	--	1.9	--
	Cobalt ³	--	--	0.5	--	--	--	0.3	--	--	0.3	--	--	0.2	--
	Lead	--	--	4.2	--	--	--	2.4	--	--	1.2	--	--	2.4	--
	Mercury	--	--	6.8	--	--	--	9.5	--	--	13.0	--	--	8.6	--
	Vanadium	--	--	6.2	--	--	--	3.4	--	--	3.0	--	--	2.9	--
Aquatic+Terrestrial Mammals															
Mink - 1	tPCB-mink	--	--	48.4	--	--	--	32.1	--	--	5.8	--	--	8.7	--
Mink - 1 (Alternate TRV) ²	tPCB-mink	--	--	96.8	--	--	--	64.2	--	--	11.5	--	--	17.3	--
	Barium ³	--	--	0.1	--	--	--	0.1	--	--	0.0	--	--	0.0	--
	Chromium	--	--	0.4	--	--	--	0.1	--	--	0.2	--	--	0.2	--
	Cobalt ³	--	--	0.1	--	--	--	0.1	--	--	0.1	--	--	0.1	--
	Lead	--	--	0.1	--	--	--	0.0	--	--	0.0	--	--	0.0	--
	Mercury	--	--	0.1	--	--	--	0.5	--	--	0.1	--	--	0.1	--
	Vanadium	--	--	0.0	--	--	--	0.0	--	--	0.0	--	--	0.0	--
Raccoon - 1	tPCB	0.0	0.0	2.3	1.3	1.1	1.1	2.8	0.8	1.6	1.5	0.7	0.6	0.8	0.0
	Barium ³	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Chromium	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.2	0.1	0.2	0.0
	Cobalt ³	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0
	Mercury	0.0	0.0	0.2	0.2	0.1	0.1	0.1	0.3	0.3	0.4	0.2	0.2	0.3	0.0
	Vanadium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Raccoon - 2	tPCB	--	--	5.5	--	--	--	3.5	--	--	0.5	--	--	0.9	--
	Barium ³	--	--	0.1	--	--	--	0.1	--	--	0.0	--	--	0.0	--
	Chromium	--	--	0.2	--	--	--	0.1	--	--	0.1	--	--	0.1	--
	Cobalt ³	--	--	0.1	--	--	--	0.0	--	--	0.0	--	--	0.0	--
	Lead	--	--	0.1	--	--	--	0.1	--	--	0.0	--	--	0.0	--
	Mercury	--	--	0.0	--	--	--	1.2	--	--	0.1	--	--	0.1	--
	Vanadium	--	--	0.1	--	--	--	0.0	--	--	0.0	--	--	0.0	--

Table AD-15. Summary of LOAEL Hazard Quotients by Exposure Unit for Aquatic and Terrestrial Mixed Diet Receptors (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		Upper AA	C5	C5	C5	C6	C6	C6	Middle AA	Middle AA	C7	C7	C7	C8	C8	C8
Exposure Subarea→		Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment
Receptors↓		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Aquatic+Terrestrial Birds																
Carolina Wren - 2	tPCB-mid	--	0.3	0.4	--	0.3	0.4	--	0.4	--	0.3	0.4	--	0.5	0.4	--
	tPCB-high	--	3.6	4.3	--	3.1	4.7	--	4.1	--	3.3	4.3	--	5.7	4.6	--
	Barium ³	--	0.7	0.7	--	0.7	0.7	--	0.7	--	0.3	0.2	--	0.3	0.3	--
	Chromium	--	2.2	2.4	--	2.2	2.0	--	2.2	--	1.2	1.4	--	1.2	1.1	--
	Cobalt ³	--	0.7	0.7	--	0.7	0.7	--	0.7	--	0.6	0.5	--	0.5	0.5	--
	Lead	--	1.7	2.3	--	1.8	1.6	--	2.1	--	0.9	0.6	--	0.7	0.7	--
	Mercury	--	3.2	3.5	--	4.3	5.7	--	3.4	--	3.0	4.6	--	8.4	3.3	--
	Vanadium	--	5.7	6.0	--	5.6	4.4	--	5.4	--	3.0	3.1	--	2.5	2.9	--
Spotted Sandpiper - 1	tPCB-mid	3.5	--	--	0.9	--	--	0.8	--	0.8	--	--	0.8	--	--	0.7
	tPCB-high	37.5	--	--	10.0	--	--	8.4	--	8.6	--	--	8.8	--	--	7.7
	Barium ³	0.6	--	--	0.9	--	--	0.7	--	0.9	--	--	0.3	--	--	0.4
	Chromium	1.2	--	--	2.4	--	--	1.6	--	2.4	--	--	1.2	--	--	1.1
	Cobalt ³	0.2	--	--	0.7	--	--	0.6	--	0.7	--	--	0.2	--	--	0.2
	Lead	2.1	--	--	3.1	--	--	2.5	--	3.1	--	--	1.0	--	--	0.9
	Mercury	8.1	--	--	4.2	--	--	5.4	--	4.2	--	--	7.3	--	--	10.5
	Vanadium	3.1	--	--	5.0	--	--	4.7	--	5.0	--	--	2.2	--	--	3.5
Aquatic+Terrestrial Mammals																
Mink - 1	tPCB-mink	13.6	--	--	3.0	--	--	1.2	--	2.8	--	--	2.8	--	--	3.1
Mink - 1 (Alternate TRV) ²	tPCB-mink	27.2	--	--	6.0	--	--	2.4	--	5.5	--	--	5.7	--	--	6.1
	Barium ³	0.0	--	--	0.1	--	--	0.1	--	0.1	--	--	0.0	--	--	0.0
	Chromium	0.2	--	--	0.5	--	--	0.4	--	0.5	--	--	0.2	--	--	0.2
	Cobalt ³	0.1	--	--	0.1	--	--	0.1	--	0.1	--	--	0.1	--	--	0.1
	Lead	0.0	--	--	0.1	--	--	0.1	--	0.1	--	--	0.0	--	--	0.0
	Mercury	0.2	--	--	0.1	--	--	0.1	--	0.1	--	--	0.1	--	--	0.2
	Vanadium	0.0	--	--	0.0	--	--	0.0	--	0.0	--	--	0.0	--	--	0.0
Raccoon - 1	tPCB	1.0	0.1	0.1	0.2	0.1	0.2	0.2	0.0	0.2	0.1	0.1	0.2	0.1	0.1	0.2
	Barium ³	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
	Chromium	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.0	0.2	0.1	0.1	0.1	0.1	0.1	0.1
	Cobalt ³	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mercury	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.0	0.1	0.1	0.2	0.2	0.4	0.1	0.4
	Vanadium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Raccoon - 2	tPCB	1.5	--	--	0.3	--	--	0.1	--	0.3	--	--	0.3	--	--	0.4
	Barium ³	0.0	--	--	0.1	--	--	0.1	--	0.1	--	--	0.0	--	--	0.0
	Chromium	0.1	--	--	0.3	--	--	0.3	--	0.3	--	--	0.1	--	--	0.1
	Cobalt ³	0.0	--	--	0.1	--	--	0.1	--	0.1	--	--	0.0	--	--	0.0
	Lead	0.0	--	--	0.1	--	--	0.1	--	0.1	--	--	0.0	--	--	0.0
	Mercury	0.2	--	--	0.1	--	--	0.1	--	0.1	--	--	0.1	--	--	0.1
	Vanadium	0.0	--	--	0.0	--	--	0.0	--	0.0	--	--	0.0	--	--	0.0

Table AD-15. Summary of LOAEL Hazard Quotients by Exposure Unit for Aquatic and Terrestrial Mixed Diet Receptors (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C9	C9	C9	C10 ¹	Lower AA	Lower AA
Exposure Subarea→		North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	Riparian Soil & Sediment	Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment
Receptors↓		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Aquatic+Terrestrial Birds							
Carolina Wren - 2	tPCB-mid	0.3	0.1	--	--	0.4	--
	tPCB-high	3.0	0.8	--	--	4.0	--
	Barium ³	0.3	0.4	--	--	0.4	--
	Chromium	1.3	1.3	--	--	1.4	--
	Cobalt ³	0.5	0.5	--	--	0.5	--
	Lead	0.7	0.8	--	--	0.9	--
	Mercury	4.5	3.0	--	--	3.9	--
	Vanadium	2.3	3.5	--	--	3.4	--
Spotted Sandpiper - 1	tPCB-mid	--	--	0.7	0.6	--	0.6
	tPCB-high	--	--	7.4	6.1	--	6.3
	Barium ³	--	--	0.3	0.5	--	0.4
	Chromium	--	--	0.9	1.2	--	1.1
	Cobalt ³	--	--	0.2	0.3	--	0.3
	Lead	--	--	1.0	1.3	--	1.2
	Mercury	--	--	4.8	9.0	--	9.1
	Vanadium	--	--	2.3	3.9	--	3.6
Aquatic+Terrestrial Mammals							
Mink - 1	tPCB-mink	--	--	1.3	2.3	--	3.2
Mink - 1 (Alternate TRV) ²	tPCB-mink	--	--	2.6	4.7	--	6.4
	Barium ³	--	--	0.0	0.0	--	0.0
	Chromium	--	--	0.2	0.3	--	0.2
	Cobalt ³	--	--	0.1	0.1	--	0.1
	Lead	--	--	0.0	0.0	--	0.0
	Mercury	--	--	0.1	0.2	--	0.2
	Vanadium	--	--	0.0	0.0	--	0.0
Raccoon - 1	tPCB	0.1	0.0	0.1	0.1	0.0	0.2
	Barium ³	0.0	0.0	0.0	0.0	0.0	0.0
	Chromium	0.1	0.1	0.1	0.1	0.0	0.1
	Cobalt ³	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.0	0.0	0.0	0.0	0.0	0.0
	Mercury	0.2	0.1	0.2	0.3	0.0	0.3
	Vanadium	0.0	0.0	0.0	0.0	0.0	0.0
Raccoon - 2	tPCB	--	--	0.1	0.3	--	0.4
	Barium ³	--	--	0.0	0.0	--	0.0
	Chromium	--	--	0.1	0.1	--	0.1
	Cobalt ³	--	--	0.0	0.0	--	0.0
	Lead	--	--	0.0	0.0	--	0.0
	Mercury	--	--	0.1	0.1	--	0.1
	Vanadium	--	--	0.0	0.0	--	0.0

Table AD-15. Summary of LOAEL Hazard Quotients by Exposure Unit for Aquatic and Terrestrial Mixed Diet Receptors (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Notes:

NOAEL HQ* ≤ 1
LOAEL HQ* ≤ 1
LOAEL HQ* > 1 and ≤ 10
LOAEL HQ* > 10

* All HQs rounded to the nearest whole number

¹ Riparian soil in reaches C1 and C10 is based on the applicable assessment area (i.e., Upper for C1 and Lower for C10). Reach C10 was not evaluated for terrestrial receptors due to lack of floodplain soil.

² Alternate TRVs were selected from Restum et al. (1998) based on growth. The LOAEL TRV is 0.05 mg/kg-day.

³ Barium and cobalt are COPCs in sediment only. Soil exposures were estimated for these metals so that the complete aquatic + terrestrial dose could be estimated.

AA: assessment area

COPCs: constituent of potential concern

HQ: hazard quotient

mg/kg-day: milligrams per kilogram per day

NOAEL: no observed adverse effect level

tPCB: total polychlorinated biphenyl

TRV: toxicity reference value

--: not available

Exposure Units:

C1: Oxford Lake Park

C2: Backwater Area

C3: Friendship Road to Highway 21

C4: Hwy 21 to Silver Run Road

C5: Silver Run Road to Mitchell Matson Road

C6: Mitchell Matson Road to 2,000 feet upstream of Curry Station Road

C7: Upstream of Curry Station Road to Eastaboga Creek

C8: Eastaboga Creek to Jackson Shoals Dam

C9: Jackson Shoals Dam to Highway 77

C10: Highway 77 Bridge to Lake Logan Martin

Exposure Subareas:

East: East Subarea Floodplain Soil

West: West Subarea Floodplain Soil

North: North Subarea Floodplain Soil

South: South Subarea Floodplain Soil

Central: Central Subarea Floodplain Soil

References:

Restum, J., S. Bursian, J. Giesy, J. Render, W. Helferich, E. Shipp, D. Verbrugge, and R. Aulerich. 1998. Multigenerational study of the effects of consumption of PCB-contaminated carp from Saginaw Bay, Lake Huron, on mink: 1. Effects on mink reproduction, kit growth, and survival, and selected biological parameters. J. Toxicol. Environ. Health Part A 54: 343 375.

Table AD-16. Summary of Terrestrial and Aquatic Bird Egg Tissue NOAEL Hazard Quotients by Exposure Unit
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1 ¹	C1 ¹	C1 ¹	C2	C2	C2	C2	C3	C3	C3	C4	C4	C4	Upper AA	Upper AA	C5	C5
Exposure Subarea→		East	West	Riparian/ Aquatic	North	South	Central	Riparian/ Aquatic	North	South	Riparian/ Aquatic	North	South	Riparian/ Aquatic	Soil Combined	Riparian/ Aquatic	North	South
Receptors↓		NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ
Terrestrial Birds																		
Mourning Dove - mid	tPCB-med	0.2	3.2	--	0.1	0.0	0.0	--	0.2	0.4	--	0.1	0.1	--	0.1	--	0.0	0.0
Mourning Dove - high	tPCB-high	2.4	42.2	--	1.2	0.1	0.4	--	2.8	5.8	--	2.0	1.3	--	2.0	--	0.2	0.3
	Mercury	--	--	--	0.0	0.0	0.0	--	0.1	0.1	--	0.1	0.1	--	0.1	--	0.0	0.0
Blue Jay - mid	tPCB-med	0.2	4.2	--	0.1	0.0	0.0	--	0.3	0.6	--	0.2	0.1	--	0.2	--	0.0	0.0
Blue Jay - high	tPCB-high	3.1	55.6	--	1.5	0.1	0.5	--	3.7	7.6	--	2.5	1.7	--	2.6	--	0.3	0.4
	Mercury	--	--	--	0.1	0.0	0.0	--	0.1	0.1	--	0.1	0.1	--	0.1	--	0.0	0.0
Carolina Wren - 1 - mid	tPCB-med	0.2	3.5	--	0.1	0.0	0.0	--	0.2	0.5	--	0.2	0.1	--	0.2	--	0.0	0.0
Carolina Wren - 1 - high	tPCB-high	2.5	46.4	--	1.2	0.1	0.4	--	3.0	6.3	--	2.1	1.4	--	2.1	--	0.2	0.3
	Mercury	--	--	--	0.0	0.0	0.0	--	0.1	0.1	--	0.1	0.1	--	0.1	--	0.0	0.0
Carolina Wren - 2 - mid	tPCB-med	0.2	1.5	--	0.1	0.1	0.1	--	0.1	0.2	--	0.1	0.1	--	0.1	--	0.0	0.0
Carolina Wren - 2 - high	tPCB-high	3.2	19.9	--	1.8	1.4	1.5	--	1.3	2.6	--	1.1	0.9	--	1.4	--	0.2	0.2
	Mercury	--	--	--	0.4	0.4	0.4	--	0.1	0.1	--	0.1	0.1	--	0.1	--	0.0	0.0
Hawk - mid	tPCB-med	22.8	27.5	--	14.3	13.8	14.0	--	2.5	3.1	--	4.2	4.0	--	6.5	--	1.1	1.1
Hawk - high	tPCB-high	304.6	367.1	--	190.1	183.7	186.2	--	33.8	41.4	--	55.4	53.1	--	86.0	--	14.5	15.2
	Mercury	--	--	--	1.3	1.2	1.2	--	0.3	0.3	--	0.2	0.2	--	0.4	--	0.2	0.2
Aquatic Birds																		
Tree Swallow	tPCB-med	--	--	2.3	--	--	--	1.4	--	--	0.2	--	--	0.4	--	0.6	--	--
	tPCB-high	--	--	31.0	--	--	--	19.3	--	--	2.1	--	--	4.7	--	7.9	--	--
	Mercury	--	--	0.0	--	--	--	0.3	--	--	0.0	--	--	0.0	--	0.1	--	--
Spotted Sandpiper - 1	tPCB-med	--	--	0.4	--	--	--	0.9	--	--	0.6	--	--	0.3	--	0.3	--	--
	tPCB-high	--	--	5.1	--	--	--	12.3	--	--	8.6	--	--	3.7	--	4.0	--	--
	Mercury	--	--	0.1	--	--	--	0.2	--	--	0.3	--	--	0.2	--	0.2	--	--
Spotted Sandpiper - 2	tPCB-med	--	--	1.9	--	--	--	1.4	--	--	0.3	--	--	0.5	--	0.8	--	--
	tPCB-high	--	--	24.7	--	--	--	18.2	--	--	4.4	--	--	7.3	--	10.2	--	--
	Mercury	--	--	0.0	--	--	--	1.1	--	--	0.0	--	--	0.0	--	0.2	--	--
Kingfisher - 1	tPCB-med	--	--	8.9	--	--	--	5.5	--	--	0.6	--	--	1.3	--	2.3	--	--
	tPCB-high	--	--	118.3	--	--	--	73.7	--	--	8.1	--	--	17.9	--	30.3	--	--
	Mercury	--	--	0.0	--	--	--	0.7	--	--	0.0	--	--	0.0	--	0.1	--	--
Kingfisher - 2	tPCB-med	--	--	7.2	--	--	--	4.5	--	--	0.5	--	--	1.1	--	1.8	--	--
	tPCB-high	--	--	95.6	--	--	--	59.5	--	--	6.6	--	--	14.5	--	24.5	--	--
	Mercury	--	--	0.0	--	--	--	0.6	--	--	0.0	--	--	0.0	--	0.1	--	--
Great Blue Heron	tPCB-med	--	--	196.9	--	--	--	122.7	--	--	13.6	--	--	29.9	--	50.4	--	--
	tPCB-high	--	--	2625.5	--	--	--	1635.5	--	--	180.9	--	--	398.1	--	672.4	--	--
	Mercury	--	--	0.5	--	--	--	21.9	--	--	0.8	--	--	0.8	--	3.7	--	--
Osprey	tPCB-med	--	--	57.4	--	--	--	35.7	--	--	3.9	--	--	8.7	--	14.7	--	--
	tPCB-high	--	--	765.3	--	--	--	476.5	--	--	52.5	--	--	115.9	--	195.9	--	--
	Mercury	--	--	0.1	--	--	--	5.9	--	--	0.2	--	--	0.2	--	1.0	--	--

Table AD-16. Summary of Terrestrial and Aquatic Bird Egg Tissue NOAEL Hazard Quotients by Exposure Unit
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C5	C6	C6	C6	Middle AA	Middle AA	C7	C7	C7	C8	C8	C8	C9	C9	C9	C10 ¹	Lower AA	Lower AA
Exposure Subarea→		Riparian/ Aquatic	North	South	Riparian/ Aquatic	Soil Combined	Riparian/ Aquatic	North	South	Riparian/ Aquatic	North	South	Riparian/ Aquatic	North	South	Riparian/ Aquatic	Riparian/ Aquatic	Soil Combined	Riparian/ Aquatic
Receptors↓		NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ
Terrestrial Birds																			
Mourning Dove - mid	tPCB-med	--	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	--	0.0	--
Mourning Dove - high	tPCB-high	--	0.4	0.6	--	0.3	--	0.2	0.3	--	0.4	0.3	--	0.4	0.1	--	--	0.2	--
	Mercury	--	0.0	0.1	--	0.0	--	0.0	0.0	--	0.1	0.0	--	0.0	0.0	--	--	0.0	--
Blue Jay - mid	tPCB-med	--	0.0	0.1	--	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	--	0.0	--
Blue Jay - high	tPCB-high	--	0.5	0.7	--	0.4	--	0.2	0.4	--	0.5	0.4	--	0.4	0.1	--	--	0.2	--
	Mercury	--	0.1	0.1	--	0.0	--	0.0	0.1	--	0.2	0.0	--	0.1	0.0	--	--	0.0	--
Carolina Wren - 1 - mid	tPCB-med	--	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	--	0.0	--
Carolina Wren - 1 - high	tPCB-high	--	0.4	0.6	--	0.3	--	0.1	0.3	--	0.4	0.3	--	0.3	0.1	--	--	0.2	--
	Mercury	--	0.1	0.1	--	0.0	--	0.0	0.1	--	0.1	0.0	--	0.1	0.0	--	--	0.0	--
Carolina Wren - 2 - mid	tPCB-med	--	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	--	0.0	--
Carolina Wren - 2 - high	tPCB-high	--	0.2	0.2	--	0.2	--	0.2	0.2	--	0.3	0.2	--	0.1	0.0	--	--	0.2	--
	Mercury	--	0.0	0.1	--	0.0	--	0.0	0.0	--	0.1	0.0	--	0.0	0.0	--	--	0.0	--
Hawk - mid	tPCB-med	--	0.5	0.6	--	1.1	--	0.6	0.6	--	0.8	0.7	--	0.4	0.2	--	--	0.7	--
Hawk - high	tPCB-high	--	6.7	7.8	--	14.2	--	7.5	8.6	--	10.1	9.2	--	5.5	3.1	--	--	8.9	--
	Mercury	--	0.2	0.3	--	0.2	--	0.2	0.3	--	0.6	0.2	--	0.3	0.2	--	--	0.2	--
Aquatic Birds																			
Tree Swallow	tPCB-mid	0.0	--	--	0.0	--	0.0	--	--	0.0	--	--	0.0	--	--	0.0	0.0	--	0.0
	tPCB-high	0.0	--	--	0.0	--	0.0	--	--	0.0	--	--	0.1	--	--	0.0	0.0	--	0.1
	Mercury	0.0	--	--	0.0	--	0.0	--	--	0.0	--	--	0.0	--	--	0.0	0.0	--	0.0
Spotted Sandpiper - 1	tPCB-mid	0.1	--	--	0.1	--	0.1	--	--	0.1	--	--	0.1	--	--	0.1	0.0	--	0.1
	tPCB-high	1.1	--	--	0.9	--	0.9	--	--	0.9	--	--	0.8	--	--	0.8	0.7	--	0.7
	Mercury	0.1	--	--	0.1	--	0.1	--	--	0.2	--	--	0.2	--	--	0.1	0.2	--	0.2
Spotted Sandpiper - 2	tPCB-mid	0.3	--	--	0.1	--	0.3	--	--	0.3	--	--	0.3	--	--	0.1	0.3	--	0.3
	tPCB-high	3.7	--	--	1.3	--	3.5	--	--	3.8	--	--	4.2	--	--	1.7	3.4	--	4.4
	Mercury	0.0	--	--	0.0	--	0.0	--	--	0.0	--	--	0.0	--	--	0.0	0.0	--	0.0
Kingfisher - 1	tPCB-mid	0.6	--	--	0.1	--	0.6	--	--	0.6	--	--	0.7	--	--	0.2	0.5	--	0.7
	tPCB-high	8.1	--	--	1.6	--	7.4	--	--	7.7	--	--	8.8	--	--	2.2	6.3	--	9.5
	Mercury	0.1	--	--	0.1	--	0.1	--	--	0.1	--	--	0.1	--	--	0.1	0.1	--	0.1
Kingfisher - 2	tPCB-mid	0.5	--	--	0.1	--	0.4	--	--	0.4	--	--	0.5	--	--	0.1	0.4	--	0.6
	tPCB-high	6.3	--	--	1.3	--	5.8	--	--	5.9	--	--	6.8	--	--	1.7	4.9	--	7.4
	Mercury	0.1	--	--	0.1	--	0.1	--	--	0.1	--	--	0.1	--	--	0.1	0.1	--	0.1
Great Blue Heron	tPCB-mid	10.7	--	--	2.2	--	9.9	--	--	11.0	--	--	12.5	--	--	3.1	9.0	--	13.6
	tPCB-high	143.2	--	--	29.3	--	131.4	--	--	146.8	--	--	166.9	--	--	41.7	120.4	--	181.6
	Mercury	1.2	--	--	1.2	--	1.2	--	--	1.4	--	--	1.4	--	--	1.4	1.4	--	1.8
Osprey	tPCB-mid	3.2	--	--	0.6	--	2.9	--	--	3.2	--	--	3.7	--	--	0.9	2.7	--	4.0
	tPCB-high	42.2	--	--	8.6	--	38.7	--	--	43.3	--	--	49.2	--	--	12.2	35.5	--	53.6
	Mercury	0.3	--	--	0.3	--	0.3	--	--	0.4	--	--	0.4	--	--	0.4	0.4	--	0.5

Table AD-16. Summary of Terrestrial and Aquatic Bird Egg Tissue NOAEL Hazard Quotients by Exposure Unit
Anniston PCB Site, Anniston, Alabama

Notes:

NOAEL HQ* ≤ 1
NOAEL HQ* > 1 and ≤ 10
NOAEL HQ* > 10

* All HQs rounded to the nearest whole number

¹ Riparian soil in reaches C1 and C10 is based on the applicable assessment area (i.e., Upper for C1 and Lower for C10). Reach C10 was not evaluated for terrestrial receptors due to lack of floodplain soil.

HQ: hazard quotient

NOAEL: no observed adverse effect level

tPCB: total polychlorinated biphenyl

TRV: toxicity reference value

--: not available

Exposure Units:

C1: Oxford Lake Park

C2: Backwater Area

C3: Friendship Road to Highway 21

C4: Hwy 21 to Silver Run Road

C5: Silver Run Road to Mitchell Matson Road

C6: Mitchell Matson Road to 2,000 feet upstream of Curry Station Road

C7: Upstream of Curry Station Road to Eastaboga Creek

C8: Eastaboga Creek to Jackson Shoals Dam

C9: Jackson Shoals Dam to Highway 77

C10: Highway 77 Bridge to Lake Logan Martin

Exposure Subareas:

East: East Subarea Floodplain Soil

West: West Subarea Floodplain Soil

North: North Subarea Floodplain Soil

South: South Subarea Floodplain Soil

Central: Central Subarea Floodplain Soil

Table AD-17. Summary of Terrestrial and Aquatic Bird Egg Tissue LOAEL Hazard Quotients by Exposure Unit
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1 ¹	C1 ¹	C1 ¹	C2	C2	C2	C2	C3	C3	C3	C4	C4	C4	Upper	Upper	C5	C5	C5
Exposure Subarea→		East	West	Riparian/ Aquatic	North	South	Central	Riparian/ Aquatic	North	South	Riparian/ Aquatic	North	South	Riparian/ Aquatic	Soil Combined	Riparian/ Aquatic	North	South	Riparian/ Aquatic
Receptors↓		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Terrestrial Birds																			
Mourning Dove - mid	tPCB-med	0.1	1.3	--	0.0	0.0	0.0	--	0.1	0.2	--	0.1	0.0	--	0.1	--	0.0	0.0	--
Mourning Dove - high	tPCB-high	1.1	19.7	--	0.5	0.1	0.2	--	1.3	2.7	--	0.9	0.6	--	0.9	--	0.1	0.2	--
	Mercury	--	--	--	0.0	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	--	0.0	0.0	--
Blue Jay - mid	tPCB-med	0.1	1.8	--	0.0	0.0	0.0	--	0.1	0.2	--	0.1	0.1	--	0.1	--	0.0	0.0	--
Blue Jay - high	tPCB-high	1.4	25.9	--	0.7	0.1	0.2	--	1.7	3.6	--	1.2	0.8	--	1.2	--	0.1	0.2	--
	Mercury	--	--	--	0.0	0.0	0.0	--	0.1	0.1	--	0.0	0.0	--	0.0	--	0.0	0.0	--
Carolina Wren - 1 - mid	tPCB-med	0.1	1.5	--	0.0	0.0	0.0	--	0.1	0.2	--	0.1	0.0	--	0.1	--	0.0	0.0	--
Carolina Wren - 1 - high	tPCB-high	1.2	21.7	--	0.6	0.0	0.2	--	1.4	3.0	--	1.0	0.6	--	1.0	--	0.1	0.1	--
	Mercury	--	--	--	0.0	0.0	0.0	--	0.1	0.1	--	0.0	0.0	--	0.0	--	0.0	0.0	--
Carolina Wren - 2 - mid	tPCB-med	0.1	0.6	--	0.1	0.0	0.0	--	0.0	0.1	--	0.0	0.0	--	0.0	--	0.0	0.0	--
Carolina Wren - 2 - high	tPCB-high	1.5	9.3	--	0.9	0.7	0.7	--	0.6	1.2	--	0.5	0.4	--	0.6	--	0.1	0.1	--
	Mercury	--	--	--	0.2	0.2	0.2	--	0.0	0.0	--	0.0	0.0	--	0.1	--	0.0	0.0	--
Hawk - mid	tPCB-med	9.7	11.7	--	6.0	5.8	5.9	--	1.1	1.3	--	1.8	1.7	--	2.7	--	0.5	0.5	--
Hawk - high	tPCB-high	142.2	171.3	--	88.7	85.7	86.9	--	15.8	19.3	--	25.8	24.8	--	40.1	--	6.8	7.1	--
	Mercury	--	--	--	0.7	0.7	0.7	--	0.1	0.1	--	0.1	0.1	--	0.2	--	0.1	0.1	--
Aquatic Birds																			
Tree Swallow	tPCB-mid	--	--	1.0	--	--	--	0.6	--	--	0.1	--	--	0.1	--	0.3	--	--	0.0
	tPCB-high	--	--	14.4	--	--	--	9.0	--	--	1.0	--	--	2.2	--	3.7	--	--	0.0
	Mercury	--	--	0.0	--	--	--	0.2	--	--	0.0	--	--	0.0	--	0.0	--	--	0.0
Spotted Sandpiper - 1	tPCB-mid	--	--	0.2	--	--	--	0.4	--	--	0.3	--	--	0.1	--	0.1	--	--	0.0
	tPCB-high	--	--	2.4	--	--	--	5.7	--	--	4.0	--	--	1.7	--	1.9	--	--	0.5
	Mercury	--	--	0.1	--	--	--	0.1	--	--	0.2	--	--	0.1	--	0.1	--	--	0.0
Spotted Sandpiper - 2	tPCB-mid	--	--	0.8	--	--	--	0.6	--	--	0.1	--	--	0.2	--	0.3	--	--	0.1
	tPCB-high	--	--	11.5	--	--	--	8.5	--	--	2.1	--	--	3.4	--	4.8	--	--	1.7
	Mercury	--	--	0.0	--	--	--	0.6	--	--	0.0	--	--	0.0	--	0.1	--	--	0.0
Kingfisher - 1	tPCB-mid	--	--	3.8	--	--	--	2.3	--	--	0.3	--	--	0.6	--	1.0	--	--	0.3
	tPCB-high	--	--	55.2	--	--	--	34.4	--	--	3.8	--	--	8.4	--	14.1	--	--	3.8
	Mercury	--	--	0.0	--	--	--	0.4	--	--	0.0	--	--	0.0	--	0.1	--	--	0.0
Kingfisher - 2	tPCB-mid	--	--	3.0	--	--	--	1.9	--	--	0.2	--	--	0.5	--	0.8	--	--	0.2
	tPCB-high	--	--	44.6	--	--	--	27.8	--	--	3.1	--	--	6.8	--	11.4	--	--	2.9
	Mercury	--	--	0.0	--	--	--	0.3	--	--	0.0	--	--	0.0	--	0.1	--	--	0.0
Great Blue Heron	tPCB-mid	--	--	83.5	--	--	--	52.0	--	--	5.8	--	--	12.7	--	21.4	--	--	4.6
	tPCB-high	--	--	1225.2	--	--	--	763.2	--	--	84.4	--	--	185.8	--	313.8	--	--	66.8
	Mercury	--	--	0.3	--	--	--	12.0	--	--	0.5	--	--	0.5	--	2.0	--	--	0.6
Osprey	tPCB-mid	--	--	24.4	--	--	--	15.2	--	--	1.7	--	--	3.7	--	6.2	--	--	1.3
	tPCB-high	--	--	357.2	--	--	--	222.4	--	--	24.5	--	--	54.1	--	91.4	--	--	19.7
	Mercury	--	--	0.1	--	--	--	3.3	--	--	0.1	--	--	0.1	--	0.5	--	--	0.2

Table AD-17. Summary of Terrestrial and Aquatic Bird Egg Tissue LOAEL Hazard Quotients by Exposure Unit
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C6	C6	C6	Middle	Middle	C7	C7	C7	C8	C8	C8	C9	C9	C9	C10 ¹	Lower	Lower
Exposure Subarea→		North	South	Riparian/ Aquatic	Soil Combined	Riparian/ Aquatic	North	South	Riparian/ Aquatic	North	South	Riparian/ Aquatic	North	South	Riparian/ Aquatic	Riparian/ Aquatic	Soil Combined	Riparian/ Aquatic
Receptors↓		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Terrestrial Birds																		
Mourning Dove - mid	tPCB-med	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	--	0.0	--
Mourning Dove - high	tPCB-high	0.2	0.3	--	0.2	--	0.1	0.1	--	0.2	0.1	--	0.2	0.0	--	--	0.1	--
	Mercury	0.0	0.0	--	0.0	--	0.0	0.0	--	0.1	0.0	--	0.0	0.0	--	--	0.0	--
Blue Jay - mid	tPCB-med	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	--	0.0	--
Blue Jay - high	tPCB-high	0.2	0.3	--	0.2	--	0.1	0.2	--	0.2	0.2	--	0.2	0.0	--	--	0.1	--
	Mercury	0.0	0.1	--	0.0	--	0.0	0.0	--	0.1	0.0	--	0.0	0.0	--	--	0.0	--
Carolina Wren - 1 - mid	tPCB-med	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	--	0.0	--
Carolina Wren - 1 - high	tPCB-high	0.2	0.3	--	0.1	--	0.1	0.1	--	0.2	0.1	--	0.2	0.0	--	--	0.1	--
	Mercury	0.0	0.0	--	0.0	--	0.0	0.0	--	0.1	0.0	--	0.0	0.0	--	--	0.0	--
Carolina Wren - 2 - mid	tPCB-med	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	--	0.0	--
Carolina Wren - 2 - high	tPCB-high	0.1	0.1	--	0.1	--	0.1	0.1	--	0.1	0.1	--	0.1	0.0	--	--	0.1	--
	Mercury	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	--	0.0	--
Hawk - mid	tPCB-med	0.2	0.2	--	0.5	--	0.2	0.3	--	0.3	0.3	--	0.2	0.1	--	--	0.3	--
Hawk - high	tPCB-high	3.1	3.6	--	6.6	--	3.5	4.0	--	4.7	4.3	--	2.6	1.4	--	--	4.1	--
	Mercury	0.1	0.2	--	0.1	--	0.1	0.2	--	0.4	0.1	--	0.2	0.1	--	--	0.1	--
Aquatic Birds																		
Tree Swallow	tPCB-mid	--	--	0.0	--	0.0	--	--	0.0	--	--	0.0	--	--	0.0	0.0	--	0.0
	tPCB-high	--	--	0.0	--	0.0	--	--	0.0	--	--	0.0	--	--	0.0	0.0	--	0.0
	Mercury	--	--	0.0	--	0.0	--	--	0.0	--	--	0.0	--	--	0.0	0.0	--	0.0
Spotted Sandpiper - 1	tPCB-mid	--	--	0.0	--	0.0	--	--	0.0	--	--	0.0	--	--	0.0	0.0	--	0.0
	tPCB-high	--	--	0.4	--	0.4	--	--	0.4	--	--	0.4	--	--	0.4	0.3	--	0.3
	Mercury	--	--	0.1	--	0.0	--	--	0.1	--	--	0.1	--	--	0.1	0.1	--	0.1
Spotted Sandpiper - 2	tPCB-mid	--	--	0.0	--	0.1	--	--	0.1	--	--	0.1	--	--	0.1	0.1	--	0.1
	tPCB-high	--	--	0.6	--	1.6	--	--	1.8	--	--	1.9	--	--	0.8	1.6	--	2.0
	Mercury	--	--	0.0	--	0.0	--	--	0.0	--	--	0.0	--	--	0.0	0.0	--	0.0
Kingfisher - 1	tPCB-mid	--	--	0.1	--	0.2	--	--	0.2	--	--	0.3	--	--	0.1	0.2	--	0.3
	tPCB-high	--	--	0.8	--	3.5	--	--	3.6	--	--	4.1	--	--	1.0	2.9	--	4.4
	Mercury	--	--	0.0	--	0.0	--	--	0.0	--	--	0.0	--	--	0.0	0.0	--	0.0
Kingfisher - 2	tPCB-mid	--	--	0.0	--	0.2	--	--	0.2	--	--	0.2	--	--	0.1	0.2	--	0.2
	tPCB-high	--	--	0.6	--	2.7	--	--	2.8	--	--	3.2	--	--	0.8	2.3	--	3.4
	Mercury	--	--	0.0	--	0.0	--	--	0.0	--	--	0.0	--	--	0.0	0.0	--	0.0
Great Blue Heron	tPCB-mid	--	--	0.9	--	4.2	--	--	4.7	--	--	5.3	--	--	1.3	3.8	--	5.8
	tPCB-high	--	--	13.7	--	61.3	--	--	68.5	--	--	77.9	--	--	19.5	56.2	--	84.7
	Mercury	--	--	0.6	--	0.7	--	--	0.8	--	--	0.8	--	--	0.8	0.8	--	1.0
Osprey	tPCB-mid	--	--	0.3	--	1.2	--	--	1.4	--	--	1.6	--	--	0.4	1.1	--	1.7
	tPCB-high	--	--	4.0	--	18.1	--	--	20.2	--	--	23.0	--	--	5.7	16.6	--	25.0
	Mercury	--	--	0.2	--	0.2	--	--	0.2	--	--	0.2	--	--	0.2	0.2	--	0.3

Table AD-17. Summary of Terrestrial and Aquatic Bird Egg Tissue LOAEL Hazard Quotients by Exposure Unit
Anniston PCB Site, Anniston, Alabama

Notes:

NOAEL HQ* ≤ 1
LOAEL HQ* ≤ 1
LOAEL HQ* > 1 and ≤ 10
LOAEL HQ* > 10

* All HQs rounded to the nearest whole number
¹ Riparian soil in reaches C1 and C10 is based on the applicable assessment area (i.e., Upper for C1 and Lower for C10). Reach C10 was not evaluated for terrestrial receptors due to lack of floodplain soil.
HQ: hazard quotient
LOAEL: lowest observed adverse effect level
tPCB: total polychlorinated biphenyls
TRV: toxicity reference value
"-": not available
Exposure Units:
C1: Oxford Lake Park
C2: Backwater Area
C3: Friendship Road to Highway 21
C4: Hwy 21 to Silver Run Road
C5: Silver Run Road to Mitchell Matson Road
C6: Mitchell Matson Road to 2,000 feet upstream of Curry Station Road
C7: Upstream of Curry Station Road to Eastaboga Creek
C8: Eastaboga Creek to Jackson Shoals Dam
C9: Jackson Shoals Dam to Highway 77
C10: Highway 77 Bridge to Lake Logan Martin
Exposure Subareas:
East: East Subarea Floodplain Soil
West: West Subarea Floodplain Soil
North: North Subarea Floodplain Soil
South: South Subarea Floodplain Soil
Central: Central Subarea Floodplain Soil

Table AD-18. Summary of Aquatic Receptors NOAEL Hazard Quotients by Exposure Unit (Measured Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1	C2	C3	C4	Upper AA	C5	C6 ¹	Middle AA	C7	C8 ¹	C9	C10	Lower AA
Exposure Subarea→		Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
Receptors↓														
Aquatic Birds		NOAEL HQs												
Tree Swallow	tPCB-mid	11.6	11.6	11.6	11.6	11.6	0.4	0.4	0.4	0.6	0.6	0.6	0.6	0.6
	tPCB-high	125.1	125.1	125.1	125.1	125.1	4.5	4.5	4.5	6.1	6.1	6.1	6.1	6.1
	Barium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Chromium	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
	Cobalt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Mercury	3.4	3.4	3.4	3.4	3.4	2.0	2.0	2.0	2.2	2.2	2.2	2.2	2.2
	Vanadium	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Spotted Sandpiper - 2	tPCB-mid	2.1	1.7	1.1	1.2	1.3	0.8	0.7	0.7	0.5	0.5	0.4	0.5	0.5
	tPCB-high	22.7	18.3	11.7	12.7	13.9	8.1	7.6	8.1	5.1	5.2	4.7	5.0	5.3
	Barium	0.9	0.8	0.6	0.6	0.7	0.9	0.9	0.9	0.6	0.6	0.7	0.7	0.7
	Chromium	0.8	0.5	0.5	0.5	0.5	0.9	0.9	0.9	0.4	0.4	0.5	0.6	0.6
	Cobalt	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
	Lead	2.8	1.6	0.9	0.9	1.3	2.1	2.1	2.1	0.8	0.8	1.1	1.2	1.1
	Mercury	2.6	40.6	3.2	3.2	8.2	3.9	3.9	3.9	4.9	4.9	4.9	4.9	5.3
	Vanadium	6.3	2.6	2.9	2.0	2.5	5.3	5.3	5.3	2.0	2.0	2.8	3.4	3.1
Kingfisher - 1	tPCB-mid	8.1	8.1	8.0	8.0	8.0	12.2	12.2	12.2	11.3	11.3	11.3	11.3	11.3
	tPCB-high	87.5	87.1	86.5	86.5	86.7	131.0	131.0	131.0	121.9	121.9	121.9	121.9	121.9
	Barium	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
	Chromium	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
	Cobalt	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
	Lead	0.4	0.3	0.2	0.2	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.3	0.2
	Mercury	1.3	5.1	1.4	1.4	1.9	3.7	3.7	3.7	4.6	4.6	4.6	4.6	4.6
	Vanadium	1.0	0.7	0.7	0.6	0.7	0.9	0.9	0.9	0.6	0.6	0.7	0.7	0.7
Kingfisher - 2	tPCB-mid	7.1	7.1	7.0	7.0	7.0	9.5	9.5	9.5	8.8	8.8	8.8	8.8	8.8
	tPCB-high	76.4	76.0	75.3	75.4	75.6	102.2	102.2	102.2	94.4	94.4	94.3	94.4	94.4
	Barium	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	Chromium	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Cobalt	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
	Lead	0.4	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3
	Mercury	1.7	5.4	1.7	1.7	2.2	3.7	3.7	3.7	4.0	4.0	4.0	4.0	4.1
	Vanadium	1.1	0.7	0.7	0.6	0.7	1.0	1.0	1.0	0.6	0.6	0.7	0.8	0.7
Great Blue Heron⁵	tPCB-mid	18.5	18.5	18.4	18.4	18.4	16.5	16.4	16.5	18.9	18.9	18.9	18.9	18.9
	tPCB-high	199.4	198.9	198.1	198.3	198.4	177.2	177.1	177.2	203.4	203.4	203.4	203.4	203.4
	Barium	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	Chromium	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
	Cobalt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead ⁷	0.3	0.2	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
	Mercury	5.8	10.0	5.9	5.9	6.4	6.1	6.1	6.1	8.1	8.1	8.1	8.1	8.2
	Vanadium	1.2	0.8	0.8	0.7	0.8	1.1	1.1	1.1	0.7	0.7	0.8	0.9	0.8
Osprey	tPCB-mid	7.6	7.6	7.6	7.6	7.6	7.0	7.0	7.0	8.0	8.0	8.0	8.0	8.0
	tPCB-high	81.7	81.7	81.7	81.7	81.7	75.0	75.0	75.0	86.1	86.1	86.1	86.1	86.1
	Barium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Chromium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Cobalt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mercury	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	3.3	3.3	3.3	3.3	3.3
	Vanadium	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2

Table AD-18. Summary of Aquatic Receptors NOAEL Hazard Quotients by Exposure Unit (Measured Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1	C2	C3	C4	Upper AA	C5	C6 ¹	Middle AA	C7	C8 ¹	C9	C10	Lower AA
Exposure Subarea→		Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
Receptors↓														
Aquatic Mammals		NOAEL HQs												
Bat	tPCB	17.4	17.4	17.4	17.4	17.4	0.6	0.6	0.6	0.9	0.9	0.9	0.9	0.9
	Barium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Chromium	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	Cobalt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mercury	0.8	0.8	0.8	0.8	0.8	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5
	Vanadium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mink - 2⁵	tPCB-mink	21.9	21.9	21.9	21.9	21.9	31.8	31.8	31.8	29.6	29.6	29.6	29.6	29.6
	Barium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Chromium	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	Cobalt	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Lead⁷	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mercury	0.1	0.1	0.1	0.1	0.1	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4
	Vanadium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Otter	tPCB-mink	38.8	38.8	38.8	38.8	38.8	37.6	37.6	37.6	40.3	40.3	40.3	40.3	40.3
	Barium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Chromium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Cobalt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mercury	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.6	0.6	0.6	0.6	0.6
	Vanadium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Notes:

NOAEL HQ* ≤ 1

NOAEL HQ* > 1 and ≤ 10

NOAEL HQ* > 10

* All HQs rounded to the nearest whole number

¹ Sediment data unavailable for this reach for non-mercury metals. Non-mercury metal EPCs from the upstream reach were conservatively used to estimate exposure.

² Great blue heron and Mink-2 are exposed to riparian soil.

AA: assessment area

HQ: hazard quotient

mg/kg-day: milligrams per kilogram per day

NOAEL: no observed adverse effect level

tPCB: total polychlorinated biphenyl

--: not available

Exposure Units:

C1: Oxford Lake Park

C2: Backwater Area

C3: Friendship Road to Highway 21

C4: Hwy 21 to Silver Run Road

C5: Silver Run Road to Mitchell Matson Road

C6: Mitchell Matson Road to 2,000 feet upstream of Curry Station Road

C7: Upstream of Curry Station Road to Eastaboga Creek

C8: Eastaboga Creek to Jackson Shoals Dam

C9: Jackson Shoals Dam to Highway 77

C10: Highway 77 Bridge to Lake Logan Martin

Sediment: Instream Sediment

Table AD-19. Summary of Aquatic Receptors LOAEL Hazard Quotients by Exposure Unit (Measured Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1	C2	C3	C4	Upper AA	C5	C6 ²	Middle AA	C7	C8 ²	C9	C10	Lower AA
Exposure Subarea→		Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
Receptors ⁵ ↓														
Aquatic Birds		LOAEL HQs												
Tree Swallow	tPCB-mid	3.9	3.9	3.9	3.9	3.9	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2
	tPCB-high	41.7	41.7	41.7	41.7	41.7	1.5	1.5	1.5	2.0	2.0	2.0	2.0	2.0
	Barium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Chromium	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
	Cobalt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mercury	1.1	1.1	1.1	1.1	1.1	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
	Vanadium	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Spotted Sandpiper - 2	tPCB-mid	0.7	0.6	0.4	0.4	0.4	0.3	0.2	0.2	0.2	0.2	0.1	0.2	0.2
	tPCB-high	7.6	6.1	3.9	4.2	4.6	2.7	2.5	2.7	1.7	1.7	1.6	1.7	1.8
	Barium	0.4	0.4	0.3	0.3	0.3	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3
	Chromium	0.8	0.4	0.5	0.5	0.4	0.9	0.9	0.9	0.4	0.4	0.5	0.6	0.5
	Cobalt	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
	Lead	1.4	0.8	0.5	0.5	0.6	1.0	1.0	1.0	0.4	0.4	0.6	0.6	0.6
	Mercury	0.9	13.5	1.1	1.1	2.7	1.3	1.3	1.3	1.6	1.6	1.6	1.6	1.8
	Vanadium	3.1	1.3	1.4	1.0	1.2	2.6	2.6	2.6	1.0	1.0	1.4	1.7	1.5
Kingfisher - 1	tPCB-mid	2.7	2.7	2.7	2.7	2.7	4.1	4.1	4.1	3.8	3.8	3.8	3.8	3.8
	tPCB-high	29.2	29.0	28.8	28.8	28.9	43.7	43.7	43.7	40.6	40.6	40.6	40.6	40.6
	Barium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Chromium	0.7	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.6	0.6	0.7	0.7	0.7
	Cobalt	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
	Lead	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
	Mercury	0.4	1.7	0.5	0.5	0.6	1.2	1.2	1.2	1.5	1.5	1.5	1.5	1.5
	Vanadium	0.5	0.3	0.3	0.3	0.3	0.5	0.5	0.5	0.3	0.3	0.3	0.4	0.4
Kingfisher - 2	tPCB-mid	2.4	2.4	2.3	2.3	2.3	3.2	3.2	3.2	2.9	2.9	2.9	2.9	2.9
	tPCB-high	25.5	25.3	25.1	25.1	25.2	34.1	34.1	34.1	31.5	31.5	31.4	31.5	31.5
	Barium	0.3	0.3	0.3	0.2	0.3	0.3	0.3	0.3	0.2	0.2	0.3	0.3	0.3
	Chromium	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Cobalt	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
	Lead	0.2	0.2	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
	Mercury	0.6	1.8	0.6	0.6	0.7	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.4
	Vanadium	0.5	0.3	0.4	0.3	0.3	0.5	0.5	0.5	0.3	0.3	0.4	0.4	0.4

**Table AD-19. Summary of Aquatic Receptors LOAEL Hazard Quotients by Exposure Unit (Measured Tissue)
Anniston PCB Site, Anniston, Alabama**

Exposure Unit→		C1	C2	C3	C4	Upper AA	C5	C6 ²	Middle AA	C7	C8 ²	C9	C10	Lower AA
Exposure Subarea→		Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
Receptors ⁵ ↓														
Great Blue Heron ³	tPCB-mid	6.2	6.2	6.1	6.1	6.1	5.5	5.5	5.5	6.3	6.3	6.3	6.3	6.3
	tPCB-high	66.5	66.3	66.0	66.1	66.1	59.1	59.0	59.1	67.8	67.8	67.8	67.8	67.8
	Barium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Chromium	0.4	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.3	0.3	0.3	0.4	0.3
	Cobalt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Mercury	1.9	3.3	2.0	2.0	2.1	2.0	2.0	2.0	2.7	2.7	2.7	2.7	2.7
	Vanadium	0.6	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4
	tPCB-mid	2.5	2.5	2.5	2.5	2.5	2.3	2.3	2.3	2.7	2.7	2.7	2.7	2.7
	tPCB-high	27.2	27.2	27.2	27.2	27.2	25.0	25.0	25.0	28.7	28.7	28.7	28.7	28.7
Osprey	Barium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Chromium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Cobalt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mercury	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.1	1.1	1.1	1.1	1.1
	Vanadium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Aquatic Mammals		LOAEL HQs												
Bat	tPCB	5.9	5.9	5.9	5.9	5.9	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3
	Barium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Chromium	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
	Cobalt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mercury	0.4	0.4	0.4	0.4	0.4	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	Vanadium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mink - 2 ³	tPCB-mink	10.9	10.9	10.9	10.9	10.9	15.9	15.9	15.9	14.8	14.8	14.8	14.8	14.8
Mink - 2 (Alternate TRV) ¹	tPCB-mink	21.9	21.9	21.9	21.9	21.9	31.8	31.8	31.8	29.6	29.6	29.6	29.6	29.6
	Barium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Chromium	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	Cobalt	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Lead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mercury	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	Vanadium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

**Table AD-19. Summary of Aquatic Receptors LOAEL Hazard Quotients by Exposure Unit (Measured Tissue)
Anniston PCB Site, Anniston, Alabama**

Exposure Unit→		C1	C2	C3	C4	Upper AA	C5	C6 ²	Middle AA	C7	C8 ²	C9	C10	Lower AA
Exposure Subarea→		Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
Receptors ⁵ ↓														
Otter	tPCB-mink	19.4	19.4	19.4	19.4	19.4	18.8	18.8	18.8	20.2	20.2	20.2	20.2	20.2
Otter (Alternate TRV) ¹	tPCB-mink	38.8	38.8	38.8	38.8	38.8	37.6	37.6	37.6	40.3	40.3	40.3	40.3	40.3
	Barium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Chromium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Cobalt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mercury	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3
	Vanadium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Notes:

NOAEL HQ* ≤ 1

LOAEL HQ* ≤ 1

LOAEL HQ* > 1 and ≤ 10

LOAEL HQ* > 10

* All HQs rounded to the nearest whole number

¹ Alternate TRVs were selected from Restum et al. (1998) based on growth. The LOAEL TRV is 0.05 mg/kg-day.

² Sediment data unavailable for this reach for non-mercury metals. Non-mercury metal EPCs from AA used to estimate incidental sediment ingestion.

³ Great blue heron and Mink-2 are exposed to riparian soil.

AA: assessment area

LOAEL: lowest-observed adverse effect level

tPCB: total polychlorinated biphenyl

--: not available

HQ: hazard quotient

mg/kg-day: milligrams per kilogram per day

TRV: toxicity reference value

Exposure Units:

C1: Oxford Lake Park

C4: Hwy 21 to Silver Run Road

C7: Upstream of Curry Station Road to Eastaboga Creek

C2: Backwater Area

C5: Silver Run Road to Mitchell Matson Road

C8: Eastaboga Creek to Jackson Shoals Dam

C3: Friendship Road to Highway 21

C6: Mitchell Matson Road to 2,000 feet upstream of Curry Station Road

C9: Jackson Shoals Dam to Highway 77

C10: Highway 77 Bridge to Lake Logan Martin

References:

Restum, J., S. Bursian, J. Giesy, J. Render, W. Helferich, E. Shipp, D. Verbrugge, and R. Aulerich. 1998. Multigenerational study of the effects of consumption of PCB-contaminated carp from Saginaw Bay, Lake

Table AD-20. Summary of Terrestrial Receptors NOAEL-based Hazard Quotients by Exposure Unit (Measured Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1 ¹	C1 ¹	C2	C2	C2	C3	C3	C4	C4	Upper AA	C5	C5
Exposure Subarea→		East	West	North	South	Central	North	South	North	South	Combined Soil	North	South
Receptors↓		NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ
Terrestrial Birds													
Mourning Dove	tPCB-mid	0.6	8.8	0.3	0.1	0.2	0.6	1.3	0.5	0.3	0.5	0.2	0.2
	tPCB-high	6.0	94.4	3.4	1.0	1.6	7.0	13.7	5.1	3.7	5.1	1.9	2.1
	Mercury	--	--	1.6	0.4	0.5	3.1	3.3	2.3	2.4	2.3	1.0	1.2
	Chromium	--	--	0.4	0.2	0.2	0.3	0.5	0.5	0.3	0.3	0.3	0.3
	Lead	--	--	0.4	0.3	0.5	0.5	1.3	0.8	0.6	0.6	0.3	0.7
Blue Jay	Vanadium	--	--	1.4	1.4	1.2	1.2	1.5	1.4	1.3	1.2	1.7	1.9
	tPCB-mid	2.2	11.2	2.0	1.7	1.8	2.3	3.0	2.1	2.0	2.1	0.3	0.3
	tPCB-high	23.9	120.3	21.0	18.5	19.1	25.0	32.3	22.9	21.4	23.0	3.5	3.8
	Mercury	--	--	5.8	4.6	4.6	7.5	7.7	6.6	6.7	6.6	3.4	3.5
	Chromium	--	--	0.6	0.4	0.4	0.4	0.7	0.6	0.5	0.5	0.4	0.5
	Lead	--	--	1.6	1.5	1.8	1.8	2.6	2.0	1.9	1.8	1.5	1.9
	Vanadium	--	--	1.9	1.9	1.7	1.7	2.1	2.0	1.9	1.8	2.3	2.5
	tPCB-mid	11.7	26.0	11.3	10.9	11.0	11.9	13.0	11.6	11.3	11.6	1.2	1.3
	tPCB-high	126.2	279.8	121.6	117.5	118.6	127.9	139.5	124.6	122.1	124.7	13.3	13.6
	Mercury	--	--	30.0	28.0	28.1	32.6	32.9	31.2	31.4	31.1	16.9	17.2
Carolina Wren - 1	Chromium	--	--	1.6	1.3	1.3	1.4	1.9	1.7	1.5	1.5	1.4	1.5
	Lead	--	--	8.6	8.5	8.9	8.9	10.2	9.3	9.0	8.9	8.4	9.1
	Vanadium	--	--	5.4	5.4	5.1	5.1	5.6	5.5	5.4	5.1	5.9	6.3
	tPCB-mid	4.9	6.8	4.8	4.8	4.8	4.8	5.0	4.8	4.8	4.8	5.0	5.0
	tPCB-high	53.2	73.7	51.9	51.4	51.5	51.8	53.4	51.5	51.2	51.7	53.6	53.6
Hawk	Chromium	--	--	0.2	0.2	0.2	0.2	0.3	0.3	0.2	0.2	0.3	0.3
	Lead	--	--	0.5	0.4	0.5	0.4	0.6	0.4	0.4	0.4	0.5	0.6
	Mercury	--	--	6.4	6.1	6.1	1.4	1.4	1.2	1.2	1.9	1.5	1.5
	Vanadium	--	--	2.0	2.0	2.0	2.0	2.1	1.9	1.9	2.0	2.5	2.5
Terrestrial Mammals													
Shrew - 1	tPCB	15.9	19.2	15.8	15.7	15.7	15.9	16.2	15.9	15.8	15.9	1.7	1.7
	Mercury	--	--	6.0	6.0	6.0	6.1	6.1	6.1	6.1	6.1	3.4	3.4
	Chromium	--	--	0.8	0.8	0.8	0.8	0.9	0.8	0.8	0.8	0.8	0.8
	Lead	--	--	2.0	2.0	2.0	2.0	2.1	2.0	2.0	2.0	2.0	2.0
	Vanadium	--	--	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Shrew - 2	tPCB	16.5	19.7	16.3	16.2	16.2	16.3	16.5	16.2	16.2	16.3	2.7	2.7
	Chromium	--	--	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9
	Lead	--	--	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	2.0
	Mercury	--	--	7.1	7.0	7.0	5.8	5.9	5.8	5.8	6.0	3.3	3.3
	Vanadium	--	--	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3
Deer	tPCB	0.0	0.3	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
	Mercury	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Chromium	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vanadium	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table AD-20. Summary of Terrestrial Receptors NOAEL-based Hazard Quotients by Exposure Unit (Measured Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1 ¹	C1 ¹	C2	C2	C2	C3	C3	C4	C4	Upper AA	C5	C5
Exposure Subarea→		East	West	North	South	Central	North	South	North	South	Combined Soil	North	South
Receptors↓		NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ
Weasel	tPCB	1.8	3.9	1.7	1.6	1.7	1.8	2.0	1.7	1.7	1.7	3.9	3.9
	Mercury	--	--	0.1	0.0	0.0	0.1	0.2	0.1	0.1	0.1	0.1	0.1
	Chromium	--	--	0.2	0.1	0.1	0.1	0.2	0.2	0.1	0.1	0.1	0.1
	Lead	--	--	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Vanadium	--	--	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Fox - 1	tPCB	1.2	2.1	1.2	1.1	1.1	1.2	1.3	1.2	1.2	1.2	2.0	2.0
	Mercury	--	--	0.2	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.1	0.1
	Chromium	--	--	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Lead	--	--	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Vanadium	--	--	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Fox - 2	tPCB	1.0	1.9	1.0	1.0	1.0	1.1	1.1	1.0	1.0	1.0	2.3	2.3
	Mercury	--	--	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Chromium	--	--	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Lead	--	--	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1
	Vanadium	--	--	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Table AD-20. Summary of Terrestrial Receptors NOAEL-based Hazard Quotients by Exposure Unit (Measured Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C6	C6	Middle AA	C7	C7	C8	C8	C9	C9	C10 ²	Lower AA
Exposure Subarea→		North	South	Combined Soil	North	South	North	South	North	South	Sediment	Combined Soil
Receptors↓		NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ
Terrestrial Birds												
Mourning Dove	tPCB-mid	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	--	0.2
	tPCB-high	2.3	2.7	2.1	1.8	2.0	2.3	2.0	2.2	1.6	--	1.8
	Mercury	1.7	2.8	1.1	0.8	1.9	4.4	1.0	1.8	0.8	--	1.2
	Chromium	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.2	0.2	--	0.3
	Lead	0.3	0.2	0.5	0.5	0.3	0.4	0.4	0.2	0.2	--	0.3
Blue Jay	Vanadium	1.6	0.8	1.5	1.7	1.8	1.4	1.7	0.7	1.6	--	1.4
	tPCB-mid	0.4	0.4	0.3	0.3	0.4	0.4	0.4	0.4	0.3	--	0.3
	tPCB-high	3.9	4.4	3.7	3.6	3.9	4.2	3.9	4.1	3.4	--	3.7
	Mercury	4.2	5.3	3.5	2.6	3.8	6.5	2.8	3.7	2.6	--	3.0
	Chromium	0.4	0.4	0.4	0.5	0.5	0.5	0.4	0.4	0.4	--	0.4
	Lead	1.5	1.4	1.8	1.7	1.5	1.6	1.6	1.4	1.4	--	1.5
	Vanadium	2.2	1.3	2.1	2.3	2.4	1.9	2.3	1.3	2.2	--	2.0
Carolina Wren - 1	tPCB-mid	1.3	1.4	1.3	1.4	1.4	1.4	1.4	1.4	1.3	--	1.4
	tPCB-high	13.9	14.6	13.6	14.6	15.0	15.5	15.0	15.3	14.2	--	14.6
	Mercury	18.2	20.0	17.1	13.0	14.8	19.2	13.3	14.7	12.9	--	13.6
	Chromium	1.4	1.3	1.4	1.4	1.5	1.4	1.4	1.3	1.3	--	1.4
	Lead	8.5	8.3	8.8	8.8	8.5	8.6	8.6	8.3	8.4	--	8.5
	Vanadium	5.8	4.4	5.6	6.0	6.1	5.4	5.9	4.4	5.8	--	5.5
Hawk	tPCB-mid	5.0	5.0	5.0	3.5	3.5	3.6	3.6	3.5	3.5	--	3.5
	tPCB-high	53.6	53.7	53.6	38.2	38.2	38.3	38.2	38.2	38.0	--	38.2
	Chromium	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	--	0.2
	Lead	0.5	0.5	0.5	0.4	0.3	0.3	0.3	0.3	0.4	--	0.4
	Mercury	1.6	1.9	1.5	1.8	2.0	2.6	1.8	2.0	1.8	--	1.9
	Vanadium	2.5	2.3	2.4	2.0	2.0	1.9	2.0	1.9	2.1	--	2.1
Terrestrial Mammals												
Shrew - 1	tPCB	1.7	1.7	1.7	1.9	1.9	1.9	1.9	1.9	1.9	--	1.9
	Mercury	3.5	3.5	3.4	2.6	2.7	2.8	2.6	2.7	2.6	--	2.6
	Chromium	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	--	0.8
	Lead	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	--	2.0
	Vanadium	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	--	0.2
Shrew - 2	tPCB	2.7	2.7	2.7	2.5	2.6	2.6	2.6	2.5	2.5	--	2.5
	Chromium	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	--	0.8
	Lead	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	--	1.9
	Mercury	3.4	3.4	3.3	2.5	2.6	2.8	2.6	2.6	2.5	--	2.6
	Vanadium	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	--	0.2
Deer	tPCB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	0.0
	Mercury	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	0.0
	Chromium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	0.0
	Lead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	0.0
	Vanadium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	0.0

Table AD-20. Summary of Terrestrial Receptors NOAEL-based Hazard Quotients by Exposure Unit (Measured Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C6	C6	Middle AA	C7	C7	C8	C8	C9	C9	C10 ²	Lower AA
Exposure Subarea→		North	South	Combined Soil	North	South	North	South	North	South	Sediment	Combined Soil
Receptors↓		NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ
Weasel	tPCB	3.9	3.9	3.9	4.0	4.0	4.0	4.0	4.0	4.0	--	4.0
	Mercury	0.1	0.2	0.1	0.1	0.2	0.3	0.2	0.2	0.1	--	0.2
	Chromium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	--	0.1
	Lead	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	--	0.1
	Vanadium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	--	0.1
Fox - 1	tPCB	2.0	2.0	2.0	2.0	2.1	2.1	2.1	2.1	2.0	--	2.0
	Mercury	0.1	0.2	0.1	0.1	0.1	0.2	0.1	0.1	0.1	--	0.1
	Chromium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	--	0.1
	Lead	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	--	0.1
	Vanadium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	--	0.1
Fox - 2	tPCB	2.3	2.3	2.3	2.4	2.4	2.4	2.4	2.4	2.4	--	2.4
	Mercury	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	--	0.1
	Chromium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	--	0.1
	Lead	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	--	0.0
	Vanadium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	--	0.1

Notes:

NOAEL HQ* ≤ 1
NOAEL HQ* > 1 and ≤ 10
NOAEL HQ* > 10

* All HQs rounded to the nearest whole number

¹ Soil in C1 was not sampled for metals. Hawk and shrew-2 are exposed to both soil and sediment, therefore, the HQs presented for metals in C1 are based on exposures to sediment only.

² Reach C10 was not evaluated for terrestrial receptors due to lack of floodplain soil.

AA = assessment area

HQ: hazard quotient

NOAEL: no observed adverse effect level

tPCB: total polychlorinated biphenyl

TRV: toxicity reference value

--: not available

Exposure Units:

C1: Oxford Lake Park

C2: Backwater Area

C3: Friendship Road to Highway 21

C4: Hwy 21 to Silver Run Road

C5: Silver Run Road to Mitchell Matson Road

C6: Mitchell Matson Road to 2,000 feet upstream of Curry Station North: North Subarea Floodplain Soil

C7: Upstream of Curry Station Road to Eastaboga Creek South: South Subarea Floodplain Soil

C8: Eastaboga Creek to Jackson Shoals Dam Central: Central Subarea Floodplain Soil

C9: Jackson Shoals Dam to Highway 77

C10: Hwy 77 Bridge to Lake Logan Martin

Exposure Subareas:

East: East Subarea Floodplain Soil

West: West Subarea Floodplain Soil

Table AD-21. Summary of Terrestrial Receptors LOAEL-based Hazard Quotients by Exposure Unit (Measured Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1 ^{1,2}	C1 ^{1,2}	C2	C2	C2	C3	C3	C4	C4	Upper AA Combined Soil	C5	C5	C6	C6	Middle AA Combined Soil	C7	C7	C8	C8	C9	C9	Lower AA Combined Soil
Exposure Subarea→		East	West	North	South	Central	North	South	North	South		North	South	North	South		North	South	North	South	North	South	
Terrestrial Birds																							
Mourning Dove	tPCB-mid	0.2	2.9	0.1	0.0	0.1	0.2	0.4	0.2	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1
	tPCB-high	2.0	31.5	1.1	0.3	0.5	2.3	4.6	1.7	1.2	1.7	0.6	0.7	0.8	0.9	0.7	0.6	0.7	0.8	0.7	0.7	0.5	0.6
	Mercury	--	--	0.5	0.1	0.2	1.0	1.1	0.8	0.8	0.8	0.3	0.4	0.6	0.9	0.4	0.3	0.6	1.5	0.3	0.6	0.3	0.4
	Chromium	--	--	0.4	0.2	0.2	0.2	0.5	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.3
	Lead	--	--	0.2	0.1	0.3	0.3	0.6	0.4	0.3	0.3	0.1	0.3	0.2	0.1	0.3	0.2	0.2	0.2	0.2	0.1	0.1	0.1
Blue Jay	Vanadium	--	--	0.7	0.7	0.6	0.6	0.7	0.7	0.7	0.6	0.8	0.9	0.8	0.4	0.7	0.8	0.9	0.7	0.8	0.4	0.8	0.7
	tPCB-mid	0.7	3.7	0.7	0.6	0.6	0.8	1.0	0.7	0.7	0.7	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	tPCB-high	8.0	40.1	7.0	6.2	6.4	8.3	10.8	7.6	7.1	7.7	1.2	1.3	1.3	1.5	1.2	1.2	1.3	1.4	1.3	1.4	1.1	1.2
	Mercury	--	--	1.9	1.5	1.5	2.5	2.6	2.2	2.2	2.2	1.1	1.2	1.4	1.8	1.2	0.9	1.3	2.2	0.9	1.2	0.9	1.0
	Chromium	--	--	0.5	0.3	0.4	0.4	0.7	0.6	0.5	0.5	0.4	0.5	0.4	0.3	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.4
Carolina Wren	Lead	--	--	0.8	0.8	0.9	0.9	1.3	1.0	0.9	0.9	0.7	1.0	0.8	0.7	0.9	0.9	0.8	0.8	0.8	0.7	0.7	0.8
	Vanadium	--	--	1.0	0.9	0.8	0.9	1.0	1.0	0.9	0.9	1.1	1.2	1.1	0.6	1.0	1.1	1.2	0.9	1.1	0.6	1.1	1.0
	tPCB-mid	3.9	8.7	3.8	3.6	3.7	4.0	4.3	3.9	3.8	3.9	0.4	0.4	0.4	0.5	0.4	0.5	0.5	0.5	0.5	0.5	0.4	0.5
	tPCB-high	42.1	93.3	40.5	39.2	39.5	42.6	46.5	41.5	40.7	41.6	4.4	4.5	4.6	4.9	4.5	4.9	5.0	5.2	5.0	5.1	4.7	4.9
	Mercury	--	--	10.0	9.3	9.4	10.9	11.0	10.4	10.5	10.4	5.6	5.7	6.1	6.7	5.7	4.3	4.9	6.4	4.4	4.9	4.3	4.5
Hawk	Chromium	--	--	1.5	1.2	1.2	1.3	1.8	1.6	1.4	1.4	1.3	1.4	1.3	1.2	1.3	1.4	1.4	1.4	1.3	1.3	1.3	1.3
	Lead	--	--	4.3	4.2	4.5	4.4	5.1	4.6	4.5	4.5	4.2	4.6	4.3	4.1	4.4	4.4	4.2	4.3	4.3	4.2	4.2	4.2
	Vanadium	--	--	2.7	2.7	2.5	2.5	2.8	2.7	2.6	2.5	2.9	3.1	2.9	2.2	2.8	2.9	3.0	2.7	2.9	2.1	2.9	2.7
	tPCB-mid	1.6	2.3	1.6	1.6	1.6	1.6	1.7	1.6	1.6	1.6	1.7	1.7	1.7	1.7	1.7	1.2	1.2	1.2	1.2	1.2	1.2	1.2
	tPCB-high	17.7	24.6	17.3	17.1	17.2	17.3	17.8	17.2	17.1	17.2	17.9	17.9	17.9	17.9	17.9	12.7	12.7	12.8	12.7	12.7	12.7	12.7
Terrestrial Mammals	Chromium	--	--	0.2	0.2	0.2	0.2	0.3	0.3	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	Lead	--	--	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.3	0.3	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	Mercury	--	--	2.1	2.0	2.0	0.5	0.5	0.4	0.4	0.6	0.5	0.5	0.5	0.6	0.5	0.6	0.7	0.9	0.6	0.7	0.6	0.6
	Vanadium	--	--	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.2	1.2	1.2	1.1	1.2	1.0	1.0	1.0	1.0	0.9	1.0	1.0
Shrew - 1	tPCB	5.4	6.5	5.3	5.3	5.3	5.4	5.5	5.4	5.4	5.4	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Mercury	--	--	3.0	3.0	3.0	3.1	3.1	3.0	3.0	3.0	1.7	1.7	1.7	1.8	1.7	1.3	1.3	1.4	1.3	1.3	1.3	1.3
	Chromium	--	--	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
	Lead	--	--	1.1	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.1	1.1	1.0	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0
	Vanadium	--	--	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Shrew - 2	tPCB	5.6	6.7	5.5	5.5	5.5	5.5	5.6	5.5	5.5	5.5	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
	Chromium	--	--	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
	Lead	--	--	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	Mercury	--	--	3.6	3.5	3.5	2.9	2.9	2.9	2.9	3.0	1.7	1.7	1.7	1.7	1.7	1.3	1.3	1.4	1.3	1.3	1.3	1.3
	Vanadium	--	--	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Deer	tPCB	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mercury	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Chromium	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vanadium	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Weasel	tPCB	0.6	1.3	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.6	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
	Mercury	--	--	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Chromium	--	--	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Lead	--	--	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vanadium	--	--	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1
Fox - 1	tPCB	0.4	0.7	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
	Mercury	--	--	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Chromium	--	--	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Lead	--	--	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vanadium	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fox - 2	tPCB	0.4	0.7	0.3	0.3	0.3	0.4	0.4	0.4	0.3	0.4	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
	Mercury	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.0	0.0
	Chromium	--	--	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Lead	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vanadium	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table AD-21. Summary of Terrestrial Receptors LOAEL-based Hazard Quotients by Exposure Unit (Measured Tissue)
Anniston PCB Site, Anniston, Alabama

Notes:

NOAEL HQ* ≤ 1
LOAEL HQ* ≤ 1
LOAEL HQ* > 1 and ≤ 10
LOAEL HQ* > 10

* All HQs rounded to the nearest whole number

¹ Riparian soil in reaches C1 and C10 is based on the applicable assessment area (i.e., Upper for C1 and Lower for C10). Reach C10 was not evaluated for terrestrial receptors due to lack of floodplain soil.

² Soil in C1 was not sampled for metals. Hawk and shrew-2 are exposed to both soil and sediment, therefore, the HQs presented for metals in C1 are based on exposures to sediment only.

AA = assessment area

HQ: hazard quotient

tPCB: total polychlorinated biphenyl

TRV: toxicity reference value

--: not available

Exposure Units:

C1: Oxford Lake Park

C2: Backwater Area

C3: Friendship Road to Highway 21

C4: Hwy 21 to Silver Run Road

C5: Silver Run Road to Mitchell Matson Road

C6: Mitchell Matson Road to 2,000 feet upstream of Curry Station Road

C7: Upstream of Curry Station Road to Eastaboga Creek

C8: Eastaboga Creek to Jackson Shoals Dam

C9: Jackson Shoals Dam to Highway 77

C10: Hwy 77 Bridge to Lake Logan Martin

Exposure Subareas:

East: East Subarea Floodplain Soil

West: West Subarea Floodplain Soil

North: North Subarea Floodplain Soil

South: South Subarea Floodplain Soil

Central: Central Subarea Floodplain Soil

Table AD-22. Summary of NOAEL Hazard Quotients by Exposure Unit for Receptors Exposed to Terrestrial + Aquatic Media (Measured Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1 ¹	C1 ¹	C1 ¹	C2	C2	C2	C2	C3	C3	C3	C4	C4	C4
Exposure Subarea→		East Floodplain Soil, Riparian Soil & Sediment	West Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Central Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment
Receptors↓		NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ
Aquatic+Terrestrial Birds														
Carolina Wren - 2	tPCB-mid	11.7	26.0	--	11.3	10.9	11.0	--	11.9	13.0	--	11.6	11.4	--
	tPCB-high	126.5	280.2	--	121.9	117.9	118.9	--	128.2	139.8	--	124.9	122.5	--
	Barium ²	--	--	--	1.5	1.6	1.6	--	1.6	1.6	--	1.6	1.6	--
	Chromium	--	--	--	1.6	1.3	1.3	--	1.4	1.9	--	1.7	1.5	--
	Cobalt ²	--	--	--	0.5	0.5	0.5	--	0.5	0.5	--	0.5	0.5	--
	Lead	--	--	--	8.7	8.5	9.0	--	9.0	10.3	--	9.4	9.1	--
	Mercury	--	--	--	30.0	28.0	28.1	--	32.6	32.9	--	31.3	31.5	--
	Vanadium	--	--	--	5.5	5.5	5.2	--	5.2	5.7	--	5.6	5.5	--
Spotted Sandpiper - 1	tPCB-mid	--	--	10.0	--	--	--	10.6	--	--	10.0	--	--	9.5
	tPCB-high	--	--	107.9	--	--	--	113.7	--	--	107.5	--	--	102.7
	Barium ²	--	--	1.5	--	--	--	1.5	--	--	1.4	--	--	1.4
	Chromium	--	--	1.2	--	--	--	1.0	--	--	1.0	--	--	1.2
	Cobalt ²	--	--	0.2	--	--	--	0.2	--	--	0.2	--	--	0.2
	Lead	--	--	8.3	--	--	--	7.6	--	--	7.1	--	--	7.6
	Mercury	--	--	25.2	--	--	--	42.6	--	--	27.7	--	--	26.1
	Vanadium	--	--	6.5	--	--	--	4.8	--	--	4.6	--	--	4.5
Aquatic+Terrestrial Mammals														
Mink - 1	tPCB-mink	--	--	17.9	--	--	--	17.9	--	--	17.9	--	--	17.9
	Barium ²	--	--	0.1	--	--	--	0.1	--	--	0.1	--	--	0.1
	Chromium	--	--	0.2	--	--	--	0.2	--	--	0.2	--	--	0.2
	Cobalt ²	--	--	0.1	--	--	--	0.1	--	--	0.1	--	--	0.1
	Lead	--	--	0.0	--	--	--	0.0	--	--	0.0	--	--	0.0
	Mercury	--	--	0.2	--	--	--	0.2	--	--	0.2	--	--	0.2
	Vanadium	--	--	0.0	--	--	--	0.0	--	--	0.0	--	--	0.0
Raccoon - 1	tPCB	1.9	4.1	1.9	1.9	1.8	1.8	2.2	2.0	2.1	2.1	1.9	1.9	1.9
	Barium ²	--	--	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Chromium	--	--	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Cobalt ²	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	--	--	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	Mercury	--	--	0.5	0.5	0.4	0.4	0.5	0.5	0.6	0.6	0.5	0.5	0.6
	Vanadium	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Raccoon - 2	tPCB	--	--	2.5	--	--	--	2.4	--	--	2.3	--	--	2.4
	Barium ²	--	--	0.0	--	--	--	0.0	--	--	0.0	--	--	0.0
	Chromium	--	--	0.1	--	--	--	0.1	--	--	0.1	--	--	0.1
	Cobalt ²	--	--	0.1	--	--	--	0.0	--	--	0.0	--	--	0.0
	Lead	--	--	0.1	--	--	--	0.0	--	--	0.0	--	--	0.0
	Mercury	--	--	0.2	--	--	--	1.1	--	--	0.2	--	--	0.2
	Vanadium	--	--	0.0	--	--	--	0.0	--	--	0.0	--	--	0.0

Table AD-22. Summary of NOAEL Hazard Quotients by Exposure Unit for Receptors Exposed to Terrestrial + Aquatic Media (Measured Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		Upper AA	Upper AA	C5	C5	C5	C6	C6	C6	Middle AA	Middle AA	C7	C7	C7
Exposure Subarea→		Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment
Receptors↓		NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ		NOAEL HQ	NOAEL HQ	NOAEL HQ
Aquatic+Terrestrial Birds														
Carolina Wren - 2	tPCB-mid	11.6	--	1.3	1.3	--	1.3	1.4	--	1.3	--	1.4	1.4	--
	tPCB-high	125.0	--	13.5	13.9	--	14.2	14.9	--	13.9	--	14.6	15.0	--
	Barium ²	1.6	--	1.5	1.5	--	1.5	1.5	--	1.5	--	1.6	1.5	--
	Chromium	1.5	--	1.4	1.5	--	1.4	1.3	--	1.4	--	1.4	1.5	--
	Cobalt ²	0.5	--	0.5	0.5	--	0.5	0.5	--	0.5	--	0.6	0.5	--
	Lead	9.0	--	8.5	9.2	--	8.6	8.4	--	8.9	--	8.9	8.6	--
	Mercury	31.2	--	17.1	17.4	--	18.4	20.2	--	17.3	--	13.0	14.8	--
	Vanadium	5.3	--	6.0	6.4	--	6.0	4.5	--	5.8	--	6.1	6.2	--
Spotted Sandpiper - 1	tPCB-mid	--	9.6	--	--	1.4	--	--	1.3	--	1.3	--	--	1.3
	tPCB-high	--	103.5	--	--	14.7	--	--	14.3	--	14.5	--	--	14.3
	Barium ²	--	1.4	--	--	1.5	--	--	1.5	--	1.5	--	--	1.3
	Chromium	--	1.0	--	--	1.4	--	--	1.2	--	1.4	--	--	1.0
	Cobalt ²	--	0.2	--	--	0.2	--	--	0.2	--	0.2	--	--	0.1
	Lead	--	7.5	--	--	7.9	--	--	7.6	--	7.9	--	--	7.1
	Mercury	--	28.0	--	--	15.3	--	--	15.8	--	15.4	--	--	13.9
	Vanadium	--	4.6	--	--	5.8	--	--	5.7	--	5.8	--	--	4.2
Aquatic+Terrestrial Mammals														
Mink - 1	tPCB-mink	--	17.9	--	--	15.4	--	--	15.4	--	15.4	--	--	15.1
	Barium ²	--	0.1	--	--	0.1	--	--	0.1	--	0.1	--	--	0.1
	Chromium	--	0.2	--	--	0.2	--	--	0.2	--	0.2	--	--	0.2
	Cobalt ²	--	0.1	--	--	0.1	--	--	0.1	--	0.1	--	--	0.1
	Lead	--	0.0	--	--	0.0	--	--	0.0	--	0.0	--	--	0.0
	Mercury	--	0.2	--	--	0.4	--	--	0.4	--	0.4	--	--	0.2
	Vanadium	--	0.0	--	--	0.0	--	--	0.0	--	0.0	--	--	0.0
Raccoon - 1	tPCB	0.0	1.9	0.7	0.7	0.7	0.7	0.7	0.7	0.0	0.7	0.5	0.6	0.6
	Barium ²	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1
	Chromium	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1
	Cobalt ²	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.0	0.2	0.1	0.2	0.2	0.2	0.1	0.2	0.0	0.2	0.2	0.2	0.2
	Mercury	0.0	0.5	0.3	0.3	0.3	0.3	0.4	0.4	0.0	0.3	0.2	0.3	0.3
	Vanadium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Raccoon - 2	tPCB	--	2.4	--	--	1.8	--	--	1.8	--	1.8	--	--	2.1
	Barium ²	--	0.0	--	--	0.0	--	--	0.0	--	0.0	--	--	0.0
	Chromium	--	0.1	--	--	0.1	--	--	0.1	--	0.1	--	--	0.1
	Cobalt ²	--	0.0	--	--	0.1	--	--	0.1	--	0.1	--	--	0.0
	Lead	--	0.0	--	--	0.1	--	--	0.1	--	0.1	--	--	0.0
	Mercury	--	0.3	--	--	0.2	--	--	0.2	--	0.2	--	--	0.2
	Vanadium	--	0.0	--	--	0.0	--	--	0.0	--	0.0	--	--	0.0

Table AD-22. Summary of NOAEL Hazard Quotients by Exposure Unit for Receptors Exposed to Terrestrial + Aquatic Media (Measured Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C8	C8	C8	C9	C9	C9	C10 ^a	Lower AA	Lower AA
Exposure Subarea→		North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	Riparian Soil & Sediment	Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment
Receptors↓		NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ
Aquatic+Terrestrial Birds										
Carolina Wren - 2	tPCB-mid	1.4	1.4	--	1.4	1.3	--	--	1.4	--
	tPCB-high	15.5	15.0	--	15.2	14.2	--	--	14.6	--
	Barium ²	1.6	1.6	--	1.4	1.5	--	--	1.5	--
	Chromium	1.5	1.4	--	1.3	1.3	--	--	1.4	--
	Cobalt ²	0.5	0.5	--	0.5	0.5	--	--	0.5	--
	Lead	8.7	8.7	--	8.4	8.5	--	--	8.6	--
	Mercury	19.2	13.3	--	14.7	12.9	--	--	13.6	--
	Vanadium	5.5	6.1	--	4.5	5.9	--	--	5.6	--
Spotted Sandpiper - 1	tPCB-mid	--	--	1.3	--	--	1.3	1.3	--	1.3
	tPCB-high	--	--	14.2	--	--	13.9	13.9	--	14.1
	Barium ²	--	--	1.4	--	--	1.3	1.4	--	1.4
	Chromium	--	--	1.0	--	--	1.0	1.1	--	1.0
	Cobalt ²	--	--	0.2	--	--	0.1	0.2	--	0.2
	Lead	--	--	7.0	--	--	7.0	7.2	--	7.1
	Mercury	--	--	15.1	--	--	13.0	14.6	--	14.7
	Vanadium	--	--	4.8	--	--	4.3	5.1	--	4.9
Aquatic+Terrestrial Mammals										
Mink - 1	tPCB-mink	--	--	15.1	--	--	15.1	15.1	--	15.1
	Barium ²	--	--	0.1	--	--	0.1	0.1	--	0.1
	Chromium	--	--	0.2	--	--	0.2	0.2	--	0.2
	Cobalt ²	--	--	0.1	--	--	0.1	0.1	--	0.1
	Lead	--	--	0.0	--	--	0.0	0.0	--	0.0
	Mercury	--	--	0.2	--	--	0.2	0.2	--	0.2
	Vanadium	--	--	0.0	--	--	0.0	0.0	--	0.0
Raccoon - 1	tPCB	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.0	0.6
	Barium ²	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1
	Chromium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1
	Cobalt ²	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.2	0.2	0.2	0.1	0.1	0.1	0.2	0.0	0.2
	Mercury	0.4	0.3	0.4	0.3	0.2	0.3	0.4	0.0	0.4
	Vanadium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Raccoon - 2	tPCB	--	--	2.1	--	--	2.0	2.1	--	2.1
	Barium ²	--	--	0.0	--	--	0.0	0.0	--	0.0
	Chromium	--	--	0.1	--	--	0.1	0.1	--	0.1
	Cobalt ²	--	--	0.0	--	--	0.0	0.0	--	0.0
	Lead	--	--	0.0	--	--	0.0	0.0	--	0.0
	Mercury	--	--	0.2	--	--	0.2	0.2	--	0.2
	Vanadium	--	--	0.0	--	--	0.0	0.0	--	0.0

Table AD-22. Summary of NOAEL Hazard Quotients by Exposure Unit for Receptors Exposed to Terrestrial + Aquatic Media (Measured Tissue)
Anniston PCB Site, Anniston, Alabama

Notes:

NOAEL HQ* ≤ 1
NOAEL HQ* > 1 and ≤ 10
NOAEL HQ* > 10

* All HQs rounded to the nearest whole number

¹ Riparian soil in reaches C1 and

² Barium and cobalt are

AA: assessment area

COPCs: constituent of potential concern

HQ: hazard quotient

mg/kg-day: milligrams per kilogram per day

NOAEL: no observed adverse effect level

tPCB: total polychlorinated biphenyl

TRV: toxicity reference value

--: not available

Exposure Units:

C1: Oxford Lake Park

C2: Backwater Area

C3: Friendship Road to Highway 21

C4: Hwy 21 to Silver Run Road

C5: Silver Run Road to Mitchell Matson Road

C6: Mitchell Matson Road to 2,000 feet upstream of Curry Station Road

C7: Upstream of Curry Station Road to Eastaboga Creek

C8: Eastaboga Creek to Jackson Shoals Dam

C9: Jackson Shoals Dam to Highway 77

C10: Highway 77 Bridge to Lake Logan Martin

Exposure Subareas:

East: East Subarea Floodplain Soil

West: West Subarea Floodplain Soil

North: North Subarea Floodplain Soil

South: South Subarea Floodplain Soil

Central: Central Subarea Floodplain Soil

Table AD-23. Summary of LOAEL Hazard Quotients by Exposure Unit for Aquatic and Terrestrial Mixed Diet Receptors (Measured Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1 ¹	C1 ¹	C1 ¹	C2	C2	C2	C2	C3	C3	C3	C4	C4	C4
Exposure Subarea→		East Floodplain Soil, Riparian Soil & Sediment	West Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Central Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment
Receptors↓		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Aquatic+Terrestrial Birds														
Carolina Wren - 2	tPCB-mid	3.9	8.7	--	3.8	3.6	3.7	--	4.0	4.3	--	3.9	3.8	--
	tPCB-high	42.2	93.4	--	40.6	39.3	39.6	--	42.7	46.6	--	41.6	40.8	--
	Barium ³	--	--	--	0.7	0.8	0.8	--	0.8	0.8	--	0.8	0.8	--
	Chromium	--	--	--	1.5	1.2	1.3	--	1.3	1.8	--	1.6	1.4	--
	Cobalt ³	--	--	--	0.5	0.5	0.5	--	0.5	0.5	--	0.5	0.5	--
	Lead	--	--	--	4.3	4.3	4.5	--	4.5	5.1	--	4.7	4.6	--
	Mercury	--	--	--	10.0	9.3	9.4	--	10.9	11.0	--	10.4	10.5	--
	Vanadium	--	--	--	2.7	2.7	2.5	--	2.6	2.8	--	2.7	2.7	--
Spotted Sandpiper - 1	tPCB-mid	--	--	3.3	--	--	--	3.5	--	--	3.3	--	--	3.2
	tPCB-high	--	--	36.0	--	--	--	37.9	--	--	35.8	--	--	34.2
	Barium ³	--	--	0.8	--	--	--	0.7	--	--	0.7	--	--	0.7
	Chromium	--	--	1.2	--	--	--	0.9	--	--	1.0	--	--	1.1
	Cobalt ³	--	--	0.2	--	--	--	0.2	--	--	0.2	--	--	0.1
	Lead	--	--	4.1	--	--	--	3.8	--	--	3.6	--	--	3.8
	Mercury	--	--	8.4	--	--	--	14.2	--	--	9.2	--	--	8.7
	Vanadium	--	--	3.2	--	--	--	2.4	--	--	2.3	--	--	2.2
Aquatic+Terrestrial Mammals														
Mink - 1	tPCB-mink	--	--	9.0	--	--	--	9.0	--	--	9.0	--	--	9.0
Mink - 1 (Alternate TRV) ²	tPCB-mink	--	--	17.9	--	--	--	17.9	--	--	17.9	--	--	17.9
	Barium ³	--	--	0.0	--	--	--	0.0	--	--	0.0	--	--	0.0
	Chromium	--	--	0.2	--	--	--	0.2	--	--	0.2	--	--	0.2
	Cobalt ³	--	--	0.1	--	--	--	0.1	--	--	0.1	--	--	0.1
	Lead	--	--	0.0	--	--	--	0.0	--	--	0.0	--	--	0.0
	Mercury	--	--	0.1	--	--	--	0.1	--	--	0.1	--	--	0.1
	Vanadium	--	--	0.0	--	--	--	0.0	--	--	0.0	--	--	0.0
Raccoon - 1	tPCB	0.0	0.0	0.7	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.6	0.6	0.7
	Barium ³	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Chromium	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Cobalt ³	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Mercury	0.0	0.0	0.3	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3
	Vanadium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Raccoon - 2	tPCB	--	--	0.8	--	--	--	0.8	--	--	0.8	--	--	0.8
	Barium ³	--	--	0.0	--	--	--	0.0	--	--	0.0	--	--	0.0
	Chromium	--	--	0.1	--	--	--	0.1	--	--	0.1	--	--	0.1
	Cobalt ³	--	--	0.0	--	--	--	0.0	--	--	0.0	--	--	0.0
	Lead	--	--	0.0	--	--	--	0.0	--	--	0.0	--	--	0.0
	Mercury	--	--	0.1	--	--	--	0.5	--	--	0.1	--	--	0.1
	Vanadium	--	--	0.0	--	--	--	0.0	--	--	0.0	--	--	0.0

Table AD-23. Summary of LOAEL Hazard Quotients by Exposure Unit for Aquatic and Terrestrial Mixed Diet Receptors (Measured Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		Upper AA	Upper AA	C5	C5	C5	C6	C6	C6	Middle AA	Middle AA	C7	C7	C7	C8
		Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment
Exposure Subarea→		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Receptors↓		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Aquatic+Terrestrial Birds															
Carolina Wren - 2	tPCB-mid	3.9	--	0.4	0.4	--	0.4	0.5	--	0.4	--	0.5	0.5	--	0.5
	tPCB-high	41.7	--	4.5	4.6	--	4.7	5.0	--	4.6	--	4.9	5.0	--	5.2
	Barium ³	0.8	--	0.8	0.8	--	0.7	0.7	--	0.7	--	0.8	0.8	--	0.8
	Chromium	1.4	--	1.3	1.4	--	1.3	1.2	--	1.3	--	1.4	1.5	--	1.4
	Cobalt ³	0.5	--	0.5	0.5	--	0.5	0.5	--	0.5	--	0.5	0.5	--	0.5
	Lead	4.5	--	4.3	4.6	--	4.3	4.2	--	4.5	--	4.4	4.3	--	4.3
	Mercury	10.4	--	5.7	5.8	--	6.1	6.7	--	5.8	--	4.3	4.9	--	6.4
	Vanadium	2.6	--	3.0	3.2	--	2.9	2.2	--	2.8	--	3.0	3.1	--	2.7
Spotted Sandpiper - 1	tPCB-mid	--	3.2	--	--	0.5	--	--	0.4	--	0.4	--	--	0.4	--
	tPCB-high	--	34.5	--	--	4.9	--	--	4.8	--	4.8	--	--	4.8	--
	Barium ³	--	0.7	--	--	0.8	--	--	0.7	--	0.8	--	--	0.7	--
	Chromium	--	1.0	--	--	1.3	--	--	1.2	--	1.3	--	--	1.0	--
	Cobalt ³	--	0.2	--	--	0.2	--	--	0.2	--	0.2	--	--	0.1	--
	Lead	--	3.7	--	--	3.9	--	--	3.8	--	3.9	--	--	3.5	--
	Mercury	--	9.3	--	--	5.1	--	--	5.3	--	5.1	--	--	4.6	--
	Vanadium	--	2.3	--	--	2.9	--	--	2.8	--	2.9	--	--	2.0	--
Aquatic+Terrestrial Mammals															
Mink - 1	tPCB-mink	--	9.0	--	--	7.7	--	--	7.7	--	7.7	--	--	7.6	--
Mink - 1 (Alternate TRV) ²	tPCB-mink	--	17.9	--	--	15.4	--	--	15.4	--	15.4	--	--	15.1	--
	Barium ³	--	0.0	--	--	0.0	--	--	0.0	--	0.0	--	--	0.0	--
	Chromium	--	0.2	--	--	0.2	--	--	0.2	--	0.2	--	--	0.2	--
	Cobalt ³	--	0.1	--	--	0.1	--	--	0.1	--	0.1	--	--	0.1	--
	Lead	--	0.0	--	--	0.0	--	--	0.0	--	0.0	--	--	0.0	--
	Mercury	--	0.1	--	--	0.2	--	--	0.2	--	0.2	--	--	0.1	--
	Vanadium	--	0.0	--	--	0.0	--	--	0.0	--	0.0	--	--	0.0	--
Raccoon - 1	tPCB	0.0	0.7	0.2	0.2	0.2	0.2	0.2	0.2	0.0	0.2	0.2	0.2	0.2	0.2
	Barium ³	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Chromium	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1
	Cobalt ³	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1
	Mercury	0.0	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.0	0.2	0.1	0.1	0.2	0.2
	Vanadium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Raccoon - 2	tPCB	--	0.8	--	--	0.6	--	--	0.6	--	0.6	--	--	0.7	--
	Barium ³	--	0.0	--	--	0.0	--	--	0.0	--	0.0	--	--	0.0	--
	Chromium	--	0.1	--	--	0.1	--	--	0.1	--	0.1	--	--	0.1	--
	Cobalt ³	--	0.0	--	--	0.0	--	--	0.0	--	0.0	--	--	0.0	--
	Lead	--	0.0	--	--	0.0	--	--	0.0	--	0.0	--	--	0.0	--
	Mercury	--	0.1	--	--	0.1	--	--	0.1	--	0.1	--	--	0.1	--
	Vanadium	--	0.0	--	--	0.0	--	--	0.0	--	0.0	--	--	0.0	--

Table AD-23. Summary of LOAEL Hazard Quotients by Exposure Unit for Aquatic and Terrestrial Mixed Diet Receptors (Measured Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C8	C8	C9	C9	C9	C9	C10 ¹	Upper AA	Upper AA
		South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	Riparian Soil & Sediment	Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	
Exposure Subarea→		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Receptors↓		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Aquatic+Terrestrial Birds										
Carolina Wren - 2	tPCB-mid	0.5	--	0.5	0.4	--	--	0.5	--	
	tPCB-high	5.0	--	5.1	4.7	--	--	4.9	--	
	Barium ³	0.8	--	0.7	0.8	--	--	0.8	--	
	Chromium	1.3	--	1.3	1.3	--	--	1.3	--	
	Cobalt ³	0.5	--	0.5	0.5	--	--	0.5	--	
	Lead	4.4	--	4.2	4.2	--	--	4.3	--	
	Mercury	4.4	--	4.9	4.3	--	--	4.5	--	
	Vanadium	3.0	--	2.2	2.9	--	--	2.8	--	
Spotted Sandpiper - 1	tPCB-mid	--	0.4	--	--	0.4	0.4	--	0.4	
	tPCB-high	--	4.7	--	--	4.6	4.6	--	4.7	
	Barium ³	--	0.7	--	--	0.7	0.7	--	0.7	
	Chromium	--	1.0	--	--	1.0	1.0	--	1.0	
	Cobalt ³	--	0.2	--	--	0.1	0.2	--	0.2	
	Lead	--	3.5	--	--	3.5	3.6	--	3.6	
	Mercury	--	5.0	--	--	4.3	4.9	--	4.9	
	Vanadium	--	2.3	--	--	2.1	2.5	--	2.4	
Aquatic+Terrestrial Mammals										
Mink - 1	tPCB-mink	--	7.6	--	--	7.6	7.6	--	7.6	
Mink - 1 (Alternate TRV) ²	tPCB-mink	--	15.1	--	--	15.1	15.1	--	15.1	
	Barium ³	--	0.0	--	--	0.0	0.0	--	0.0	
	Chromium	--	0.2	--	--	0.2	0.2	--	0.2	
	Cobalt ³	--	0.1	--	--	0.1	0.1	--	0.1	
	Lead	--	0.0	--	--	0.0	0.0	--	0.0	
	Mercury	--	0.1	--	--	0.1	0.1	--	0.1	
	Vanadium	--	0.0	--	--	0.0	0.0	--	0.0	
Raccoon - 1	tPCB	0.2	0.2	0.2	0.2	0.2	0.2	0.0	0.2	
	Barium ³	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	Chromium	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	
	Cobalt ³	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	Lead	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	
	Mercury	0.1	0.2	0.1	0.1	0.1	0.2	0.0	0.2	
	Vanadium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Raccoon - 2	tPCB	--	0.7	--	--	0.7	0.7	--	0.7	
	Barium ³	--	0.0	--	--	0.0	0.0	--	0.0	
	Chromium	--	0.1	--	--	0.1	0.1	--	0.1	
	Cobalt ³	--	0.0	--	--	0.0	0.0	--	0.0	
	Lead	--	0.0	--	--	0.0	0.0	--	0.0	
	Mercury	--	0.1	--	--	0.1	0.1	--	0.1	
	Vanadium	--	0.0	--	--	0.0	0.0	--	0.0	

Table AD-23. Summary of LOAEL Hazard Quotients by Exposure Unit for Aquatic and Terrestrial Mixed Diet Receptors (Measured Tissue)
Anniston PCB Site, Anniston, Alabama

Notes:

NOAEL HQ* ≤ 1
LOAEL HQ* ≤ 1
LOAEL HQ* > 1 and ≤ 10
LOAEL HQ* > 10

* All HQs rounded to the nearest whole number

¹ Riparian soil in reaches C1 and C10 is based on the applicable assessment area (i.e., Upper for C1 and Lower for C10). Reach C10 was not evaluated for terrestrial receptors due to lack of floodplain soil.

² Alternate TRVs were selected from Restum et al. (1998) based on growth. The LOAEL TRV is 0.05 mg/kg-day.

³ Barium and cobalt are COPCs in sediment only. Soil exposures were estimated for these metals so that the complete aquatic + terrestrial dose could be estimated.

AA = assessment area

COPCs: constituent of potential concern

HQ: hazard quotient

mg/kg-day: milligrams per kilogram per day

NOAEL: no observed adverse effect level

tPCB: total polychlorinated biphenyl

TRV: toxicity reference value

--: not available

Exposure Units:

C1: Oxford Lake Park

C2: Backwater Area

C3: Friendship Road to Highway 21

C4: Hwy 21 to Silver Run Road

C5: Silver Run Road to Mitchell Matson Road

C6: Mitchell Matson Road to 2,000 feet upstream of Curry Station Road

C7: Upstream of Curry Station Road to Eastaboga Creek

C8: Eastaboga Creek to Jackson Shoals Dam

C9: Jackson Shoals Dam to Highway 77

C10: Highway 77 Bridge to Lake Logan Martin

Exposure Subareas:

East: East Subarea Floodplain Soil

West: West Subarea Floodplain Soil

North: North Subarea Floodplain Soil

South: South Subarea Floodplain Soil

Central: Central Subarea Floodplain Soil

References:

Restum, J., S. Bursian, J. Giesy, J. Render, W. Helferich, E. Shipp, D. Verbrugge, and R. Aulerich. 1998. Multigenerational study of the effects of consumption of PCB-contaminated carp from Saginaw Bay, Lake Huron, on mink: 1. Effects on mink reproduction, kit growth, and survival, and selected biological parameters. J. Toxicol. Environ. Health Part A 54: 343 375.

Table AD-24. Hazard Quotients Based on Measured Tissue and Critical Tissue Concentrations
Anniston PCB Site, Anniston, Alabama

Assessment Area	Matrix	Detects	Total Samples	Minimum	Maximum	Mean	95% UCL	EPC	Critical Tissue Concentration		Hazard Quotients	
									NOAEL CTC	LOAEL CTC	NOAEL HQ	LOAEL HQ
PCBs												
Upper Assessment Area	Aquatic											
	aquatic plants	9	9	0.414	1.194	0.823	0.978	0.978	NA	NA	NA	NA
	benthic invertebrates	9	9	0.864	3.51	1.70	2.65	2.65	158	422	0.0	0.0
	crayfish	7	7	1.288	3.80	2.46	--	3.80 m	21	57	0.2	0.1
	emergent insects	9	9	0.305	27	16	23	23	21	NA	1.1	NA
	frogs	7	7	2.531	38	15	--	38 m	NA	NA	NA	NA
	mollusks	9	9	5.905	17	12	14	14	1263	1875	0.0	0.0
	snake	2	2	26	167	96	--	167 m	NA	NA	NA	NA
	bottom fish	9	9	34	68	53	61	61	7.0	34	8.7	1.8
	forage fish	27	27	6.77	44	21	24	24	7.0	34	3.4	0.7
	predator fish	9	9	22	175	84	111	111	7.0	34	15.9	3.2
	all fish	45	45	6.77	175	40	50	50	7.0	34	7.2	1.5
	Terrestrial											
	small mammals	14	16	0.319	13.53	3.22	6.36	6.36	10	23	0.6	0.3
	terrestrial insects	0	6	N/A	N/A	N/A	--	N/A m	307	480	NA	NA
	terrestrial plants	18	18	0.033	0.257	0.108	0.145	0.145	NA	NA	NA	NA
	worm	6	9	14	85	40	45	45	78	83	0.6	0.5
Middle Assessment Area	Aquatic											
	aquatic plants	6	9	0.39	1.69	0.867	0.978	0.978	NA	NA	NA	NA
	benthic invertebrates	9	9	1.18	1.99	1.62	1.83	1.83	158	422	0.0	0.0
	crayfish	7	7	0.892	2.62	1.81	--	2.62 m	21	57	0.1	0.0
	emergent insects	9	9	0.31	1.011	0.685	0.806	0.806	21	NA	0.0	NA
	frogs	7	7	2.42	4.58	3.39	--	4.58 m	NA	NA	NA	NA
	mollusks	9	9	4.60	11.88	7.74	9.48	9.48	1263	1875	0.0	0.0
	snake	2	2	19	122	71	--	122 m	NA	NA	NA	NA
	bottom fish	9	9	18	51	32	39	39	7.0	34	5.6	1.1
	forage fish	27	27	18	51	33	36	36	7.0	34	5.1	1.0
	predator fish	9	9	37	127	74	95	95	7.0	34	13.6	2.8
	all fish	45	45	18	127	41	46	46	7.0	34	6.6	1.3
	Terrestrial											
	small mammals	8	11	0.13	20	4	15	15	10	23	1.4	0.7
	terrestrial insects	0	6	N/A	N/A	N/A	--	N/A m	307	480	NA	NA
	terrestrial plants	5	18	0.0344	0.437	0.182	0.13	0.13	NA	NA	NA	NA
	worm	5	9	0.913	11.08	3.95	4.64	4.64	78	83	0.1	0.1
Lower Assessment Area	Aquatic											
	aquatic plants	6	9	0.244	0.631	0.402	0.427	0.427	NA	NA	NA	NA
	benthic invertebrates	9	9	0.614	1.57	0.922	1.09	1.09	158	422	0.0	0.0
	crayfish	9	9	0.235	1.28	0.833	1.05	1.05	21	57	0.0	0.0
	emergent insects	9	9	0.67	1.38	0.957	1.11	1.11	21	NA	0.1	NA
	frogs	2	2	5.29	5.43	5.36	--	5.43 m	NA	NA	NA	NA
	mollusks	9	9	6.076	14	11	12	12	1263	1875	0.0	0.0
	snake	7	7	26	55	39	--	55 m	NA	NA	NA	NA
	bottom fish	9	9	22	84	53	66	66	7.0	34	9.5	1.9
	forage fish	27	27	16	47	31	34	34	7.0	34	4.8	1.0
	predator fish	9	9	42	127	83	102	102	7.0	34	14.5	3.0
	all fish	45	45	16	127	46	53	53	7.0	34	7.5	1.5
	Terrestrial											
	small mammals	8	17	0.195	38	8	15	15	10	23	1.5	0.7
	terrestrial insects	0	6	N/A	N/A	N/A	--	N/A m	307	480	NA	NA
	terrestrial plants	0	18	N/A	N/A	N/A	--	N/A m	NA	NA	NA	NA
	worm	5	9	3.30	7.90	5.59	5.23	5.23	78	83	0.1	0.1

Table AD-24. Hazard Quotients Based on Measured Tissue and Critical Tissue Concentrations
Anniston PCB Site, Anniston, Alabama

Assessment Area	Matrix	Detects	Total Samples	Minimum	Maximum	Mean	95% UCL	EPC	Critical Tissue Concentration		Hazard Quotients	
									NOAEL CTC	LOAEL CTC	NOAEL HQ	LOAEL HQ
Mercury												
Upper Assessment Area	Aquatic											
	aquatic plants	7	9	0.0457	0.113	0.0787	0.0859	0.0859	NA	NA	NA	NA
	benthic invertebrates	9	9	0.128	0.311	0.192	0.232	0.232	56	90	0.0	0.0
	crayfish	6	7	0.115	0.19	0.136	--	0.19 m	0.92	16	0.2	0.0
	emergent insects	9	9	0.105	0.417	0.25	0.321	0.321	24	NA	0.0	NA
	frogs	7	7	0.122	1.03	0.646	--	1.03 m	NA	NA	NA	NA
	mollusks	9	9	0.14	0.377	0.24	0.292	0.292	7.5	150	0.0	0.0
	snake	2	2	0.609	0.875	0.742	--	0.875 m	NA	NA	NA	NA
	bottom fish	9	9	0.262	0.75	0.463	0.567	0.567	0.85	0.93	0.7	0.6
	forage fish	26	27	0.0607	0.277	0.165	0.182	0.182	0.85	0.93	0.2	0.2
	predator fish	9	9	0.856	1.95	1.24	1.47	1.47	0.85	0.93	1.7	1.6
	all fish	44	45	0.0607	1.949	0.446	0.736	0.736	0.85	0.93	0.9	0.8
	Terrestrial											
	small mammals	8	16	0.0203	0.0906	0.0526	0.0468	0.0468	NA	NA	NA	NA
	terrestrial insects	4	6	0.0207	0.0377	0.0314	--	0.0377 m	NA	NA	NA	NA
	terrestrial plants	0	18	N/A	N/A	N/A	--	N/A m	NA	NA	NA	NA
	worm	9	9	0.11	7.36	3.76	5.58	5.58	15	NA	0.4	NA
Middle Assessment Area	Aquatic											
	aquatic plants	5	9	0.0625	0.376	0.134	0.258	0.258	NA	NA	NA	NA
	benthic invertebrates	9	9	0.22	0.444	0.301	0.35	0.35	56	90	0.0	0.0
	crayfish	7	7	0.119	0.206	0.167	--	0.206 m	0.92	16	0.2	0.0
	emergent insects	9	9	0.0337	0.318	0.134	0.188	0.188	24	NA	0.0	NA
	frogs	7	7	0.235	1.76	0.566	--	1.76 m	NA	NA	NA	NA
	mollusks	9	9	0.136	0.424	0.3	0.36	0.36	7.5	150	0.0	0.0
	snake	2	2	0.54	1.71	1.12	--	1.71 m	NA	NA	NA	NA
	bottom fish	9	9	0.157	0.466	0.326	0.399	0.399	0.85	0.93	0.5	0.4
	forage fish	27	27	0.239	0.761	0.471	0.512	0.512	0.85	0.93	0.6	0.6
	predator fish	9	9	0.97	1.97	1.40	1.59	1.59	0.85	0.93	1.9	1.7
	all fish	45	45	0.16	1.97	0.63	0.74	0.74	0.85	0.93	0.9	0.8
	Terrestrial											
	small mammals	5	11	0.02	0.28	0.13	0.12	0.12	NA	NA	NA	NA
	terrestrial insects	0	6	N/A	N/A	N/A	--	N/A m	NA	NA	NA	NA
	terrestrial plants	2	18	0.02	0.06	0.04	--	0.06 m	NA	NA	NA	NA
	worm	9	9	0.53	4.40	1.31	3.16	3.16	15	NA	0.2	NA
Lower Assessment Area	Aquatic											
	aquatic plants	7	9	0.03	0.09	0.06	0.07	0.07	NA	NA	NA	NA
	benthic invertebrates	9	9	0.25	0.70	0.38	0.48	0.48	56	90	0.0	0.0
	crayfish	8	9	0.11	0.29	0.19	0.23	0.23	0.92	16	0.3	0.0
	emergent insects	9	9	0.08	0.25	0.17	0.21	0.21	24	NA	0.0	NA
	frogs	2	2	0.32	0.56	0.44	--	0.56 m	NA	NA	NA	NA
	mollusks	9	9	0.52	1.01	0.77	0.86	0.86	7.5	150	0.1	0.0
	snake	7	7	0.42	2.12	1.24	--	2.12 m	NA	NA	NA	NA
	bottom fish	9	9	0.35	1.41	0.68	0.90	0.90	0.85	0.93	1.1	1.0
	forage fish	27	27	0.21	1.09	0.57	0.65	0.65	0.85	0.93	0.8	0.7
	predator fish	9	9	1.47	3.04	2.04	2.35	2.35	0.85	0.93	2.8	2.5
	all fish	45	45	0.21	3.04	0.89	1.07	1.07	0.85	0.93	1.3	1.2
	Terrestrial											
	small mammals	5	17	0.05	0.75	0.24	0.17	0.17	NA	NA	NA	NA
	terrestrial insects	0	6	N/A	N/A	N/A	--	N/A m	NA	NA	NA	NA
	terrestrial plants	0	18	N/A	N/A	N/A	--	N/A m	NA	NA	NA	NA
	worm	9	9	0.14	3.71	1.58	2.39	2.39	15	NA	0.2	NA

Table AD-24. Hazard Quotients Based on Measured Tissue and Critical Tissue Concentrations
Anniston PCB Site, Anniston, Alabama

Assessment Area	Matrix	Detects	Total Samples	Minimum	Maximum	Mean	95% UCL	EPC	Critical Tissue Concentration		Hazard Quotients	
									NOAEL CTC	LOAEL CTC	NOAEL HQ	LOAEL HQ
Lead												
Upper Assessment Area	Aquatic											
	bottom fish	1	1	0.375	0.375	0.375	--	0.375 m	9.3	15	0.0	0.0
	forage fish	2	4	0.195	2.07	1.13	--	2.07 m	9.3	15	0.2	0.1
	predator fish	--	--	--	--	--	--	-- m	9.3	15	NA	NA
	all fish	3	5	0.195	2.07	0.88	--	2.07 m	9.3	15	0.2	0.1
Middle Assessment Area	Aquatic											
	bottom fish	1	1	0.265	0.265	0.265	--	0.265 m	9.3	15	0.0	0.0
	forage fish	--	--	--	--	--	--	-- m	9.3	15	NA	NA
	predator fish	1	1	0.0959	0.0959	0.0959	--	0.0959 m	9.3	15	0.0	0.0
	all fish	2	2	0.0959	0.265	0.18	--	0.265 m	9.3	15	0.0	0.0
Lower Assessment Area	Aquatic											
	bottom fish	1	2	0.216	0.216	0.216	--	0.216 m	9.3	15	0.0	0.0
	forage fish	2	2	0.155	0.177	0.166	--	0.177 m	9.3	15	0.0	0.0
	predator fish	1	3	0.214	0.214	0.214	--	0.214 m	9.3	15	0.0	0.0
	all fish	4	7	0.155	0.216	0.191	--	0.216 m	9.3	15	0.0	0.0
Vanadium												
Upper Assessment Area	Aquatic											
	bottom fish	0	1	N/A	N/A	N/A	--	N/A m	0.09	2.1	NA	NA
	forage fish	1	4	1.188	1.19	1.19	--	1.19 m	0.09	2.1	13.2	0.6
	predator fish	--	--	--	--	--	--	-- m	0.09	2.1	NA	NA
	all fish	1	5	1.188	1.19	1.19	--	1.19 m	0.09	2.1	13.2	0.6
Middle Assessment Area	Aquatic											
	bottom fish	0	1	N/A	N/A	N/A	--	N/A m	0.09	2.1	NA	NA
	forage fish	--	--	--	--	--	--	-- m	0.09	2.1	NA	NA
	predator fish	0	1	N/A	N/A	N/A	--	N/A m	0.09	2.1	NA	NA
	all fish	0	2	N/A	N/A	N/A	--	N/A m	0.09	2.1	NA	NA
Lower Assessment Area	Aquatic											
	bottom fish	1	2	0.258	0.258	0.258	--	0.258 m	0.09	2.1	2.9	0.1
	forage fish	0	2	N/A	N/A	N/A	--	N/A m	0.09	2.1	NA	NA
	predator fish	1	3	0.148	0.148	0.148	--	0.148 m	0.09	2.1	1.6	0.1
	all fish	2	7	0.148	0.258	0.203	--	0.258 m	0.09	2.1	2.9	0.1

Notes:

All units in mg/kg dw

CTC: critical tissue concentration

EPC: exposure point concentration

HQ: hazard quotient

LOAEL: lowest observed adverse effect level

m: maximum

N/A: Measured tissue concentrations were not detected

NA: CTC not available

NOAEL: no observed adverse effect level

PCB: polychlorinated biphenyl

UCL: upper confidence limit on arithmetic mean

0 values indicated HQ is <1

Tissue CTCs are presented in Table 5-2b.

NOAEL and LOAEL HQ < 1*

NOAEL HQ > 1 and LOAEL HQ < 1*

NOAEL or LOAEL HQ > 1 and < 10*

LOAEL HQ > 10*

* All HQs rounded to the nearest whole number

Table AD-25. Summary of LOAEL Hazard Quotients by Exposure Unit for Aquatic and Terrestrial Mixed Diet Receptors (Modeled Tissue) Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1 ¹	C1 ¹	C1 ¹	C2	C2	C2	C2	C3	C3	C3	C4	C4	C4	Upper AA
Exposure Subarea→		East Floodplain Soil, Riparian Soil & Sediment	West Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Central Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	Floodplain Soil, Riparian Soil & Sediment
Receptors↓		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Aquatic+Terrestrial Birds															
Carolina Wren - 2	tPCB-mid	6	37	--	3	3	3	--	2	5	--	2	2	--	3
	tPCB-high	64	402	--	37	28	31	--	26	52	--	23	17	--	28
	Barium ³	--	--	--	1	1	1	--	0	0	--	0	0	--	0
	Chromium	--	--	--	2	1	1	--	1	2	--	2	1	--	1
	Cobalt ³	--	--	--	0	1	1	--	1	1	--	0	0	--	0
	Lead	--	--	--	1	1	2	--	1	2	--	1	1	--	1
	Mercury	--	--	--	43	42	42	--	6	7	--	5	5	--	10
	Vanadium	--	--	--	3	3	3	--	3	3	--	3	2	--	3
Spotted Sandpiper - 1	tPCB-mid	--	--	4	--	--	--	11	--	--	7	--	--	3	--
	tPCB-high	--	--	48	--	--	--	116	--	--	81	--	--	35	--
	Barium ³	--	--	1	--	--	--	1	--	--	0	--	--	1	--
	Chromium	--	--	2	--	--	--	1	--	--	1	--	--	2	--
	Cobalt ³	--	--	0	--	--	--	0	--	--	0	--	--	0	--
	Lead	--	--	4	--	--	--	2	--	--	1	--	--	2	--
	Mercury	--	--	7	--	--	--	9	--	--	13	--	--	9	--
	Vanadium	--	--	6	--	--	--	3	--	--	3	--	--	3	--
Aquatic+Terrestrial Mammals															
Mink - 1	tPCB-mink	--	--	48	--	--	--	32	--	--	6	--	--	9	--
Mink - 1 (Alternate TRV) ²	tPCB-mink	--	--	97	--	--	--	64	--	--	12	--	--	17	--
	Barium ³	--	--	0	--	--	--	0	--	--	0	--	--	0	--
	Chromium	--	--	0	--	--	--	0	--	--	0	--	--	0	--
	Cobalt ³	--	--	0	--	--	--	0	--	--	0	--	--	0	--
	Lead	--	--	0	--	--	--	0	--	--	0	--	--	0	--
	Mercury	--	--	0	--	--	--	1	--	--	0	--	--	0	--
	Vanadium	--	--	0	--	--	--	0	--	--	0	--	--	0	--
Raccoon - 1	tPCB	2	12	2	1	1	1	3	1	2	1	1	1	1	0
	Barium ³	--	--	0	0	0	0	0	0	0	0	0	0	0	0
	Chromium	--	--	0	0	0	0	0	0	0	0	0	0	0	0
	Cobalt ³	--	--	0	0	0	0	0	0	0	0	0	0	0	0
	Lead	--	--	0	0	0	0	0	0	0	0	0	0	0	0
	Mercury	--	--	0	0	0	0	0	0	0	0	0	0	0	0
	Vanadium	--	--	0	0	0	0	0	0	0	0	0	0	0	0
Raccoon - 2	tPCB	--	--	5	--	--	--	4	--	--	1	--	--	1	--
	Barium ³	--	--	0	--	--	--	0	--	--	0	--	--	0	--
	Chromium	--	--	0	--	--	--	0	--	--	0	--	--	0	--
	Cobalt ³	--	--	0	--	--	--	0	--	--	0	--	--	0	--
	Lead	--	--	0	--	--	--	0	--	--	0	--	--	0	--
	Mercury	--	--	0	--	--	--	1	--	--	0	--	--	0	--
	Vanadium	--	--	0	--	--	--	0	--	--	0	--	--	0	--

Table AD-25. Summary of LOAEL Hazard Quotients by Exposure Unit for Aquatic and Terrestrial Mixed Diet Receptors (Modeled Tissue) Anniston PCB Site, Anniston, Alabama

Exposure Unit→		Upper AA	C5	C5	C5	C6	C6	C6	Middle AA	Middle AA	C7	C7	C7	C8	C8	C8
Exposure Subarea→		Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment
Receptors↓		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Aquatic+Terrestrial Birds																
Carolina Wren - 2	tPCB-mid	--	0	0	--	0	0	--	0	--	0	0	--	1	0	--
	tPCB-high	--	4	4	--	3	5	--	4	--	3	4	--	6	5	--
	Barium ³	--	1	1	--	1	1	--	1	--	0	0	--	0	0	--
	Chromium	--	2	2	--	2	2	--	2	--	1	1	--	1	1	--
	Cobalt ³	--	1	1	--	1	1	--	1	--	1	0	--	0	1	--
	Lead	--	2	2	--	2	2	--	2	--	1	1	--	1	1	--
	Mercury	--	3	3	--	4	6	--	3	--	3	5	--	8	3	--
	Vanadium	--	6	6	--	6	4	--	5	--	3	3	--	2	3	--
Spotted Sandpiper - 1	tPCB-mid	3	--	--	1	--	--	1	--	1	--	--	1	--	--	1
	tPCB-high	37	--	--	10	--	--	8	--	9	--	--	9	--	--	8
	Barium ³	1	--	--	1	--	--	1	--	1	--	--	0	--	--	0
	Chromium	1	--	--	2	--	--	2	--	2	--	--	1	--	--	1
	Cobalt ³	0	--	--	1	--	--	1	--	1	--	--	0	--	--	0
	Lead	2	--	--	3	--	--	2	--	3	--	--	1	--	--	1
	Mercury	8	--	--	4	--	--	5	--	4	--	--	7	--	--	11
	Vanadium	3	--	--	5	--	--	5	--	5	--	--	2	--	--	4
Aquatic+Terrestrial Mammals																
Mink - 1	tPCB-mink	14	--	--	3	--	--	1	--	3	--	--	3	--	--	3
Mink - 1 (Alternate TRV) ²	tPCB-mink	27	--	--	6	--	--	2	--	6	--	--	6	--	--	6
	Barium ³	0	--	--	0	--	--	0	--	0	--	--	0	--	--	0
	Chromium	0	--	--	0	--	--	0	--	0	--	--	0	--	--	0
	Cobalt ³	0	--	--	0	--	--	0	--	0	--	--	0	--	--	0
	Lead	0	--	--	0	--	--	0	--	0	--	--	0	--	--	0
	Mercury	0	--	--	0	--	--	0	--	0	--	--	0	--	--	0
	Vanadium	0	--	--	0	--	--	0	--	0	--	--	0	--	--	0
Raccoon - 1	tPCB	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Barium ³	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Chromium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cobalt ³	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Lead	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mercury	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Vanadium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Raccoon - 2	tPCB	1	--	--	0	--	--	0	--	0	--	--	0	--	--	0
	Barium ³	0	--	--	0	--	--	0	--	0	--	--	0	--	--	0
	Chromium	0	--	--	0	--	--	0	--	0	--	--	0	--	--	0
	Cobalt ³	0	--	--	0	--	--	0	--	0	--	--	0	--	--	0
	Lead	0	--	--	0	--	--	0	--	0	--	--	0	--	--	0
	Mercury	0	--	--	0	--	--	0	--	0	--	--	0	--	--	0
	Vanadium	0	--	--	0	--	--	0	--	0	--	--	0	--	--	0

Table AD-25. Summary of LOAEL Hazard Quotients by Exposure Unit for Aquatic and Terrestrial Mixed Diet Receptors (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C9	C9	C9	C10 ¹	Lower AA	Lower AA
Exposure Subarea→		North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	Riparian Soil & Sediment	Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment
Receptors↓		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Aquatic+Terrestrial Birds							
Carolina Wren - 2	tPCB-mid	0	0	--	--	0	--
	tPCB-high	3	1	--	--	4	--
	Barium ³	0	0	--	--	0	--
	Chromium	1	1	--	--	1	--
	Cobalt ³	0	1	--	--	1	--
	Lead	1	1	--	--	1	--
	Mercury	5	3	--	--	4	--
	Vanadium	2	3	--	--	3	--
Spotted Sandpiper - 1	tPCB-mid	--	--	1	1	--	1
	tPCB-high	--	--	7	6	--	6
	Barium ³	--	--	0	0	--	0
	Chromium	--	--	1	1	--	1
	Cobalt ³	--	--	0	0	--	0
	Lead	--	--	1	1	--	1
	Mercury	--	--	5	9	--	9
	Vanadium	--	--	2	4	--	4
Aquatic+Terrestrial Mammals							
Mink - 1	tPCB-mink	--	--	1	2	--	3
Mink - 1 (Alternate TRV) ²	tPCB-mink	--	--	3	5	--	6
	Barium ³	--	--	0	0	--	0
	Chromium	--	--	0	0	--	0
	Cobalt ³	--	--	0	0	--	0
	Lead	--	--	0	0	--	0
	Mercury	--	--	0	0	--	0
	Vanadium	--	--	0	0	--	0
Raccoon - 1	tPCB	0	0	0	0	0	0
	Barium ³	0	0	0	0	0	0
	Chromium	0	0	0	0	0	0
	Cobalt ³	0	0	0	0	0	0
	Lead	0	0	0	0	0	0
	Mercury	0	0	0	0	0	0
	Vanadium	0	0	0	0	0	0
Raccoon - 2	tPCB	--	--	0	0	--	0
	Barium ³	--	--	0	0	--	0
	Chromium	--	--	0	0	--	0
	Cobalt ³	--	--	0	0	--	0
	Lead	--	--	0	0	--	0
	Mercury	--	--	0	0	--	0
	Vanadium	--	--	0	0	--	0

Table AD-25. Summary of LOAEL Hazard Quotients by Exposure Unit for Aquatic and Terrestrial Mixed Diet Receptors (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Notes:

NOAEL HQ* ≤ 1
LOAEL HQ* ≤ 1
LOAEL HQ* > 1 and ≤ 10
LOAEL HQ* > 10

* All HQs rounded to the nearest whole number

¹ Riparian soil in reaches C1 and C10 is based on the applicable assessment area (i.e., Upper for C1 and Lower for C10). Reach C10 was not evaluated for terrestrial receptors due to lack of floodplain soil.

² Alternate TRVs were selected from Restum et al. (1998) based on growth. The LOAEL TRV is 0.05 mg/kg-day.

³ Barium and cobalt are COPCs in sediment only. Soil exposures were estimated for these metals so that the complete aquatic + terrestrial dose could be estimated.

AA: assessment area

COPCs: constituent of potential concern

HQ: hazard quotient

mg/kg-day: milligrams per kilogram per day

NOAEL: no observed adverse effect level

tPCB: total polychlorinated biphenyl

TRV: toxicity reference value

--: not available

Exposure Units:

C1: Oxford Lake Park

C2: Backwater Area

C3: Friendship Road to Highway 21

C4: Hwy 21 to Silver Run Road

C5: Silver Run Road to Mitchell Matson Road

C6: Mitchell Matson Road to 2,000 feet upstream of Curry Station Road

C7: Upstream of Curry Station Road to Eastaboga Creek

C8: Eastaboga Creek to Jackson Shoals Dam

C9: Jackson Shoals Dam to Highway 77

C10: Highway 77 Bridge to Lake Logan Martin

Exposure Subareas:

East: East Subarea Floodplain Soil

West: West Subarea Floodplain Soil

North: North Subarea Floodplain Soil

South: South Subarea Floodplain Soil

Central: Central Subarea Floodplain Soil

References:

Restum, J., S. Bursian, J. Giesy, J. Render, W. Helferich, E. Shipp, D. Verbrugge, and R. Aulerich. 1998. Multigenerational study of the effects of consumption of PCB-contaminated carp from Saginaw Bay, Lake Huron, on mink: 1. Effects on mink reproduction, kit growth, and survival, and selected biological parameters. J. Toxicol. Environ. Health Part A 54: 343 375.

Table AD-26. Site-Specific PCB and Mercury Toxicity Thresholds for Benthic Invertebrates Anniston PCB Site, Anniston Alabama

Species ^d	Endpoint Type	Endpoint	Site-Specific PCB Toxicity Thresholds (mg PCB/kg dw sed)				Site-Specific PCB Toxicity Thresholds (mg PCB/kg OC)			Site-Specific Mercury Toxicity Thresholds (mg/kg dw sed)		
			EC0 ^b	EC0* ^a	EC10* ^a	EC20* ^a	EC0* ^a	EC10* ^a	EC20* ^a	EC0* ^a	EC10* ^a	EC20* ^a
<i>C. dilutus</i>	Growth	13-d ash-free dry weight	0.05 ^c	6.0	17	32	322	880	1610	1.6	5.3	7.6
		13-d biomass per replicate chamber	0.05 ^c	6.0	14	23	346	711	1170	2.3	5.0	6.6
<i>H. azteca</i>		28-d biomass per replicate chamber	0.05 ^c	1.7	25	58	UND ^e	4880	7600	0.90	4.0	7.5
42-d biomass per replicate chamber		0.05 ^c	18	40	68	1220	2520	3930	4.1	6.9	10	
<i>C. dilutus</i>	Reproduction	Emergence percentage	0.05 ^c	2.0	6.8	14	170	465	873	0.94	3.0	4.7
		No. of egg cases	0.05 ^c	21	31	46	1160	1660	2310	3.1	4.5	6.3
		Total young	0.05 ^c	69	89	114	3390	4150	5080	11	12	14
		Young/egg case	18 ^b	209	260	324	8390	9890	11700	18	20	22
<i>H. azteca</i>		42-d total young	0.05 ^c	9.2	13	18	453	627	866	2.2	2.8	3.5
		42-d young/female	0.05 ^c	1.5	3.0	5.4	102	181	302	0.50	0.84	1.3
		42-d young/female (normalized to 42-d survival)	0.05 ^c	1.4	2.6	4.4	73	120	195	0.41	0.66	1.0
<i>C. dilutus</i>	Survival	13-d survival	0.05 ^c	14	76	123	1000	3710	5570	3.6	9.2	13
Adult survival time		1 ^b	98	186	323	4580	8320	13900	-- ^f	-- ^f	-- ^f	
<i>H. azteca</i>		28-d survival	0.05 ^c	UND ^e	105	152	UND ^e	4636	6390	2.4	8.1	11
		42-d survival	0.05 ^c	31	127	165	2380	5250	6690	5.6	10	13

Notes:

^a EC0*, EC10*, and EC20* are the regression-predicted PCB concentrations (measured as Aroclors) that would cause an additional 0%, 10%, or 20% effect beyond the lowest response measured in the reference sediments (i.e., 1×, 0.9×, and 0.8× the response at the “bottom” of the reference envelope).

^b EC0 is the PCB concentration at which the average reference-sediment response would be predicted to occur, when projected onto the concentration-response curve generated for that endpoint with OU-4 sediments.

^c EC0 was set at a concentration of 0.05 (the mean reference sediment concentration) when the average reference-sediment response was greater than the regression-predicted maximum control-normalized response.

^d Values not calculated for 7 endpoints because a decreasing concentration-response relationship did not exist for the endpoint (see Table C-1 in Appendix C). In addition, values for the adult biomass endpoint for *C. dilutus* are not included as site-specific toxicity thresholds because of the high uncertainty associated with the fact that adult ash-free dry weight was not measured.

^e UND: undefined EC0*, because the lowest control-normalized reference-sediment response (88.8%) was greater than the regression-predicted maximum control-normalized response (85.9%).

^f Value not calculated because a decreasing concentration-response relationship did not exist for the endpoint.

d: day

mg/kg dw sed: milligrams per kilogram dry weight sediment

PCB: polychlorinated biphenyl

OC: organic carbon

Table AD-27. ECx estimates for 42d young/female (Normalised to survival and as % control). Analysis by TRAP ver 1.30a, 2 parameter threshold sigmoid model.
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

Non-Detects at Method Detection Limit (MDL)						% Change (MDL vs 0.5 MDL)	Non-Detects at 0.5 Method Detection Limit (MDL)					
p	Xp	95% LCL	95% UCL	Xp SE	Log Xp		p	Xp	95% LCL	95% UCL	Xp SE	Log Xp
50	18.915	6.9286	51.639	0.21386	1.2768	11%	50	21.253	7.7185	58.52	0.21568	1.3274
20	3.1084	0.35521	27.202	0.4619	0.49254	16%	20	3.6838	0.40014	33.914	0.4727	0.5663
10	1.251	5.62E-02	27.868	0.66086	9.73E-02	18%	10	1.523	6.16E-02	37.627	0.68291	0.18269
5	0.65731	1.24E-02	34.856	0.84555	-0.18223	19%	5	0.81554	1.32E-02	50.5	0.87857	-8.86E-02
0	0.139	2.82E-04	68.504	1.3203	-0.857	23%	0	0.18055	2.73E-04	119.41	1.3829	-0.74341

UCL = Upper Confidence Limit

LCL = Lower Confidence Limit

BERA = Baseline Ecological Risk Assessment

TRAP ver 1.30 = US EPA Toxicity Relationship Analysis Program version 1.30

Table AD-28. ECx estimates for 42d Survival. Analysis by TRAP ver 1.30a, 3 parameter threshold sigmoid model.
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

Non-Detects at Method Detection Limit (MDL)						% Change (MDL vs 0.5 MDL)	Non-Detects at 0.5 Method Detection Limit (MDL)					
p	Xp	95%LCL	95%UCL	Xp SE	Log Xp		p	Xp	95%LCL	95%UCL	Xp SE	Log Xp
50	261.86	197.09	347.92	6.05E-02	2.4181	0%	50	261.86	197.09	347.92	6.05E-02	2.4181
20	172.03	103.57	285.77	0.10806	2.2356	0%	20	172.03	103.57	285.77	0.10806	2.2356
10	139.21	68.23	284.02	0.15185	2.14	0%	10	139.21	68.23	284.02	0.15185	2.1437
5	119.85	45.64	314.75	0.2056	2.0786	0%	5	119.85	45.64	314.75	0.2056	2.08
0	83.494	4.82	1446.6	0.60735	1.9217	0%	0	83.494	4.82	1446.6	0.60735	1.9217

UCL = Upper Confidence Limit

LCL = Lower Confidence Limit

BERA = Baseline Ecological Risk Assessment

TRAP ver 1.30 = US EPA Toxicity Relationship Analysis Program version 1.30

Table AD-29. ECx estimates for 42d biomass per replicate chamber. Analysis by TRAP ver 1.30a, 3 parameter threshold sigmoid model.
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

Non-Detects at Method Detection Limit (MDL)						% Change (MDL vs 0.5 MDL)	Non-Detects at 0.5 Method Detection Limit (MDL)					
p	Xp	95%LCL	95%UCL	Xp SE	Log Xp		p	Xp	95%LCL	95%UCL	Xp SE	Log Xp
50	348.96	249.23	488.61	7.17E-02	2.5428	0%	50	348.96	249.23	488.61	7.17E-02	2.5428
20	279.89	152.24	514.59	0.12967	2.447	0%	20	279.89	152.24	514.59	0.12967	2.447
10	250.45	110.47	567.78	0.17429	2.3987	0%	10	250.45	110.47	567.78	0.17429	2.3987
5	231.51	80.897	662.56	0.2239	2.3646	0%	5	231.51	80.897	662.56	0.2239	2.3646
0	191.5	15.062	2434.8	0.54145	2.2822	0%	0	191.5	15.062	2434.8	0.54145	2.2822

UCL = Upper Confidence Limit

LCL = Lower Confidence Limit

BERA = Baseline Ecological Risk Assessment

TRAP ver 1.30 = US EPA Toxicity Relationship Analysis Program version 1.30

Table AD-30. Summary of Studies Proposed for Derivation of Critical Tissue Concentrations for Benthic Invertebrates
Slide 15 from the Powerpoint Presentation, May 16 2017 Meeting
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

Test Organism	Organism Group	Chemical Form	Exposure Route	Effect Group	Endpoint	TRV	Reported Total PCB or Hg CTC (mg/kg)	Basis	Total PCB or Hg (mg/kg ww)	Percent solids	Total PCB or Hg (mg/kg dw)	Reference
<i>Hexagenia spp.</i>	emergent insects	PCB	sediment	MOR	36% mortality	LOEC	1.4	ww	1.4	0.31	5	Van Geest et al. 2011
<i>Penaeus duorarum</i>	crustacean	Aroclor 1254	water	MOR	72% mortality	LOEC	16 ^C	NS	NA	0.28	16	Duke et al. 1970
<i>Culex tarsalis</i>	emergent insects	Aroclor 1254	water	GRO	no metamorphosis	LOEC	27	dw	NA		27	Sanders and Chandler 1972
<i>Crassostrea virginica</i>	mollusc	Aroclor 1254	water	GRO	41% decrease in growth rate	LOEC	3.3	NS	NA	0.08	3.3	Duke et al. 1970
<i>Gammarus pseudolimnaeus</i>	epibenthic	Aroclor 1242	water	REP	complete reproductive failure	LOEC	316	NS	NA	0.18	316	Nebeker and Puglisi 1974
<i>Lumbriculus variegatus</i>	oligochaete	Congener 1	diet	GRO, MOR	survival, biomass	LOEC	64.7 ^A	ww	64.7	0.17	381	Fisher et al. 1999
<i>Lumbriculus variegatus</i>	oligochaete	Congener 47	diet	GRO, MOR	survival, biomass	LOEC	112.7	ww	112.7	0.17	663	Fisher et al. 1999
<i>Lumbriculus variegatus</i>	oligochaete	Congener 15	diet	GRO, MOR	survival, biomass	LOEC	118.7	ww	118.7	0.17	698	Fisher et al. 1999
<i>Lumbriculus variegatus</i>	oligochaete	Congener 153	diet	GRO, MOR	survival, biomass	LOEC	126.3	ww	126.3	0.17	743	Fisher et al. 1999
<i>Crassostrea virginica</i>	mollusc	Aroclor 1254	water	GRO	Sign. decrease in growth rate (shell height and in-water weight)	LOEC	150	ww	150	0.08	1875	Lowe et al. 1972
<i>Orconectes nais</i>	crustacean	Aroclor 1254	water	MOR	no effect	NOEC	0.2	dw	NA	0.28	0.2	Sanders and Chandler 1972
<i>Hexagenia spp.</i>	emergent insects	PCB	sediment	MOR	survival	NOEC	0.59	ww	0.59	0.31	2	van Geest et al. 2011
<i>Pteronarcys dorsata</i>	emergent insects	Aroclor 1254	water	MOR	no effect	NOEC	7	dw	NA		7	Sanders and Chandler 1972
<i>Palaemonetes kadiakensis</i>	crustacean	Aroclor 1254	water	MOR	no effect	NOEC	16 ^D	dw	NA	0.28	16	Sanders and Chandler 1972
<i>Callinectes sapidus</i>	crustacean	Aroclor 1254	water	MOR	5% mortality; also 5% mortality in c	NOEC	23	NS	NA	0.28	23	Duke et al. 1970
<i>Gammarus pseudolimnaeus</i>	epibenthic	Aroclor 1242	water	REP	no effect	NOEC	76	NS	NA	0.18	76	Nebeker and Puglisi 1974
<i>Hyalella azteca</i>	epibenthic	Aroclor 1242	water	GRO, REP, MOR	survival, weight, # of young	NOEC	28	ww	28	0.18	156	Borgmann et al. 1990
<i>Lumbriculus variegatus</i>	oligochaete	Congener 1	diet	GRO, MOR	survival, biomass	NOEC	33.2	ww	33.2	0.17	195	Fisher et al. 1999
<i>Lumbriculus variegatus</i>	oligochaete	Congener 47	diet	GRO, MOR	survival, biomass	NOEC	49.3	ww	49.3	0.17	290	Fisher et al. 1999
<i>Lumbriculus variegatus</i>	oligochaete	Congener 15	diet	GRO, MOR	survival, biomass	NOEC	63.1 ^B	ww	63.1	0.17	371	Fisher et al. 1999
<i>Lumbriculus variegatus</i>	oligochaete	Congener 153	diet	GRO, MOR	survival, biomass	NOEC	64.9	ww	64.9	0.17	382	Fisher et al. 1999
<i>Tubifex tubifex</i>	aquatic worms	Hg	sediment	GRO, REP	growth rate, total young	LOEC	89.6 nmol/g	dw	NA	NA	18	Mendez-Fernandez et al. 2014
<i>Rangia cuneata</i>	mollusc	Hg	water	MOR	survival	LOEC	6	ww	6	0.08	75	Dillon 1977
<i>Hyalella azteca</i>	Epibenthic	Hg	water	MOR	survival	LOEC	90	dw	NA	NA	90	Borgmann et al. 1993
<i>Tubifex tubifex</i>	aquatic worms	Hg	sediment	GRO, REP	growth rate, total young	NOEC	63.5 nmol/g	dw	NA	NA	12.7	Mendez-Fernandez et al. 2014
<i>Hexagenia rigida</i> +A27:M28	emergent	CH3HgCl	water	GRO	growth	NOEC	7.48	ww	7.48	0.31	24	Sauter et al. 1993
<i>Hyalella azteca</i>	Epibenthic	Hg	water	MOR	survival	NOEC	56	dw	NA	NA	56	Borgmann et al. 1993

Shading indicates studies proposed for derivation of CTCs by Arcadis, 5-16-17 meeting Slide 15

Blue shading indicates study recommended for TRV derivation by EPA

^A Paper cited tissue concentrations in units of mmol/kg. Arcadis used the molecular weight of Aroclor 1254 to convert to mg/kg, I used the congener-specific molecular weights. Arcadis value is 92 mg/kg ww.

^B Paper cited tissue concentrations in units of mmol/kg. Arcadis used the molecular weight of Aroclor 1254 to convert to mg/kg, I used the congener-specific molecular weights. Arcadis value is 112 mg/kg ww.

^C Value cited in paper is 16 mg/kg. Paper does not state whether basis is wet or dry weight.

^D Value cited in paper is 16 mg/kg. Paper states residue concentrations presented in the text and tables are on a dry-weight whole body basis (page 259).

^E 96-hour LOEC reported; an acute-to-chronic uncertainty factor of 0.1 used to calculate chronic LOEC value

NOEC = No observed effect concentration

LOEC = Low observed effect concentration

ww = wet weight

dw = dry weight

CTC = Critical tissue concentration

GRO = Growth

REP = Reproduction

MOR= Mortality

Hg = Mercury

CH3HgCL = Methylmercuric chloride

mg/kg = milligrams per kilogram

nmol/g = nanomols per gram

NA = Not applicable

NS = Not stated

TRV = Toxicity Reference Value

References:

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Revised Table AD-31. HQs calculated for Benthic Invertebrates Using Critical Tissue Concentrations Proposed by Pharmacia/Solutia and EPA
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

Analyte	Assessment Area	Receptor	EPC	P/S				EPA			
				NOEC (mg/kg dw)	LOEC (mg/kg dw)	NOEC HQ	LOEC HQ	NOEC (mg/kg dw)	LOEC (mg/kg dw)	NOEC HQ	LOEC HQ
PCBs	UAA	Benthic invertebrates	2.65	NA	NA	NA	NA	2	5	1.3	0.5
		Crayfish	3.8	21	57	0.2	0.1	2	5	1.9	0.8
		Crayfish ^A	3.8	0.2	16	19.0	0.2	2	5	1.9	0.8
		Emergent insects	23	7	27	3.3	0.9	2	5	11.5	4.6
		Mollusks	14	1263	1875	0.0	0.0	2	5	7.0	2.8
		Mollusks ^B	14	NA	3.3	NA	4.2	—	—	—	—
PCBs	MAA	Benthic invertebrates	1.83	NA	NA	NA	NA	2	5	0.9	0.4
		Crayfish	2.62	21	57	0.1	0.0	2	5	1.3	0.5
		Crayfish ^A	2.62	0.2	16	13.1	0.2	2	5	1.3	0.5
		Emergent insects	0.806	7	27	0.1	0.0	2	5	0.4	0.2
		Mollusks	9.48	1263	1875	0.0	0.0	2	5	4.7	1.9
		Mollusks ^B	9.48	NA	3.3	NA	2.9	—	—	—	—
PCBs	LAA	Benthic invertebrates	1.09	NA	NA	NA	NA	2	5	0.5	0.2
		Crayfish	1.05	21	57	0.1	0.0	2	5	0.5	0.2
		Crayfish ^A	1.05	0.2	16	5.3	0.1	2	5	0.5	0.2
		Emergent insects	1.11	7	27	0.2	0.0	2	5	0.6	0.2
		Mollusks	12	1263	1875	0.0	0.0	2	5	6.0	2.4
		Mollusks ^B	12	NA	3.3	NA	3.6	—	—	—	—
Mercury	UAA	Benthic invertebrates	0.232	56	90	0.0	0.0	12.7	17.97	0.0	0.0
		Crayfish	0.19	0.92	16	0.2	0.0	12.7	17.97	0.0	0.0
		Emergent insects	0.321	24	NA	0.0	NA	12.7	17.97	0.0	0.0
		Mollusks	0.292	7.5	150	0.0	0.0	12.7	17.97	0.0	0.0
		Mollusks ^B	0.292	NA	75	NA	0.0	12.7	17.97	0.0	0.0
Mercury	MAA	Benthic invertebrates	0.35	56	90	0.0	0.0	12.7	17.97	0.0	0.0
		Crayfish	0.206	0.92	16	0.2	0.0	12.7	17.97	0.0	0.0
		Emergent insects	0.188	24	NA	0.0	NA	12.7	17.97	0.0	0.0
		Mollusks	0.292	7.5	150	0.0	0.0	12.7	17.97	0.0	0.0
		Mollusks ^B	0.36	NA	75	NA	0.0	12.7	17.97	0.0	0.0
Mercury	LAA	Benthic invertebrates	0.48	56	90	0.0	0.0	12.7	17.97	0.0	0.0
		Crayfish	0.23	0.92	16	0.3	0.0	12.7	17.97	0.0	0.0
		Emergent insects	0.21	24	NA	0.0	NA	12.7	17.97	0.0	0.0
		Mollusks	0.292	7.5	150	0.0	0.0	12.7	17.97	0.0	0.0
		Mollusks ^B	0.86	NA	7.5	NA	0.1	12.7	17.97	0.1	0.0

^A The NOEC value from Sanders and Chandler (1972) on slide 15 of the May 16, 2017 presentation (21 mg/kg dw) checks in terms of numeric value and basis. The LOEC value from Duke et al. 1970 is 16 mg/kg, however basis is not stated anywhere in the text or on the tables in this paper. Therefore, the conservative assumption that this value is dry weight must be made. The NOEC value (0.2 mg/kg dw) is cited on Table 1 of Sanders and Chandler for *Orconectes nais*.

Table AD-31. (cont.) HQs calculated for Benthic Invertebrates Using Critical Tissue Concentrations Proposed by Pharmacia/Solutia and EPA
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

^B Section 3.4.4 of Appendix D states “A LOAEL of 33 mg/kg ww available from Duke et al. (1970) was not considered appropriate for CTC development because the measured endpoint was oyster shell growth, which varies in response to a variety of environmental factors and is not considered predictive of organism health.” The endpoint measured in the selected critical study (Lowe et al. [1972]), as stated in the abstract, was also shell growth rate (shell height and in-water weight). As stated on Table AD8-1 (BERA Table 6-24), “Low end selected when multiple values”. The 96-hour LOAEL from Duke et al. should have been selected as the CTC. An acute-to chronic uncertainty factor of 0.1 was used to calculate a LOAEL of 3.3 mg/kg. Basis was not stated in the paper, therefore a LOAEL CTC of 3.3 mg/kg dry weight was assumed.

PCB = polychlorinated biphenyl
 UAA = Upper assessment area
 MAA = Middle assessment area
 LAA = Lower assessment area
 mg/kg dw = milligrams per kilogram dry weight

EPC = Exposure point concentration
 NOEC = No observed effect concentration
 LOEC = Lowest observed effect concentration
 NA = Not available
 P/S = Pharmacia/Solutia

Bold, italicized text indicates NOEC HQ ≥ 1.0

Grey shading indicates acceptable risk

Green shading indicates indeterminate risk

Yellow shading indicates unacceptable risk

References:

Duke, T. W., J. L. Lowe, et al. (1970). "A polychlorinated biphenyl (Aroclor 1254) in the water, sediment and biota of Escambia Bay, Florida." Bull Environ. Contam. Toxicol. 5: 171-180.

Sanders, H. O. and J. H. Chandler (1972). "Biological magnification of a polychlorinated biphenyl (Aroclor 1254) from water by aquatic invertebrates." Bull Environ. Contam. Toxicol. 7(5): 237-263.

Table AD-32. Summary of Studies Reporting Critical Tissue Concentrations for PCBs in
Fish OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

Common Name	Scientific Name	Exposure Route	Effect Group	Endpoint	TRV	Reported Total PCB CTC (mg/kg)	Basis	Total PCB (mg/kg ww)	Percent Solids	Total PCB (mg/kg dw)	Reference
Zebrafish	<i>Danio rerio</i>	diet	GRO	Growth (weight)	LOEC	0.14	ww	0.14		0.56	Orn et al. 1998
Guppy	<i>Poecilia reticulata</i>	diet	MOR	LD22	LOEC	2.6	ww	2.6		10.4	Opperhuizen and Schrap 1988
Zebrafish	<i>Danio rerio</i>	diet	MOR	Decrease in median larval survival time	LOEC	2.7	ww	2.7	25	10.8	Orn et al. 1998
Common sole	<i>Solea solea</i>	water	GRO	Delayed larval development	LOEC	6.82	ww	6.82	25	27.28	Foekema et al. 2014
Winter flounder	<i>Pseudopleuronectes americanus</i>	NS	GRO	Reduced growth	LOEC	7.1	ww	7.1		28.4	Black et al. 1988
Common sole	<i>Solea solea</i>	water	MOR	LD50 for larvae	LOEC	7.48	ww	7.48	25	29.92	Foekema et al. 2014
Sheepshead minnow	<i>Cyprinodon variegatus</i>	water	MOR	Decrease in fry survival	LOEC	9.3	ww	9.3	25	37.2	Hansen et al. 1974
Channel catfish	<i>Ictalurus punctatus</i>	diet	GRO	Reduced growth	LOEC	14.3	ww	14.3		57.2	Hansen et al. 1976
Minnow	<i>Phoxinus phoxinus</i>	diet	REP, MOR	Reduction in time to hatch, death of fry within 1 week of hatching	LOEC	15	ww	15	25	60	Bengtsson 1980
Norfolk Spot	<i>Leiostomus xanthurus</i>	water	MOR	LD17	LOEC	17	ww	17		68	Hansen et al. 1971
Pinfish	<i>Lagodon rhomboides</i>	water	MOR	Reduced survival	LOEC	65	ww	65		260	Hansen et al. 1974
Zebrafish	<i>Danio rerio</i>	diet	MOR	Decrease in median larval survival time	NOEC	1.1	ww	1.1	25	4.4	Orn et al. 1998
Minnow	<i>Phoxinus phoxinus</i>	diet	REP, MOR	Reduction in time to hatch, death of fry within 1 week of hatching	NOEC	1.6	ww	1.6	25	6.4	Bengtsson 1980
Sheepshead minnow	<i>Cyprinodon variegatus</i>	water	MOR	Decrease in fry survival	NOEC	1.9	ww	1.9	25	7.6	Hansen et al. 1974

Shading indicates studies proposed for derivation of CTCs by Arcadis, 5-16-17 meeting Slide 15

Blue shading indicates study recommended for TRV derivation by EPA

Red shading indicates study with non-salmonid species extracted from the ERED database. Original paper not reviewed to confirm values

NOEC = No observed effect concentration
LOEC = Low observed effect concentration
ww = wet weight
dw = dry weight
CTC = Critical tissue concentration

GRO = Growth
REP = Reproduction
MOR= Mortality
mg/kg = milligrams per kilogram
LDX = Lethal dose to X% of tested organisms

TRV = Toxicity Reference Value

**Table AD-32. (cont.) Summary of Studies Reporting Critical Tissue Concentrations for PCBs in
Fish OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama**

References:

Bengtsson, B. E. 1980. Long-term effects of PCB (Clophen A50) on growth, reproduction and swimming performance in the minnow, *Phoxinus phoxinus*. Water Res. 14: 681-687.

Black (1988). "The effect of inherited contamination on egg and larval winter flounder, *Pseudopleuronectes americanus* ." Mar. Environ. Res. 15: 45-62.

Foekema, E. M., M. L. Parron, et al. (2014). "Internal effect concentrations of organic substances for early life development of egg-exposed fish." Ecotox. Envir. Safety 101: 14-22.

Hansen, D. J. (1971). "Chronic toxicity, uptake, and retention of Aroclor 1254 in two estuarine fishes." Bull Environ. Contam. Toxicol. 6: 113-119.

Hansen, D. J., S. C. Schimmel, et al. (1973). "Aroclor 1254 in eggs of sheepshead minnows: Effect on fertilization success and survival of embryos and fry." Proc. 27th Annual Conf. Southeast Assoc. Game Fish Comm. 27: 420-426.

Hansen, D. J. (1974). "Aroclor 1016: Toxicity to and uptake by estuarine animals." Environ. Res. 7: 363-373.

Hansen, D. J. (1976). "Effects of Dietary Aroclor 1242 on channel catfish (*Ictalurus punctatus*) and the selective accumulation of PCB components." J. Fish Res. Board Can 33: 1343-1352.

Opperhuizen, A. and S. M. Schrap. 1988. Uptake efficiencies of two polychlorinatedbiphenyls in fish after dietary exposure to five different concentrations. Chemosphere 17(2): 253-262.

Orn, S., P. L. Anderson, L. Forlin, M. Tysklind and L. Norrgren. 1998. The impact on reproduction of an orally administered mixture of selected PCBs in zebrafish (*Danio rerio*). Arch Environ. Contam. Toxicol. 35: 53-57.

Table AD-33. HQs Calculated for Fish Using Critical Tissue Concentrations Proposed by Pharmacia/Solutia and EPA

OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

Assessment Area	Matrix	Detects	Total Samples	Min	Max	Mean	95% UCL	EPC	Critical Tissue Concentration		Hazard Quotients	
									NOAEL CTC	LOAEL CTC	NOAEL HQ	LOAEL HQ
PCBs -- P/S CTC Values												
Upper Assessment Area	bottom fish	9	9	33.8	67.5	52.7	60.8	60.8	7	34.4	8.7	1.8
	forage fish	27	27	6.8	43.7	20.9	23.8	23.8	7	34.4	3.4	0.7
	predator fish	9	9	21.8	175.2	84.0	111.3	111.3	7	34.4	15.9	3.2
	all fish	45	45	6.8	175.2	39.9	50.1	50.1	7	34.4	7.2	1.5
Middle Assessment Area	bottom fish	9	9	18.2	50.8	32.3	38.9	38.9	7	34.4	5.6	1.1
	forage fish	27	27	18.4	51.1	32.8	36.0	36.0	7	34.4	5.1	1.0
	predator fish	9	9	37.0	126.5	74.0	95.4	95.4	7	34.4	13.6	2.8
	all fish	45	45	18.2	126.5	41.0	46.0	46.0	7	34.4	6.6	1.3
Lower Assessment Area	bottom fish	9	9	22.4	84.3	53.5	66.2	66.2	7	34.4	9.5	1.9
	forage fish	27	27	16.5	47.4	30.7	33.5	33.5	7	34.4	4.8	1.0
	predator fish	9	9	42.5	126.8	83.2	101.8	101.8	7	34.4	14.5	3.0
	all fish	45	45	16.5	126.8	45.8	52.8	52.8	7	34.4	7.5	1.5
PCBs -- EPA CTC Values												
Upper Assessment Area	bottom fish	9	9	33.8	67.5	52.7	60.8	60.8	—	27.3	—	2.2
	forage fish	27	27	6.8	43.7	20.9	23.8	23.8	—	27.3	—	0.9
	predator fish	9	9	21.8	175.2	84.0	111.3	111.3	—	27.3	—	4.1
	all fish	45	45	6.8	175.2	39.9	50.1	50.1	—	27.3	—	1.8
Middle Assessment Area	bottom fish	9	9	18.2	50.8	32.3	38.9	38.9	—	27.3	—	1.4
	forage fish	27	27	18.4	51.1	32.8	36.0	36.0	—	27.3	—	1.3
	predator fish	9	9	37.0	126.5	74.0	95.4	95.4	—	27.3	—	3.5
	all fish	45	45	18.2	126.5	41.0	46.0	46.0	—	27.3	—	1.7
Lower Assessment Area	bottom fish	9	9	22.4	84.3	53.5	66.2	66.2	—	27.3	—	2.4
	forage fish	27	27	16.5	47.4	30.7	33.5	33.5	—	27.3	—	1.2
	predator fish	9	9	42.5	126.8	83.2	101.8	101.8	—	27.3	—	3.7
	all fish	45	45	16.5	126.8	45.8	52.8	52.8	—	27.3	—	1.9

All units in mg/kg dw

CTC: critical tissue concentration

EPC: exposure point concentration

HQ: hazard quotient

LOAEL: lowest observed adverse effect level

m: maximum

N/A: Measured tissue concentrations were not detected

NA: CTC not available

NOAEL: no observed adverse effect level

PCB: polychlorinated biphenyl

UCL: upper confidence limit on arithmetic mean

Tissue CTCs are presented in Table 5-2b.

Bold, italicized text indicates NOEC HQ ≥ 1.0

Green shading indicates indeterminate risk

Yellow shading indicates unacceptable risk

**Table AD-34. HQs calculated for Dioxin-Like Compounds (2,3,7,8-TCDD) in Fish Using Critical Tissue Concentrations
Proposed by Pharmacia/Solutia and EPA
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama**

Species Group	Assessment Area	Whole body concentration (pg/g dw)	P/S CTC Values				EPA CTC Values				Tillitt et al. 2017	
			Critical Tissue Concentration (pg/g dw)		Hazard Quotients		Critical Tissue Concentration (pg/g dw)		Hazard Quotients		Critical Tissue Concentration (pg/g dw)	Hazard Quotient
			Mean Lipid CTC	Max Lipid CTC	Mean HQ	Max HQ	Mean Lipid CTC	Max Lipid CTC	Mean HQ	Max HQ	Mean Lipid CTC	LOAEL HQ
Bottom Fish	Lower	0.552	255	572	0.0	0.0	81	182	0.0	0.0	1220	0.0
Bottom Fish	Middle	4.36	255	572	0.0	0.0	81	182	0.1	0.0	1220	0.0
Forage Fish	Lower	0.852	255	572	0.0	0.0	81	182	0.0	0.0	1220	0.0
Forage Fish	Lower	12.6	255	572	0.0	0.0	81	182	0.2	0.1	1220	0.0
Forage Fish	Lower	358.4	255	572	1.4	0.6	81	182	4.4	2.0	1220	0.3
Forage Fish	Middle	1.148	255	572	0.0	0.0	81	182	0.0	0.0	1220	0.0
Forage Fish	Middle	1.864	255	572	0.0	0.0	81	182	0.0	0.0	1220	0.0
Forage Fish	Upper	0.736	255	572	0.0	0.0	81	182	0.0	0.0	1220	0.0
Forage Fish	Upper	0.816	255	572	0.0	0.0	81	182	0.0	0.0	1220	0.0
Forage Fish	Upper	0.888	255	572	0.0	0.0	81	182	0.0	0.0	1220	0.0
Forage Fish	Upper	0.888	255	572	0.0	0.0	81	182	0.0	0.0	1220	0.0
Forage Fish	Upper	1.108	255	572	0.0	0.0	81	182	0.0	0.0	1220	0.0
Forage Fish	Upper	1.116	255	572	0.0	0.0	81	182	0.0	0.0	1220	0.0
Forage Fish	Upper	1.208	255	572	0.0	0.0	81	182	0.0	0.0	1220	0.0
Forage Fish	Upper	2.436	255	572	0.0	0.0	81	182	0.0	0.0	1220	0.0
Predator Fish	Lower	1.396	255	572	0.0	0.0	81	182	0.0	0.0	1220	0.0
Predator Fish	Upper	4.88	255	572	0.0	0.0	81	182	0.1	0.0	1220	0.0
Bottom Fish	Lower	146.8	255	572	0.6	0.3	81	182	1.8	0.8	1220	0.1
Bottom Fish	Middle	300.4	255	572	1.2	0.5	81	182	3.7	1.7	1220	0.2
Forage Fish	Lower	171.2	255	572	0.7	0.3	81	182	2.1	0.9	1220	0.1
Forage Fish	Lower	328.4	255	572	1.3	0.6	81	182	4.1	1.8	1220	0.3

Table AD-34. (continued) HQs calculated for Dioxin-Like Compounds (2,3,7,8-TCDD) in Fish Using Critical Tissue Concentrations

Species Group	Assessment Area	Whole body concentration (pg/g dw)	P/S CTC Values				EPA CTC Values				Tillitt et al. 2017	
			Critical Tissue Concentration (pg/g dw)		Hazard Quotients		Critical Tissue Concentration (pg/g dw)		Hazard Quotients		Critical Tissue Concentration (pg/g dw)	Hazard Quotient
			Mean Lipid CTC	Max Lipid CTC	Mean HQ	Max HQ	Mean Lipid CTC	Max Lipid CTC	Mean HQ	Max HQ	Mean Lipid CTC	LOAEL HQ
Forage Fish	Lower	668	255	572	2.6	1.2	81	182	8.2	3.7	1220	0.5
Forage Fish	Middle	98.4	255	572	0.4	0.2	81	182	1.2	0.5	1220	0.1
Forage Fish	Middle	256.4	255	572	1.0	0.4	81	182	3.2	1.4	1220	0.2
Forage Fish	Upper	18.76	255	572	0.1	0.0	81	182	0.2	0.1	1220	0.0
Forage Fish	Upper	19	255	572	0.1	0.0	81	182	0.2	0.1	1220	0.0
Forage Fish	Upper	21.32	255	572	0.1	0.0	81	182	0.3	0.1	1220	0.0
Forage Fish	Upper	22.68	255	572	0.1	0.0	81	182	0.3	0.1	1220	0.0
Forage Fish	Upper	25.08	255	572	0.1	0.0	81	182	0.3	0.1	1220	0.0
Forage Fish	Upper	27.04	255	572	0.1	0.0	81	182	0.3	0.1	1220	0.0
Forage Fish	Upper	31.64	255	572	0.1	0.1	81	182	0.4	0.2	1220	0.0
Forage Fish	Upper	40.8	255	572	0.2	0.1	81	182	0.5	0.2	1220	0.0
Predator Fish	Upper	45.2	255	572	0.2	0.1	81	182	0.6	0.2	1220	0.0
Predator Fish	Lower	242	255	572	0.9	0.4	81	182	3.0	1.3	1220	0.2

pg/g dw = picograms per gram dry weight

CTC = critical tissue concentration

HQ: hazard quotient

LOAEL: lowest observed adverse effect level

N/A: Measured tissue concentrations were not detected

NOAEL: no observed adverse effect level

PCB: polychlorinated biphenyl

UCL: upper confidence limit on arithmetic mean

Bold, italicized text indicates NOEC HQ ≥ 1.0

Green shading indicates indeterminate risk

Yellow shading indicates unacceptable risk

References:

Tillitt, D. E., J. A. Buckler, et al. (2017). "Sensitivity of lake sturgeon (*Acipenser fulvescens*) early life stages to 2,3,7,8-tetrachlorodibenzo-*p*-dioxin and 3,3',4,4',5-pentachlorobiphenyl." *Environ. Toxicol. Chem.* **36**(4): 988-998.

Table AD-35. Summary of Site-Specific BAFs for Dioxin/Furan and Dioxin-like PCB Congeners
Anniston PCB Site, Anniston, Alabama

Congeners	Sitewide Median Soil BAFs ¹ (dw/dw)					Sitewide Median Sediment BAFs ¹ (dw/dw)					
	Mammals	BAF Type ²	Invertebrates	Terrestrial Plants	BAF Type	Aquatic Plants	BAF Type	Benthic Invertebrates	BAF Type	Crayfish	BAF Type
Soil/sediment BSA KM Means (N)	5		5	5		4		4		4	
Individual Tissue (N)	6		0	2		2		2		2	
PCDD/PCDF Congeners											
1,2,3,4,6,7,8-HpCDD	0.042	median	No Data	0.136	median	0.395	median	0.701	median	0.110	median
1,2,3,4,6,7,8-HpCDF	0.087	median	No Data	NA		NA		0.521	median	NA	
1,2,3,4,7,8,9-HpCDF	0.026	ave ratio	No Data	NA		NA		NA		NA	
1,2,3,4,7,8-HxCDD	NA		No Data	NA		NA		NA		NA	
1,2,3,4,7,8-HxCDF	0.181	median	No Data	0.164	median	0.285	median	0.955	median	NA	
1,2,3,6,7,8-HxCDD	0.116	ave ratio	No Data	NA		NA		NA		NA	
1,2,3,6,7,8-HxCDF	0.167	median	No Data	0.086	median	NA		NA		NA	
1,2,3,7,8,9-HxCDD	NA		No Data	NA		NA		NA		NA	
1,2,3,7,8,9-HxCDF	NA		No Data	NA		NA		NA		NA	
1,2,3,7,8-PeCDD	NA		No Data	NA		NA		NA		NA	
1,2,3,7,8-PeCDF	NA		No Data	NA		0.557	median	2.85	median	0.815	median
2,3,4,6,7,8-HxCDF	2.26	median	No Data	NA		NA		NA		NA	
2,3,4,7,8-PeCDF	1.76	median	No Data	NA		NA		2.29	median	0.725	median
2,3,7,8-TCDD	NA		No Data	NA		NA		NA		NA	
2,3,7,8-TCDF	0.040	median	No Data	0.081	median	1.56	median	6.50	median	1.06	median
Octa CDD	0.026	median	No Data	0.087	median	0.243	median	0.365	median	0.062	median
Octa CDF	0.016	ave ratio	No Data	NA		NA		NA		NA	
Dioxin-Like PCB Congeners											
BZ#105	0.542	median	No Data	0.148	median	0.625	median	1.05	median	0.822	median
BZ#114	NA		No Data	NA		NA		NA		NA	
BZ#118	0.652	median	No Data	0.134	median	0.528	median	0.952	median	0.882	median
BZ#123	NA		No Data	NA		NA		NA		NA	
BZ#126	NA		No Data	NA		NA		NA		NA	
BZ#153	NA		No Data	NA		NA		NA		NA	
BZ#156	2.49	median	No Data	NA		NA		2.83	median	0.648	median
BZ#157	NA		No Data	NA		NA		NA		NA	
BZ#167	NA		No Data	NA		NA		NA		NA	
BZ#169	NA		No Data	NA		NA		NA		NA	
BZ#189	NA		No Data	NA		NA		NA		NA	
BZ#77	NA		No Data	NA		NA		NA		NA	
BZ#81	NA		No Data	NA		NA		NA		NA	

Table AD-35. Summary of Site-Specific BAFs for Dioxin/Furan and Dioxin-like PCB Congeners
Anniston PCB Site, Anniston, Alabama

Congeners	Sitewide Median BAF Sediment BAFs ¹ (dw/dw)															
	Emergent Insects	BAF Type	Bottom Fish	BAF Type	Forage Fish	BAF Type	Predator Fish	BAF Type	Frogs	BAF Type	Snakes	BAF Type	Molluscs	BAF Type	All Fish	BAF Type
Soil/sediment BSA KM Means (N)	4		4		4		4		4		4		4		4	
Individual Tissue (N)	2		2		7		1		2		1		2		10	
PCDD/PCDF Congeners																
1,2,3,4,6,7,8-HpCDD	4.55	median	NA		NA		NA		0.196	median	NA		0.552	median	NA	
1,2,3,4,6,7,8-HpCDF	2.53	median	0.173	median	0.157	median	NA		0.134	median	NA		NA		0.165	median
1,2,3,4,7,8,9-HpCDF	0.980	median	NA		NA		NA		NA		NA		NA		NA	
1,2,3,4,7,8-HxCDD	NA		NA		2.92	median	2.68	median	NA		NA		NA		2.92	median
1,2,3,4,7,8-HxCDF	0.445	median	NA		NA		NA		0.378	median	0.325	median	1.16	median	NA	
1,2,3,6,7,8-HxCDD	14.7	median	NA		NA		NA		NA		0.504	median	NA		NA	
1,2,3,6,7,8-HxCDF	NA		NA		NA		NA		0.624	median	0.534	median	12.7	median	NA	
1,2,3,7,8,9-HxCDD	NA		NA		NA		NA		NA		NA		NA		NA	
1,2,3,7,8,9-HxCDF	NA		NA		NA		NA		NA		NA		NA		NA	
1,2,3,7,8-PeCDD	NA		NA		NA		NA		NA		NA		NA		NA	
1,2,3,7,8-PeCDF	2.11	median	NA		4.35	median	NA		0.999	median	0.925	median	NA		4.35	median
2,3,4,6,7,8-HxCDF	NA		NA		NA		NA		NA		0.352	median	NA		NA	
2,3,4,7,8-PeCDF	NA		8.15	median	NA		NA		1.25	median	3.80	median	6.95	median	8.15	median
2,3,7,8-TCDD	NA		NA		215	ave ratio	NA		NA		4.77	median	NA		151	ave ratio
2,3,7,8-TCDF	2.75	median	12.6	median	9.48	median	12.6	median	0.839	median	0.983	median	55.0	median	10.2	median
Octa CDD	1.86	median	0.032	median	0.091	median	NA		0.040	median	0.055	median	0.471	median	0.082	median
Octa CDF	2.07	median	NA		NA		NA		NA		0.051	median	NA		NA	
Dioxin-Like PCB Congeners															NA	
BZ#105	17.9	median	13.0	median	10.7	median	17.5	median	3.11	median	10.6	median	6.81	median	11.0	median
BZ#114	NA		NA		NA		NA		NA		NA		NA		NA	
BZ#118	20.5	median	18.8	median	15.5	median	26.5	median	5.87	median	16.6	median	12.5	median	16.4	median
BZ#123	NA		NA		NA		NA		NA		NA		NA		NA	
BZ#126	NA		NA		NA		NA		NA		NA		NA		NA	
BZ#153	NA		NA		NA		NA		NA		NA		NA		NA	
BZ#156	17.6	median	15.4	median	13.6	median	26.3	median	4.00	median	16.4	median	8.38	median	14.0	median
BZ#157	NA		NA		2.26	ave ratio	NA		NA		NA		NA		1.58	ave ratio
BZ#167	NA		NA		NA		NA		NA		NA		NA		NA	
BZ#169	NA		NA		NA		NA		NA		NA		NA		NA	
BZ#189	NA		NA		NA		NA		NA		NA		NA		NA	
BZ#77	NA		NA		NA		NA		NA		NA		NA		NA	
BZ#81	NA		NA		NA		NA		NA		NA		NA		NA	

**Table AD-35. Summary of Site-Specific BAFs for Dioxin/Furan and Dioxin-like PCB Congeners
Anniston PCB Site, Anniston, Alabama**

Notes:

¹ Soil and sediment BAFs calculated using soil/sediment Kaplan-Meier Mean in BSA and individual tissue composites (detects only); OU-4 data only.

² ave ratio: site-wide average ratio BAF. See Attachment F1 text for details.

median: Sitewide median BAF. See Attachment F1 text for details.

BAF: bioaccumulation factor

BSA: biological sampling area

CDD: chlorodibenzo-p-dioxin

CDF: chlorodibenzo-p-furan

dw: dry weight

KM: Kaplan-Meier

HpCDD: heptachlorodibenzo-p-dioxin

HpCDF: heptachlorodibenzofuran

HxCDD: hexachlorodibenzo-p-dioxin

HxCDF: hexachlorodibenzofuran

N: number of samples

NA: Not available because dioxin/furan congeners were not detected above the laboratory reporting limits in tissue sample

PCB: polychlorinated biphenyl

PCDD: polychlorinated dibenzodioxin

PCDF: polychlorinated dibenzofuran

PeCDD: pentachlorodibenzo-p-dioxin

PeCDF: pentachlorodibenzofuran

TCDD: tetrachlorodibenzo-p-dioxin

TCDF: tetrachlorodibenzofuran

Table AD-36. Estimated Exposure of Carolina wren to PCB-126 as a Representative Dioxin-like PCB in Anniston OU4.
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

AA ¹	Location	PCB 126 concentrations in earthworms from OU4						FIR (kg/kg/d) ⁸	Fraction of earthworms in diet ⁹	Estimated exposure (ng/kg/d) ¹⁰	NOAEL (ng/kg/d) ¹¹	HQ ¹²
		Measured (mg/kg ww) ²	Moisture Content ³	Measured (mg/kg dw) ⁴	Measured (ng/kg dw) ⁵	TEF ⁶	TEQ Conc. (ng/kg dw) ⁷					
Upper	C3-N	0.043	0.84	0.2688	268750	0.1	26875	0.24	0.46	2967	145	20.5
Lower	C7-N	0.011	0.84	0.0688	68750	0.1	6875	0.24	0.46	759	145	5.2
Lower	C7-N	0.0047	0.84	0.0294	29375	0.1	2937.5	0.24	0.46	324.3	145	2.2

Notes

1. AA: Assessment Area
2. Data from Anniston OU4 BERA, Appendix E. Only detected concentrations were included.
3. Fraction moisture from USEPA (1993)
4. Dry weight concentration=wet weight concentration/(1-moisture content)
5. ng/kg=mg/kg*1,000,000
6. Avian TCDD toxicity equivalency factor for PCB 126; from Table F-3, Anniston OU4 BERA, and Van den Berg et al. (1998)
7. TEQ concentration: TCDD-like concentration; measured concentration*TEF.
8. FIR: food ingestion rate for Carolina wrens; from Table F-4a, Anniston OU4 BERA.
9. From Table F-5a, Anniston OU4 BERA; 15% worms, 31% spiders (worm tissue used as a surrogate for spider tissue)
10. TEQ concentration*FIR*fraction earthworms in diet
11. NOAEL from Appendix F, Anniston OU4 BERA, Section 3.1.3
12. HQ: exposure/NOAEL

References:

Van den Berg, M., L. Birnaum, A.T.C. Bosveld, B. Brunstrom, P. Cook, M. Freely, J.P. Giesy, A. Hanberg, R. Hasegawa, S.W. Kennedy, T. Kubiak, J.C. Larsen, F.X. Rolaf van Leeuwen, A.K. Djien Liem, C. Nolt, R. E. Peterson, L. Poellinger, S. Safe, D. Screnk, D. Tillitt, M. Tysklind, M. Younes, F. Waern, and T. Zacharewski. (1998). Toxic equivalency Factors (TEFs) for PCBs, PCDDs, PCDFs for Humans and Wildlife. Environemntal Health Perspectives 106:12.

EPA. (1993). Wildlife Exposure Factors Handbook. U.S. Environmental Protection Agency, Washington, D.C., EPA/600/R-93/187.

Table AD-37. Avian Exposure Parameter
Scenarios Anniston PCB Site, Anniston, Alabama

Parameter	Aquatic Ground-feeding Invertivore				Piscivore				Ground-feeding Invertivore			
	Spotted Sandpiper				Belted Kingfisher				Carolina Wren			
	Data	Source	Data	Source	Data	Source	Data	Source	Data	Source	Data	Source
	Scenario 1		Scenario 2		Scenario 1		Scenario 2		Scenario 1		Scenario 2	
Composition of Diet (%)												
Soil Invertebrates (Worms)	50%	Assumed, based on Oring et al. (1997)	0%	--	0%	--	0%	--	15%	Cristol et al. 2008; Walters et al. 2010	15%	Cristol et al. 2008; Walters et al. 2010
Terrestrial Invertebrates (grasshoppers)	0%	--	0%	--	0%	--	0%	--	45%	Cristol et al. 2008; Walters et al. 2010	45%	Cristol et al. 2008; Walters et al. 2010
Terrestrial Invertebrates, Spiders, Detritivores	0%	--	0%	--	0%	--	0%	--	31%	Cristol et al. 2008; Walters et al. 2010	0%	--
Aquatic Emergent and Flying Insects	0%	--	0%	--	0%	--	0%	--	0%	--	0%	--
Aquatic Invertebrates, Spiders, Detritivores	0%	--	0%	--	0%	--	0%	--	0%	--	31%	Cristol et al. 2008; Walters et al. 2010
Terrestrial Plants	0%	--	0%	--	0%	--	0%	--	9%	Cristol et al. 2008; Walters et al. 2010	0%	--
Aquatic Plants	0%	--	0%	--	0%	--	0%	--	0%	--	9%	Cristol et al. 2008; Walters et al. 2010
Mammals	0%	--	0%	--	0%	--	0%	--	0%	--	0%	--
Reptiles	0%	--	0%	--	0%	--	0%	--	0%	--	0%	--
Amphibians	0%	--	0%	--	0%	--	5%	Alexander (1977), Salyer and Lagler (1946) and Davis (1982) as cited in USEPA (1993)	0%	--	0%	--
All Fish	0%	--	0%	--	0%	--	0%	--	0%	--	0%	--
Predator Fish Only	0%	--	0%	--	0%	--	0%	--	0%	--	0%	--
Forage Fish (4-15 cm)	0%	--	0%	--	100%	Consume primarily fish (Hamas 2009); Prose (1985) fish size	76%	Alexander (1977), Salyer and Lagler (1946) and Davis (1982) as cited in USEPA (1993); Prose (1985) fish size	0%	--	0%	--
Aquatic Invertebrates (Odonata Larvae)	50%	Rubbelke (1976)	50%	Rubbelke (1976)	0%	--	0%	--	0%	--	0%	--
Aquatic Oligochaetes (Lumbriculus)	0%	--	50%	Assumed	0%	--	0%	--	0%	--	0%	--
Crayfish	0%	--	0%	--	0%	--	19%	Alexander (1977), Salyer and Lagler (1946) and Davis (1982) as cited in USEPA (1993) - crayfish	0%	--	0%	--
Mollusc	0%	--	0%	--	0%	--	0%	--	0%	--	0%	--

Notes:
Full references provided in Table 4-2c.
%: percent
--: not applicable
cm: centimeters
PCB: polychlorinated biphenyl
USEPA: United States Environmental Protection Agency

Table AD-38. Soil Summary Statistics by Assessment
Area Anniston PCB Site, Anniston, Alabama

Constituent	Units	Depth (ft bgs)	Summary Statistics											Exposure Point Concentration				
			Detects	/	Total	FOD	Minimum Detect	Maximum Detect	Minimum Nondetect	Maximum Nondetect	Mean	Median	Variance	Standard Deviation	95% UCL	95% UCL Method	Selected EPC	Basis
Upper Assessment Area																		
Dioxin/Furan Congeners																		
1,2,3,4,6,7,8-HpCDD	ng/kg	0-0.5	38	/	38	100	22.5	178	N/A	N/A	89.12	92.25	1341	36.62	99.14	95% Student's-t UCL	99.14	UCL
1,2,3,4,6,7,8-HpCDF	ng/kg	0-0.5	29	/	38	76	10.7	71.6	4.83	70.8	36.4	35.6	198.8	14.1	36.31	95% KM (t) UCL	36.31	UCL
1,2,3,4,7,8,9-HpCDF	ng/kg	0-0.5	36	/	38	95	1.1	16.4	2.84	3.66	8.276	8.035	14.49	3.807	9.044	95% KM (t) UCL	9.044	UCL
1,2,3,4,7,8-HxCDD	ng/kg	0-0.5	34	/	38	89	0.489	2.8	0.276	0.842	1.139	1.12	0.202	0.45	1.155	95% KM Student's t	1.155	UCL
1,2,3,4,7,8-HxCDF	ng/kg	0-0.5	38	/	38	100	4.19	59	N/A	N/A	29.21	26.85	217	14.73	33.24	95% Student's-t UCL	33.24	UCL
1,2,3,6,7,8-HxCDD	ng/kg	0-0.5	34	/	38	89	0.49	7.01	0.95	2.04	2.877	2.75	2.027	1.424	3.087	95% KM (t) UCL	3.087	UCL
1,2,3,6,7,8-HxCDF	ng/kg	0-0.5	36	/	38	95	1.1	94.6	3.35	5.59	13.87	8.16	313.5	17.71	17.64	95% KM H-UCL	17.64	UCL
1,2,3,7,8,9-HxCDD	ng/kg	0-0.5	34	/	38	89	0.659	7.38	1.38	3.36	2.929	2.82	1.858	1.363	3.196	95% GROS Adjusted Gamma UCL	3.196	UCL
1,2,3,7,8,9-HxCDF	ng/kg	0-0.5	24	/	38	63	0.315	1.17	0.165	2.46	0.761	0.819	0.0687	0.262	0.746	95% KM (t) UCL	0.746	UCL
1,2,3,7,8-PeCDD	ng/kg	0-0.5	26	/	38	68	0.283	1.36	0.148	1.11	0.605	0.55	0.0739	0.272	0.612	95% GROS Adjusted Gamma UCL	0.612	UCL
1,2,3,7,8-PeCDF	ng/kg	0-0.5	35	/	38	92	1.11	15.2	2.7	45.7	7.094	6.4	12.31	3.508	7.945	95% KM (t) UCL	7.945	UCL
2,3,4,6,7,8-HxCDF	ng/kg	0-0.5	38	/	38	100	0.72	9.77	N/A	N/A	4.561	4.575	4.646	2.155	5.151	95% Student's-t UCL	5.151	UCL
2,3,4,7,8-PeCDF	ng/kg	0-0.5	38	/	38	100	1.63	28.4	N/A	N/A	13.26	11.8	46.28	6.803	15.12	95% Student's-t UCL	15.12	UCL
2,3,7,8-TCDD	ng/kg	0-0.5	6	/	38	16	0.137	0.327	0.0722	1.38	0.227	0.223	0.00442	0.0665	0.131	95% KM (t) UCL	0.131	UCL
2,3,7,8-TCDF	ng/kg	0-0.5	36	/	38	95	1.71	81	7.65	56.8	21.59	18.4	250.9	15.84	25.86	95% GROS Adjusted Gamma UCL	25.86	UCL
octa CDD	ng/kg	0-0.5	38	/	38	100	353	9960	N/A	N/A	3101	2325	4421036	2103	3737	95% Adjusted Gamma UCL	3737	UCL
octa CDF	ng/kg	0-0.5	36	/	38	95	7.73	141	28.6	55.7	67.8	65	957.4	30.94	74.35	95% KM (t) UCL	74.35	UCL
Polychlorinated Biphenyl Congeners																		
BZ#77	mg/kg	0-0.5	0	/	39	0	N/A	N/A	0.0016	0.017	N/A	N/A	N/A	N/A	--	--	Not Detected	Not Detected
BZ#81	mg/kg	0-0.5	0	/	39	0	N/A	N/A	0.0032	0.034	N/A	N/A	N/A	N/A	--	--	Not Detected	Not Detected
BZ#105	mg/kg	0-0.5	39	/	39	100	0.012	0.14	N/A	N/A	0.0615	0.053	0.00128	0.0357	0.0712	95% Student's-t UCL	0.0712	UCL
BZ#114	mg/kg	0-0.5	1	/	39	3	0.0089	0.0089	0.0016	0.017	0.0089	0.0089	N/A	N/A	--	--	0.0089	Maximum Detect
BZ#118	mg/kg	0-0.5	39	/	39	100	0.024	0.28	N/A	N/A	0.116	0.11	0.00443	0.0666	0.134	95% Student's-t UCL	0.134	UCL
BZ#123	mg/kg	0-0.5	0	/	39	0	N/A	N/A	0.0016	0.017	N/A	N/A	N/A	N/A	--	--	Not Detected	Not Detected
BZ#126	mg/kg	0-0.5	4	/	39	10	0.016	0.028	0.0015	0.017	0.0203	0.0185	0.000029583	0.00544	--	--	0.028	Maximum Detect
BZ#153	mg/kg	0-0.5	39	/	39	100	0.048	0.42	N/A	N/A	0.184	0.16	0.00964	0.0982	0.21	95% Student's-t UCL	0.21	UCL
BZ#156	mg/kg	0-0.5	39	/	39	100	0.005	0.048	N/A	N/A	0.0209	0.02	0.00012208	0.011	0.0239	95% Student's-t UCL	0.0239	UCL
BZ#157	mg/kg	0-0.5	18	/	39	46	0.0018	0.017	0.0032	0.017	0.00765	0.0082	0.00001433	0.00379	0.00674	95% KM (t) UCL	0.00674	UCL
BZ#167	mg/kg	0-0.5	11	/	39	28	0.0027	0.015	0.0037	0.034	0.00883	0.0088	0.000018618	0.00431	0.00802	95% KM (t) UCL	0.00802	UCL
BZ#169	mg/kg	0-0.5	0	/	39	0	N/A	N/A	0.0015	0.017	N/A	N/A	N/A	N/A	--	--	Not Detected	Not Detected
BZ#189	mg/kg	0-0.5	0	/	39	0	N/A	N/A	0.0015	0.017	N/A	N/A	N/A	N/A	--	--	Not Detected	Not Detected
TEQ																		
Avian PCDD/PCDF TEQ (ND=0)	µg/kg	0-0.5	38	/	38	100	0.00429	0.106	--	--	0.0407	--	--	0.0212	0.0465	95% Student's-t UCL	0.0465	UCL
Avian PCDD/PCDF TEQ (ND=1/2DL)	µg/kg	0-0.5	38	/	38	100	0.0045	0.107	--	--	0.0419	--	--	0.022	0.0479	95% Student's-t UCL	0.0479	UCL
Avian PCDD/PCDF TEQ (ND=FullIDL)	µg/kg	0-0.5	38	/	38	100	0.00471	0.108	--	--	0.0431	--	--	0.0238	0.0496	95% Student's-t UCL	0.0496	UCL
Avian DL-PCB TEQ (ND=0)	µg/kg	0-0.5	39	/	39	100	0.00205	2.81	--	--	0.217	--	--	0.641	0.665	95% Chebyshev (Mean, Sd) UCL	0.665	UCL
Avian DL-PCB TEQ (ND=1/2DL)	µg/kg	0-0.5	39	/	39	100	0.285	4.27	--	--	1.575	--	--	0.954	1.88	95% Adjusted Gamma UCL	1.88	UCL
Avian DL-PCB TEQ (ND=FullIDL)	µg/kg	0-0.5	39	/	39	100	0.565	5.985	--	--	2.932	--	--	1.567	3.45	95% Adjusted Gamma UCL	3.45	UCL
Avian Total TEQ (ND=0)	µg/kg	0-0.5	39	/	39	100	0.00259	2.855	--	--	0.257	--	--	0.642	0.705	95% Chebyshev (Mean, Sd) UCL	0.705	UCL
Avian Total TEQ (ND=1/2DL)	µg/kg	0-0.5	39	/	39	100	0.3	4.315	--	--	1.615	--	--	0.962	1.925	95% Adjusted Gamma UCL	1.925	UCL
Avian Total TEQ (ND=FullIDL)	µg/kg	0-0.5	39	/	39	100	0.585	6.088	--	--	2.974	--	--	1.578	3.497	95% Adjusted Gamma UCL	3.497	UCL
Mammalian PCDD/PCDF TEQ (ND=0)	µg/kg	0-0.5	38	/	38	100	0.00205	0.0269	--	--	0.0142	--	--	0.00591	0.0158	95% Student's-t UCL	0.0158	UCL
Mammalian PCDD/PCDF TEQ (ND=1/2DL)	µg/kg	0-0.5	38	/	38	100	0.00226	0.0308	--	--	0.0146	--	--	0.00625	0.0163	95% Student's-t UCL	0.0163	UCL
Mammalian PCDD/PCDF TEQ (ND=FullIDL)	µg/kg	0-0.5	38	/	38	100	0.00247	0.0352	--	--	0.015	--	--	0.00666	0.0169	95% Student's-t UCL	0.0169	UCL
Mammalian DL-PCB TEQ (ND=0)	µg/kg	0-0.5	39	/	39	100	0.00127	2.81	--	--	0.214	--	--	0.641	0.662	95% Chebyshev (Mean, Sd) UCL	0.662	UCL
Mammalian DL-PCB TEQ (ND=1/2DL)	µg/kg	0-0.5	39	/	39	100	0.1	2.92	--	--	0.673	--	--	0.588	0.884	95% H-UCL	0.884	UCL
Mammalian DL-PCB TEQ (ND=FullIDL)	µg/kg	0-0.5	39	/	39	100	0.198	3.03	--	--	1.131	--	--	0.674	1.352	95% Adjusted Gamma UCL	1.352	UCL
Mammalian Total TEQ (ND=0)	µg/kg	0-0.5	39	/	39	100	0.00163	2.826	--	--	0.228	--	--	0.642	0.676	95% Chebyshev (Mean, Sd) UCL	0.676	UCL
Mammalian Total TEQ (ND=1/2DL)	µg/kg	0-0.5	39	/	39	100	0.1	2.936	--	--	0.687	--	--	0.59	0.9	95% H-UCL	0.9	UCL
Mammalian Total TEQ (ND=FullIDL)	µg/kg	0-0.5	39	/	39	100	0.198	3.046	--	--	1.146	--	--	0.678	1.368	95% Adjusted Gamma UCL	1.368	UCL
Fish PCDD/PCDF TEQ (ND=0)	µg/kg	0-0.5	38	/	38	100	0.00174	0.0312	--	--	0.0145	--	--	0.00675	0.0163	95% Student's-t UCL	0.0163	UCL
Fish PCDD/PCDF TEQ (ND=1/2DL)	µg/kg	0-0.5	38	/	38	100	0.002	0.0343	--	--	0.0149	--	--	0.00701	0.0168	95% Student's-t UCL	0.0168	UCL
Fish PCDD/PCDF TEQ (ND=FullIDL)	µg/kg	0-0.5	38	/	38	100	0.00226	0.0374	--	--	0.0153	--	--	0.0073	0.0173	95% Student's-t UCL	0.0173	UCL
Fish DL-PCB TEQ (ND=0)	µg/kg	0-0.5	39	/	39	100	0.000212	0.141	--	--	0.0114	--	--	0.032	0.0337	95% Chebyshev (Mean, Sd) UCL	0.0337	UCL
Fish DL-PCB TEQ (ND=1/2DL)	µg/kg	0-0.5	39	/	39	100	0.00538	0.148	--	--	0.0333	--	--	0.0298	0.0435	95% H-UCL	0.0435	UCL
Fish DL-PCB TEQ (ND=FullIDL)	µg/kg	0-0.5	39	/	39	100	0.0103	0.155	--	--	0.0551	--	--	0.0336	0.066	95% Adjusted Gamma UCL	0.066	UCL
Fish Total TEQ (ND=0)	µg/kg	0-0.5	39	/	39	100	0.000272	0.156	--	--	0.0255	--	--					

Table AD-38. Soil Summary Statistics by Assessment
Area Anniston PCB Site, Anniston, Alabama

Constituent	Units	Depth (ft bgs)	Summary Statistics												Exposure Point Concentration				
			Detects	/	Total	FOD	Minimum Detect	Maximum Detect	Minimum Nondetect	Maximum Nondetect	Mean	Median	Variance	Standard Deviation	95% UCL	95% UCL Method	Selected EPC	Basis	
Middle Assessment Area																			
Dioxin/Furan Congeners																			
1,2,3,4,6,7,8-HpCDD	ng/kg	0-0.5	34	/	34	100	25.5	425	N/A	N/A	109.6	88.45	6422	80.14	132.9	95% Student's-t UCL	132.9	UCL	
1,2,3,4,6,7,8-HpCDF	ng/kg	0-0.5	23	/	34	68	8.87	156	13.3	66.7	51.54	45	1148	33.88	50.82	95% KM (t) UCL	50.82	UCL	
1,2,3,4,7,8,9-HpCDF	ng/kg	0-0.5	33	/	34	97	1.37	54.5	13.5	13.5	10.99	9.55	94.46	9.719	13.57	95% GROS Adjusted Gamma UCL	13.57	UCL	
1,2,3,4,7,8-HxCDD	ng/kg	0-0.5	25	/	34	74	0.314	3.19	0.24	5.6	1.386	1.2	0.619	0.787	1.433	95% KM (t) UCL	1.433	UCL	
1,2,3,4,7,8-HxCDF	ng/kg	0-0.5	33	/	34	97	5.54	183	6.63	6.63	37.97	29.9	1235	35.14	50.19	95% GROS Adjusted Gamma UCL	50.19	UCL	
1,2,3,6,7,8-HxCDD	ng/kg	0-0.5	30	/	34	88	0.949	17.6	1.23	5.81	4.811	3.85	12.75	3.571	5.468	95% KM (t) UCL	5.468	UCL	
1,2,3,6,7,8-HxCDF	ng/kg	0-0.5	29	/	34	85	1.4	372	8.67	23.9	71.21	43.3	6764	82.24	94.96	95% Gamma Adjusted KM-UCL	94.96	UCL	
1,2,3,7,8,9-HxCDD	ng/kg	0-0.5	24	/	34	71	0.708	8.21	1.07	7.81	3.987	4.205	4.864	2.205	4.07	95% KM (t) UCL	4.07	UCL	
1,2,3,7,8,9-HxCDF	ng/kg	0-0.5	9	/	34	26	0.223	1.83	0.505	6.71	0.878	0.704	0.316	0.562	0.813	95% KM (t) UCL	0.813	UCL	
1,2,3,7,8-PeCDD	ng/kg	0-0.5	3	/	34	9	0.393	1.56	0.11	2.41	0.833	0.547	0.402	0.634	--	--	1.56	Maximum Detect	
1,2,3,7,8-PeCDF	ng/kg	0-0.5	19	/	34	56	1.83	1140	0.815	780	67.79	6.34	67440	259.7	186	95% KM (Chebyshev) UCL	186	UCL	
2,3,4,6,7,8-HxCDF	ng/kg	0-0.5	23	/	34	68	1.01	16.3	3.45	15.5	5.194	4.36	13.94	3.734	5.52	95% KM (t) UCL	5.52	UCL	
2,3,4,7,8-PeCDF	ng/kg	0-0.5	32	/	34	94	3.17	73.7	3.61	15.3	15.79	11.15	189.5	13.77	20.28	95% GROS Adjusted Gamma UCL	20.28	UCL	
2,3,7,8-TCDD	ng/kg	0-0.5	2	/	34	6	0.136	0.543	0.106	13.9	0.34	0.34	0.0828	0.288	--	--	0.543	Maximum Detect	
2,3,7,8-TCDF	ng/kg	0-0.5	31	/	34	91	5.3	437	36.6	602	73.56	47.6	7608	87.22	95.74	95% GROS Adjusted Gamma UCL	95.74	UCL	
octa CDD	ng/kg	0-0.5	34	/	34	100	441	6520	N/A	N/A	2260	1980	1742230	1320	2709	95% Adjusted Gamma UCL	2709	UCL	
octa CDF	ng/kg	0-0.5	34	/	34	100	16.3	252	N/A	N/A	89.16	76.85	3012	54.88	105.1	95% Student's-t UCL	105.1	UCL	
Polychlorinated Biphenyl Congeners																			
BZ#77	mg/kg	0-0.5	1	/	35	3	0.071	0.071	0.0016	0.018	0.071	0.071	N/A	N/A	--	--	0.071	Maximum Detect	
BZ#81	mg/kg	0-0.5	0	/	35	0	N/A	N/A	0.0031	0.037	N/A	N/A	N/A	N/A	--	--	Not Detected	Not Detected	
BZ#105	mg/kg	0-0.5	35	/	35	100	0.0047	0.13	N/A	N/A	0.0454	0.04	0.00087173	0.0295	0.0559	95% Adjusted Gamma UCL	0.0559	UCL	
BZ#114	mg/kg	0-0.5	0	/	35	0	N/A	N/A	0.0016	0.018	N/A	N/A	N/A	N/A	--	--	Not Detected	Not Detected	
BZ#118	mg/kg	0-0.5	35	/	35	100	0.0099	0.22	N/A	N/A	0.088	0.08	0.00284	0.0533	0.107	95% Adjusted Gamma UCL	0.107	UCL	
BZ#123	mg/kg	0-0.5	0	/	35	0	N/A	N/A	0.0016	0.018	N/A	N/A	N/A	N/A	--	--	Not Detected	Not Detected	
BZ#126	mg/kg	0-0.5	0	/	35	0	N/A	N/A	0.0016	0.018	N/A	N/A	N/A	N/A	--	--	Not Detected	Not Detected	
BZ#153	mg/kg	0-0.5	35	/	35	100	0.031	0.32	N/A	N/A	0.156	0.14	0.00624	0.079	0.178	95% Student's-t UCL	0.178	UCL	
BZ#156	mg/kg	0-0.5	35	/	35	100	0.0023	0.04	N/A	N/A	0.0167	0.015	0.00008546	0.00924	0.0193	95% Student's-t UCL	0.0193	UCL	
BZ#157	mg/kg	0-0.5	12	/	35	34	0.0024	0.012	0.0016	0.018	0.00648	0.0056	9.8742E-06	0.00314	0.00511	95% KM (t) UCL	0.00511	UCL	
BZ#167	mg/kg	0-0.5	0	/	35	0	N/A	N/A	0.0031	0.037	N/A	N/A	N/A	N/A	--	--	Not Detected	Not Detected	
BZ#169	mg/kg	0-0.5	0	/	35	0	N/A	N/A	0.0016	0.018	N/A	N/A	N/A	N/A	--	--	Not Detected	Not Detected	
BZ#189	mg/kg	0-0.5	0	/	35	0	N/A	N/A	0.0016	0.018	N/A	N/A	N/A	N/A	--	--	Not Detected	Not Detected	
TEQ																			
Avian PCDD/PCDF TEQ (ND=0)	µg/kg	0-0.5	34	/	34	100	0.00976	0.482	--	--	0.0971	--	--	0.0965	0.128	95% Adjusted Gamma UCL	0.128	UCL	
Avian PCDD/PCDF TEQ (ND=1/2DL)	µg/kg	0-0.5	34	/	34	100	0.00986	0.498	--	--	0.114	--	--	0.117	0.151	95% Adjusted Gamma UCL	0.151	UCL	
Avian PCDD/PCDF TEQ (ND=FullIDL)	µg/kg	0-0.5	34	/	34	100	0.00996	0.808	--	--	0.131	--	--	0.158	0.177	95% Adjusted Gamma UCL	0.177	UCL	
Avian DL-PCB TEQ (ND=0)	µg/kg	0-0.5	35	/	35	100	0.000799	3.55	--	--	0.109	--	--	0.599	0.55	95% Chebyshev (Mean, Sd) UCL	0.55	UCL	
Avian DL-PCB TEQ (ND=1/2DL)	µg/kg	0-0.5	35	/	35	100	0.277	4.05	--	--	1.279	--	--	0.844	1.539	95% Adjusted Gamma UCL	1.539	UCL	
Avian DL-PCB TEQ (ND=FullIDL)	µg/kg	0-0.5	35	/	35	100	0.553	6.445	--	--	2.448	--	--	1.428	2.909	95% Adjusted Gamma UCL	2.909	UCL	
Avian Total TEQ (ND=0)	µg/kg	0-0.5	35	/	35	100	0.00505	3.644	--	--	0.203	--	--	0.607	0.254	95% H-UCL	0.254	UCL	
Avian Total TEQ (ND=1/2DL)	µg/kg	0-0.5	35	/	35	100	0.287	4.144	--	--	1.389	--	--	0.902	1.671	95% Adjusted Gamma UCL	1.671	UCL	
Avian Total TEQ (ND=FullIDL)	µg/kg	0-0.5	35	/	35	100	0.563	7.253	--	--	2.575	--	--	1.525	3.011	95% Student's-t UCL	3.011	UCL	
Mammalian PCDD/PCDF TEQ (ND=0)	µg/kg	0-0.5	34	/	34	100	0.00309	0.097	--	--	0.0256	--	--	0.0208	0.0323	95% Adjusted Gamma UCL	0.0323	UCL	
Mammalian PCDD/PCDF TEQ (ND=1/2DL)	µg/kg	0-0.5	34	/	34	100	0.0032	0.135	--	--	0.0288	--	--	0.0256	0.0367	95% Adjusted Gamma UCL	0.0367	UCL	
Mammalian PCDD/PCDF TEQ (ND=FullIDL)	µg/kg	0-0.5	34	/	34	100	0.00331	0.173	--	--	0.032	--	--	0.0313	0.0442	95% H-UCL	0.0442	UCL	
Mammalian DL-PCB TEQ (ND=0)	µg/kg	0-0.5	35	/	35	100	0.000507	0.0117	--	--	0.00477	--	--	0.00281	0.00579	95% Adjusted Gamma UCL	0.00579	UCL	
Mammalian DL-PCB TEQ (ND=1/2DL)	µg/kg	0-0.5	35	/	35	100	0.105	1.19	--	--	0.441	--	--	0.262	0.524	95% Adjusted Gamma UCL	0.524	UCL	
Mammalian DL-PCB TEQ (ND=FullIDL)	µg/kg	0-0.5	35	/	35	100	0.209	2.371	--	--	0.878	--	--	0.521	1.042	95% Adjusted Gamma UCL	1.042	UCL	
Mammalian Total TEQ (ND=0)	µg/kg	0-0.5	35	/	35	100	0.00308	0.106	--	--	0.0296	--	--	0.0226	0.0371	95% Adjusted Gamma UCL	0.0371	UCL	
Mammalian Total TEQ (ND=1/2DL)	µg/kg	0-0.5	35	/	35	100	0.108	1.325	--	--	0.469	--	--	0.278	0.557	95% Adjusted Gamma UCL	0.557	UCL	
Mammalian Total TEQ (ND=FullIDL)	µg/kg	0-0.5	35	/	35	100	0.213	2.544	--	--	0.909	--	--	0.541	1.079	95% Adjusted Gamma UCL	1.079	UCL	
Fish PCDD/PCDF TEQ (ND=0)	µg/kg	0-0.5	34	/	34	100	0.00313	0.12	--	--	0.0243	--	--	0.0224	0.0309	95% Adjusted Gamma UCL	0.0309	UCL	
Fish PCDD/PCDF TEQ (ND=1/2DL)	µg/kg	0-0.5	34	/	34	100	0.00324	0.143	--	--	0.0271	--	--	0.026	0.0365	95% H-UCL	0.0365	UCL	
Fish PCDD/PCDF TEQ (ND=FullIDL)	µg/kg	0-0.5	34	/	34	100	0.00335	0.166	--	--	0.03	--	--	0.0301	0.0406	95% H-UCL	0.0406	UCL	
Fish DL-PCB TEQ (ND=0)	µg/kg	0-0.5	35	/	35	100	0.0000845	0.00732	--	--	0.00096484	--	--	0.0012	0.00124	95% Adjusted Gamma UCL	0.00124	UCL	
Fish DL-PCB TEQ (ND=1/2DL)	µg/kg	0-0.5	35	/	35	100	0.005	0.0574	--	--	0.0216	--	--	0.0125	0.0255	95% Adjusted Gamma UCL	0.0255	UCL	
Fish DL-PCB TEQ (ND=FullIDL)	µg/kg	0-0.5	35	/	35	100	0.00992	0.113	--	--	0.0422	--	--	0.0247	0.05	95% Adjusted Gamma UCL	0.05	UCL	
Fish Total TEQ (ND=0)	µg/kg	0-0.5	35	/	35	100	0.000514	0.122	--	--	0.0246	--	--	0.0227	0.0319	95% Adjusted Gamma UCL	0.0319	UCL	
Fish Total TEQ (ND=1/2DL)	µg/kg	0-0.5	35	/	35	100	0.00824	0.2	--	--	0.0479	--	--	0.0352	0.0584	95% Adjusted Gamma UCL	0.0584	UCL	
Fish Total TEQ (ND=FullIDL)	µg/kg	0-0.5	35	/	35	100	0.0133	0.279	--	--	0.0713	--	--	0.0493	0.086	95% Adjusted Gamma UCL	0.086	UCL	
Miscellaneous																			
Moisture, percent	%	0-0.5	34	/	34	100	11	37	N/A	N/A	21.68	20.5							

Table AD-38. Soil Summary Statistics by Assessment
Area Anniston PCB Site, Anniston, Alabama

Constituent	Units	Depth (ft bgs)	Summary Statistics											Exposure Point Concentration				
			Detects	/	Total	FOD	Minimum Detect	Maximum Detect	Minimum Nondetect	Maximum Nondetect	Mean	Median	Variance	Standard Deviation	95% UCL	95% UCL Method	Selected EPC	Basis
Lower Assessment Area																		
Dioxin/Furan Congeners																		
1,2,3,4,6,7,8-HpCDD	ng/kg	0-0.5	28	/	28	100	11.8	250	N/A	N/A	69.87	57.2	2499	49.99	87.69	95% Adjusted Gamma UCL	87.69	UCL
1,2,3,4,6,7,8-HpCDF	ng/kg	0-0.5	20	/	28	71	2.7	109	0.34	34.6	22.99	13.45	753.5	27.45	30.03	95% KM Adjusted Gamma UCL	30.03	UCL
1,2,3,4,7,8,9-HpCDF	ng/kg	0-0.5	20	/	28	71	0.18	24.3	0.17	2.15	5.785	3.235	43.82	6.62	7.361	95% Gamma Adjusted KM-UCL	7.361	UCL
1,2,3,4,7,8-HxCDD	ng/kg	0-0.5	19	/	28	68	0.19	2.51	0.119	2.53	0.947	0.82	0.382	0.618	1.025	95% GROS Adjusted Gamma UCL	1.025	UCL
1,2,3,4,7,8-HxCDF	ng/kg	0-0.5	23	/	28	82	0.59	86.7	0.082	4.61	16.38	10.3	438.9	20.95	23.88	95% Gamma Adjusted KM-UCL	23.88	UCL
1,2,3,6,7,8-HxCDD	ng/kg	0-0.5	22	/	28	79	0.195	10	0.928	2.62	2.296	1.18	6.381	2.526	2.918	95% GROS Adjusted Gamma UCL	2.918	UCL
1,2,3,6,7,8-HxCDF	ng/kg	0-0.5	25	/	28	89	1.12	365	0.25	1.88	65.51	41.5	7859	88.65	103.2	95% Gamma Adjusted KM-UCL	103.2	UCL
1,2,3,7,8,9-HxCDD	ng/kg	0-0.5	25	/	28	89	0.316	5.42	1.45	2.77	2.017	1.83	1.394	1.181	2.309	95% KM (t) UCL	2.309	UCL
1,2,3,7,8,9-HxCDF	ng/kg	0-0.5	2	/	28	7	1.41	2.665	0.11	4.4	2.038	2.038	0.788	0.887	--	--	2.665	Maximum Detect
1,2,3,7,8-PeCDD	ng/kg	0-0.5	1	/	28	4	0.969	0.969	0.093	1.62	0.969	0.969	N/A	N/A	--	--	0.969	Maximum Detect
1,2,3,7,8-PeCDF	ng/kg	0-0.5	8	/	28	29	0.4	23.6	0.13	708	7.989	3.425	74.74	8.645	6.04	95% KM (t) UCL	6.04	UCL
2,3,4,6,7,8-HxCDF	ng/kg	0-0.5	18	/	28	64	0.3	13.7	0.097	5.78	3.498	2.05	14.38	3.792	4.113	95% KM Adjusted Gamma UCL	4.113	UCL
2,3,4,7,8-PeCDF	ng/kg	0-0.5	21	/	28	75	0.66	37.1	0.14	4.73	7.437	4	88.05	9.384	19.45	95% KM H-UCL	19.45	UCL
2,3,7,8-TCDD	ng/kg	0-0.5	2	/	28	7	0.441	0.75	0.092	0.752	0.596	0.596	0.0477	0.218	--	--	0.75	Maximum Detect
2,3,7,8-TCDF	ng/kg	0-0.5	26	/	28	93	1.24	683	0.58	4.32	83.51	11.55	32648	180.7	222.2	95% KM (Chebyshev) UCL	222.2	UCL
octa CDD	ng/kg	0-0.5	28	/	28	100	899	4200	N/A	N/A	2149	2130	684060	827.1	2415	95% Student's-t UCL	2415	UCL
octa CDF	ng/kg	0-0.5	27	/	28	96	2.2	216	0.74	0.74	36.67	20	2306	48.02	59.2	95% Gamma Adjusted KM-UCL	59.2	UCL
Polychlorinated Biphenyl Congeners																		
BZ#77	mg/kg	0-0.5	5	/	28	18	0.0019	0.315	0.0014	0.017	0.0711	0.012	0.0186	0.136	0.0812	95% Gamma Adjusted KM-UCL	0.0812	UCL
BZ#81	mg/kg	0-0.5	0	/	28	0	N/A	N/A	0.0028	0.035	N/A	N/A	N/A	N/A	--	--	Not Detected	Not Detected
BZ#105	mg/kg	0-0.5	21	/	28	75	0.0023	0.12	0.0014	0.0017	0.0269	0.012	0.00124	0.0352	0.0378	95% Gamma Adjusted KM-UCL	0.0378	UCL
BZ#114	mg/kg	0-0.5	0	/	28	0	N/A	N/A	0.0014	0.017	N/A	N/A	N/A	N/A	--	--	Not Detected	Not Detected
BZ#118	mg/kg	0-0.5	24	/	28	86	0.0019	0.23	0.0014	0.0015	0.0462	0.015	0.00436	0.0661	0.0736	95% Gamma Adjusted KM-UCL	0.0736	UCL
BZ#123	mg/kg	0-0.5	2	/	28	7	0.0041	0.023	0.0014	0.017	0.0136	0.0136	0.00017861	0.0134	--	--	0.023	Maximum Detect
BZ#126	mg/kg	0-0.5	7	/	28	25	0.002	0.044	0.0014	0.017	0.0148	0.0031	0.00035273	0.0188	0.00506	95% KM H-UCL	0.00506	UCL
BZ#153	mg/kg	0-0.5	25	/	28	89	0.0032	0.37	0.0028	0.003	0.0853	0.042	0.0139	0.118	0.136	95% Gamma Adjusted KM-UCL	0.136	UCL
BZ#156	mg/kg	0-0.5	17	/	28	61	0.0019	0.042	0.0014	0.0017	0.0125	0.0069	0.0001806	0.0134	0.0129	95% KM H-UCL	0.0129	UCL
BZ#157	mg/kg	0-0.5	1	/	28	4	0.0031	0.0031	0.0014	0.017	0.0031	0.0031	N/A	N/A	--	--	0.0031	Maximum Detect
BZ#167	mg/kg	0-0.5	2	/	28	7	0.0031	0.0041	0.0028	0.035	0.0036	0.0036	0.0000005	0.00070711	--	--	0.0041	Maximum Detect
BZ#169	mg/kg	0-0.5	0	/	28	0	N/A	N/A	0.0014	0.017	N/A	N/A	N/A	N/A	--	--	Not Detected	Not Detected
BZ#189	mg/kg	0-0.5	1	/	28	4	0.0015	0.0015	0.0014	0.017	0.0015	0.0015	N/A	N/A	--	--	0.0015	Maximum Detect
TEQ																		
Avian PCDD/PCDF TEQ (ND=0)	µg/kg	0-0.5	28	/	28	100	0.000186	0.743	--	--	0.0914	--	--	0.189	0.247	95% Chebyshev (Mean, Sd) UCL	0.247	UCL
Avian PCDD/PCDF TEQ (ND=1/2DL)	µg/kg	0-0.5	28	/	28	100	0.000674	0.744	--	--	0.0952	--	--	0.192	0.253	95% Chebyshev (Mean, Sd) UCL	0.253	UCL
Avian PCDD/PCDF TEQ (ND=FullIDL)	µg/kg	0-0.5	28	/	28	100	0.00116	0.745	--	--	0.0989	--	--	0.195	0.26	95% Chebyshev (Mean, Sd) UCL	0.26	UCL
Avian DL-PCB TEQ (ND=0)	µg/kg	0-0.5	28	/	28	100	0	19.75	--	--	0.984	--	--	3.773	4.093	95% Chebyshev (Mean, Sd) UCL	4.093	UCL
Avian DL-PCB TEQ (ND=1/2DL)	µg/kg	0-0.5	28	/	28	100	0.246	21.2	--	--	1.607	--	--	4.041	4.936	95% Chebyshev (Mean, Sd) UCL	4.936	UCL
Avian DL-PCB TEQ (ND=FullIDL)	µg/kg	0-0.5	28	/	28	100	0.492	22.65	--	--	2.23	--	--	4.425	5.875	95% Chebyshev (Mean, Sd) UCL	5.875	UCL
Avian Total TEQ (ND=0)	µg/kg	0-0.5	28	/	28	100	0.000186	20.23	--	--	1.076	--	--	3.879	8.371	99% Chebyshev (Mean, Sd) UCL	8.371	UCL
Avian Total TEQ (ND=1/2DL)	µg/kg	0-0.5	28	/	28	100	0.249	21.68	--	--	1.702	--	--	4.165	5.134	95% Chebyshev (Mean, Sd) UCL	5.134	UCL
Avian Total TEQ (ND=FullIDL)	µg/kg	0-0.5	28	/	28	100	0.495	23.13	--	--	2.329	--	--	4.562	6.087	95% Chebyshev (Mean, Sd) UCL	6.087	UCL
Mammalian PCDD/PCDF TEQ (ND=0)	µg/kg	0-0.5	28	/	28	100	0.000578	0.121	--	--	0.0189	--	--	0.0293	0.0389	95% H-UCL	0.0389	UCL
Mammalian PCDD/PCDF TEQ (ND=1/2DL)	µg/kg	0-0.5	28	/	28	100	0.000751	0.122	--	--	0.0204	--	--	0.0305	0.0408	95% H-UCL	0.0408	UCL
Mammalian PCDD/PCDF TEQ (ND=FullIDL)	µg/kg	0-0.5	28	/	28	100	0.000924	0.123	--	--	0.0219	--	--	0.0317	0.0337	95% Adjusted Gamma UCL	0.0337	UCL
Mammalian DL-PCB TEQ (ND=0)	µg/kg	0-0.5	28	/	28	100	0	4.41	--	--	0.368	--	--	1.106	1.279	95% Chebyshev (Mean, Sd) UCL	1.279	UCL
Mammalian DL-PCB TEQ (ND=1/2DL)	µg/kg	0-0.5	28	/	28	100	0.0917	4.64	--	--	0.564	--	--	1.137	1.5	95% Chebyshev (Mean, Sd) UCL	1.5	UCL
Mammalian DL-PCB TEQ (ND=FullIDL)	µg/kg	0-0.5	28	/	28	100	0.183	4.87	--	--	0.76	--	--	1.223	1.768	95% Chebyshev (Mean, Sd) UCL	1.768	UCL
Mammalian Total TEQ (ND=0)	µg/kg	0-0.5	28	/	28	100	0.000578	4.531	--	--	0.387	--	--	1.13	1.721	97.5% Chebyshev (Mean, Sd) UCL	1.721	UCL
Mammalian Total TEQ (ND=1/2DL)	µg/kg	0-0.5	28	/	28	100	0.0936	4.762	--	--	0.584	--	--	1.163	1.543	95% Chebyshev (Mean, Sd) UCL	1.543	UCL
Mammalian Total TEQ (ND=FullIDL)	µg/kg	0-0.5	28	/	28	100	0.186	4.993	--	--	0.782	--	--	1.251	1.813	95% Chebyshev (Mean, Sd) UCL	1.813	UCL
Fish PCDD/PCDF TEQ (ND=0)	µg/kg	0-0.5	28	/	28	100	0.000243	0.0876	--	--	0.0151	--	--	0.0214	0.0238	95% Adjusted Gamma UCL	0.0238	UCL
Fish PCDD/PCDF TEQ (ND=1/2DL)	µg/kg	0-0.5	28	/	28	100	0.000417	0.0886	--	--	0.0172	--	--	0.0231	0.0267	95% Adjusted Gamma UCL	0.0267	UCL
Fish PCDD/PCDF TEQ (ND=FullIDL)	µg/kg	0-0.5	28	/	28	100	0.000591	0.098	--	--	0.0193	--	--	0.0253	0.0297	95% Adjusted Gamma UCL	0.0297	UCL
Fish DL-PCB TEQ (ND=0)	µg/kg	0-0.5	28	/	28	100	0	0.233	--	--	0.0198	--	--	0.0594	0.0687	95% Chebyshev (Mean, Sd) UCL	0.0687	UCL
Fish DL-PCB TEQ (ND=1/2DL)	µg/kg	0-0.5	28	/	28	100	0.00434	0.241	--	--	0.0289	--	--	0.0602	0.0784	95% Chebyshev (Mean, Sd) UCL	0.0784	UCL
Fish DL-PCB TEQ (ND=FullIDL)	µg/kg	0-0.5	28	/	28	100	0.00868	0.249	--	--	0.038	--	--	0.0634	0.0902	95% Chebyshev (Mean, Sd) UCL	0.0902	UCL
Fish Total TEQ (ND=0)	µg/kg	0-0.5	28	/	28	100	0.000243	0.31	--	--	0.0349	--	--	0.0777	0.0989	95% Chebyshev (Mean, Sd) UCL	0.0989	UCL
Fish Total TEQ (ND=1/2DL)	µg/kg	0-0.5	28	/	28	100	0.00507	0.32	--	--	0.0461	--	--	0.0804	0.112	95% Chebyshev (Mean, Sd) UCL	0.112	UCL
Fish Total TEQ (ND=FullIDL)	µg/kg	0-0.5	28	/	28	100	0.00989	0.33	--	--	0.0573	--	--					

Table AD-38. Soil Summary Statistics by Assessment
Area Anniston PCB Site, Anniston, Alabama

Constituent	Units	Depth (ft bgs)	Summary Statistics											Exposure Point Concentration			
			Detects / Total	FOD	Minimum Detect	Maximum Detect	Minimum Nondetect	Maximum Nondetect	Mean	Median	Variance	Standard Deviation	95% UCL	95% UCL Method	Selected EPC	Basis	
Miscellaneous																	
Moisture, percent	%	0-0.5	17 / 17	100	7.18	23	N/A	N/A	16.48	18	21.2	4.604	18.43	95% Student's-t UCL	18.43	UCL	
Solids, percent	%	0-0.5	252 / 252	100	42	97.45	N/A	N/A	87.78	88.1	40.33	6.351	88.43	95% Modified-t UCL	88.43	UCL	
TOC by lloyd kahn	mg/kg	0-0.5	288 / 288	100	1100	55300	N/A	N/A	14296	12550	67468462	8214	15080	95% Approximate Gamma UCL	15080	UCL	

Notes:

%: percent
CDD: chlorodibenzo-p-dioxin
CDF: chlorodibenzo-p-furan
DL: dioxin-like
DL-PCB: dioxin-like polychlorinated biphenyl
EPC: exposure point concentration
FOD: frequency of detection
ft bgs: feet below ground surface
HpCDD: heptachlorodibenzo-p-dioxin
HpCDF: heptachlorodibenzofuran
HxCDD: hexachlorodibenzo-p-dioxin
HxCDF: hexachlorodibenzofuran
KM: Kaplan-Meier
mg/kg: milligram per kilogram
N/A: not applicable

ND: nondetect
ng/kg: nanogram per kilogram
PCDD: polychlorinated dibenzodioxin
PCDF: polychlorinated dibenzofuran
PeCDD: pentachlorodibenzo-p-dioxin
PeCDF: pentachlorodibenzofuran
RPD: relative percent difference
Sd: standard deviation
TCDD: tetrachlorodibenzo-p-dioxin
TCDF: tetrachlorodibenzofuran
TEQ: toxic equivalent
TOC: total organic carbon
UCL: upper confidence limit
µg/kg: microgram per kilogram

Revised Table AD-39. Percentage and Number of Surface Sediment Samples Exceeding Site-Specific Toxicity Thresholds by Reach
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

Exposure Unit	Surface Sediment Samples Exceeding Toxicity Threshold Values																						
	Total Number of Samples in Reach	Total PCBs (mg/kg dw)																					
		H. azteca 42-day young/female (normalized to survival)								C. dilutus Percent Emergence								C. dilutus survival					
		< EC0* (EC0* = 1.4 mg/kg)		≥ EC0*, < EC10* (EC10* = 2.6 mg/kg)		≥ EC10*, < EC20* (EC20* =4.4 mg/kg)		≥ EC20 (≥ 4.4 mg/kg)		< EC0* (EC0* = 2.0 mg/kg)		≥ EC0*, < EC10* (EC10* = 6.8 mg/kg)		≥ EC10*, < EC20* (EC20* = 14.3 mg/kg)		≥ EC20 (≥ 14.3 mg/kg)		< EC0* (EC0* = 4 mg/kg)		≥ EC0*, < EC10* (EC10* = 75.7 mg/kg)		≥ EC10*, < EC20* (EC20* = 123 mg/kg)	
		%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number
C1	16	31	5	25	4	13	2	31	5	44	7	44	7	6	1	6	1	94	15	6	1	0	0
C2	39	72	28	5	2	10	4	13	5	77	30	13	5	0	0	10	4	90	35	8	3	3	1
C3	14	57	8	36	5	7	1	0	0	86	12	14	2	0	0	0	0	100	14	0	0	0	0
C4	25	84	21	8	2	0	0	8	2	88	22	4	1	4	1	4	1	100	24	4	1	0	0
C5	48	83	40	10	5	4	2	2	1	87	42	13	6	0	0	0	0	100	48	0	0	0	0
C6	4	100	4	0	0	0	0	0	0	100	4	0	0	0	0	0	0	100	4	0	0	0	0
C7	36	70	25	11	4	19	7	0	0	72	26	28	10	0	0	0	0	100	36	0	0	0	0
C8	32	75	24	22	7	3	1	0	0	94	30	6	2	0	0	0	0	100	32	0	0	0	0
C9	17	100	17	0	0	0	0	0	0	100	17	0	0	0	0	0	0	100	17	0	0	0	0
C10	36	89	32	8	3	3	1	0	0	97	35	3	1	0	0	0	0	100	36	0	0	0	0
Total	267	76	204	12	32	7	18	5	13	84	225	13	34	1	2	2	6	98	261	2	5	0.4	1

**Table AD-40 Percentage of Surface Sediment Samples Exceeding Toxicity Thresholds by
Reach Anniston PCB Site, Anniston, Alabama**

EU	Total Number of Samples in Reach	Percentage of Surface Sediment Samples Exceeding Sediment Toxicity Threshold Values ^a									
		Total PCBs (mg/kg dw)					Total PCBs (mg/kg-OC)				
		<i>H. azteca</i> 42-day young/female (normalized to survival)				<i>C. dilutis</i> Survival	<i>H. azteca</i> 42-day young/female (normalized to survival)				<i>C. dilutis</i> Survival
		< EC0* (1.4)	>EC0*; ≤ EC10* (2.6)	>EC10*; ≤ EC20* (4.4)	> EC20*	> EC0* (14)	< EC0* (72.8)	>EC0*; ≤ EC10* (120)	>EC10*; ≤ EC20* (195)	> EC20*	> EC0* (1000)
C1	16	31%	25%	25%	19%	6%	25%	0%	6%	69%	25%
C2	39	72%	5%	10%	13%	10%	74%	0%	5%	21%	8%
C3	14	57%	36%	7%	0%	0%	43%	14%	14%	29%	0%
C4	25	84%	8%	0%	8%	4%	52%	12%	8%	28%	0%
C5	48	83%	10%	4%	2%	0%	54%	15%	17%	15%	0%
C6	4	100%	0%	0%	0%	0%	75%	25%	0%	0%	0%
C7	36	69%	11%	19%	0%	0%	50%	14%	17%	19%	3%
C8	32	78%	19%	3%	0%	0%	94%	6%	0%	0%	0%
C9	17	100%	0%	0%	0%	0%	100%	0%	0%	0%	0%
C10	37	89%	8%	3%	0%	0%	92%	8%	0%	0%	0%
Total	268	77%	12%	7%	4%	2%	67%	9%	8%	16%	3%

**Table AD-40 Percentage of Surface Sediment Samples Exceeding Toxicity Thresholds by
Reach Anniston PCB Site, Anniston, Alabama**

EU	Percentage of Surface Sediment Samples Exceeding Sediment Toxicity Threshold Values ^a					
	Mercury (mg/kg dw)					
	Total Number of Samples in Reach	<i>H. azteca</i> 42-day young/female (normalized to survival)				<i>C. dilutis</i> Survival
		< EC0*	>EC0*; ≤ EC10*	>EC10*; ≤ EC20*	> EC20*	> EC0* (3.6)
C1	2	0%	100%	0%	0%	0%
C2	7	43%	0%	14%	43%	14%
C3	10	40%	20%	30%	10%	0%
C4	7	29%	0%	57%	14%	0%
C5	25	8%	44%	32%	16%	0%
C6	0	--	--	--	--	--
C7	21	38%	33%	14%	14%	5%
C8	3	33%	0%	33%	33%	0%
C9	1	0%	0%	100%	0%	0%
C10	15	47%	7%	13%	33%	0%
Total	91	30%	25%	25%	20%	2%

Notes

^a EC0*, EC10*, and EC20* are the regression-predicted PCB or mercury concentrations that would cause an additional 0%, 10%, or 20% effect beyond the lowest response measured in the reference sediments (i.e., 1×, 0.9×, and 0.8× the response at the “bottom” of the reference envelope).
H. azteca 42-day young/female (normalized to survival) is the most sensitive endpoint.
 -- : Not calculated since there were no samples collected for mercury from this EU.

EU: exposure unit

OC: organic carbon

PCBs: polychlorinated biphenyls

Negligible risk when concentration is below EC0* for most sensitive reproduction endpoint

Low risk based on exceedance of EC0* for most sensitive reproduction endpoint

Moderate risk based on exceedance of EC10* for most sensitive reproduction endpoint

High risk based on exceedance of EC20* for most sensitive reproduction endpoint

Risk Based based on EC0* for most sensitive survival endpoint.

Table AD-41. Summary of Calculated HQs from Dietary Exposure Models Calculated using the Maximum or 95% UCL Measured PCB concentration in Reach C1 East and C1 West Sediment and “Riparian” Soil

**OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama**

Analyte	Maximum sediment concentration (mg/kg)	Maximum soil concentration (mg/kg)	EPA Calculated, abiotic data from Reach C1	EPA Calculated, abiotic data from Reach C1			From the OU-4 BERA (Reach C1) (abiotic data are 95% UCL for the UAA)	
			Spotted Sandpiper	Spotted Sandpiper	Raccoon		Spotted Sandpiper	Raccoon
			LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	LOAEL HQ
Mercury	0.58	17.4	14.44	42.7	0.8	1.6	8.0	—
Chromium	46	46	1.28	1.3	0.6	0.7	< 1	—
Lead	110	89.1	4.30	8.9	0.4	0.8	4.0	—
Vanadium	53	22.8	3.30	6.8	0.1	0.2	3.0	—
C1-West -- High sensitivity TRV	41	206.5	91.87	277.7	4.3	12.6	36.0	< 1
C1-West -medium sensitivity TRV	41	206.5	8.53	25.4	—	—	3.0	—
C1-East -- High sensitivity TRV	41	59	6.82	20.3	4.0	11.8	—	< 1
C1-East -medium sensitivity TRV	41	59	6.82	20.3	—	—	—	—
Analyte	95% UCL sediment concentration (mg/kg)	95% UCL soil concentration (mg/kg)	EPA Calculated, abiotic data from Reach C1	EPA Calculated, abiotic data from Reach C1				
			Spotted Sandpiper	Spotted Sandpiper	Raccoon			
			LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ		
Mercury	0.58	2.8	8.5	25.1	0.4	0.7		
Chromium	46	27.5	1.2	1.2	0.6	0.7		
Lead	110	56.5	4.1	8.5	0.4	0.7		
Vanadium	53	20.2	3.2	6.7	0.1	0.2		
C1-West -- High sensitivity TRV	15.98	206.5	60.8	183.9	2.3	6.8		
C1-West -medium sensitivity TRV	15.98	206.5	5.6	16.8	—	—		
C1-East -- High sensitivity TRV	15.98	59	3.9	11.7	2.0	6.0		
C1-East -medium sensitivity TRV	15.98	59	3.9	11.7	—	—		

Bold text indicates NOAEL-based HQs ≥ 1.0

Grey shading indicates acceptable risk (NOAEL-based HQ < 1.0)

Green shading is indeterminate risk (NOAEL-based HQ ≥ 1.0 and LOAEL-based HQ < 1.0)

Yellow shading indicates unacceptable risk (LOAEL-based HQ ≥ 1.0)

Red shading indicates high unacceptable risk (LOAEL-based HQ ≥ 10.0 , or based on severity of effect observed in critical study LOAEL TRV was derived from

mg/kg = milligrams per kilogram

LOAEL = Lowest observed adverse effect level

NOAEL = No observed adverse effect level

HQ = Hazard quotient

UAA = Upper Assessment Area

TRV = Toxicity Reference Value

95% UCL = 95% upper confidence limit

BERA = Baseline ERA

OU = Operable Unit

Table AD-42. Summary of Potential Risks to Lower Trophic Level Receptors from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk
Anniston PCB Site, Anniston, Alabama
OU-4 BERA Addendum

Line Of Evidence	Exposure Unit	ARCADIS				Exposure Area	EPA			
		Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis		Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
Aquatic Plants/Aquatic Life										
Compare surface water EPC to Alabama and/or National Water Quality Standards	C1, LAA	High	Moderate	Moderate/Low	— Use of conservative Alabama water quality standards	C1, LAA	High Unacceptable	Moderate/High	Moderate/Low	— Benchmarks considered protective of 95% of aquatic species (including aquatic plants)
					— Considered to be adequately and sufficiently protective of aquatic life (including aquatic plants)					— National Water Quality Standards are potential ARARs at CERCLA sites.
	UAA, MAA	Moderate			— EPC exceeds chronic criteria but not acute	UAA, MAA	Unacceptable			— EPC exceeds chronic criterion but not acute
Compare surface water EPC to plant-specific benchmarks	UAA, MAA, LAA	Negligible	Moderate	Moderate/ Low	— Benchmark is receptor-specific	UAA, MAA, LAA	Acceptable	High/high potential to underestimate population risk	Moderate/Low	— Benchmark is receptor-specific
	C1	Moderate			— Benchmark is literature-based and confidence is moderate	C1	Unacceptable			— Benchmark is literature-based and confidence is moderate/low
Weight of Evidence Conclusion						C1	Unacceptable	Moderate/High	Moderate/Low	Lines of evidence have high uncertainty and produce divergent results.
						UAA, MAA, LAA	Acceptable			
Terrestrial Plants										—
Compare soil EPCs to plant benchmark	C1 East and C2 (all EUs) through C9 (all EUs)	Negligible	Moderate	Low	—Conservative literature-based benchmarks based on laboratory tests. The applicability of this benchmark is highly uncertain	C1 East and C2 (all EUs) through C9 (all EUs)	Acceptable		Agree	—
	C1 West	Moderate	High	Low	— C1 West EPC based on the maximum detected concentration	C1 West	Unacceptable		Low	
Terrestrial Plant Community Evaluation	UAA, MAA, LAA	No Impairment indicated	NA	Low	— Based on Site-specific observations	UAA, MAA, LAA	NA	NA	Low	— Survey data are a secondary line of evidence
					— Evaluation indicated no upstream to downstream trend					— No reference comparison
					Overall, the results suggest no adverse effect of PCBs or other COPCs on the terrestrial plant community					— Cannot make conclusions on adverse effect of PCBs or other COPCs on the terrestrial plant community as chemistry was not measured in samples collected where community survey samples were taken
Weight of Evidence Conclusion						C1 East, C2 to C9 C1 West	Acceptable Unacceptable	Moderate/High	Low	Low confidence associated with all LOEs. Most LOEs in concurrence
Benthic Invertebrates/Aquatic Invertebrates										
Compare individual sediment samples to site-specific dry weight reproduction-based toxicity thresholds (Hyaella azteca)	C4, C5, C6, C9 and C10	Negligible	Moderate	Moderate/ High	— EC values based on site-specific toxicity tests	C1, C2	High Unacceptable	Low	Moderate/High	— EC values based on site-specific toxicity tests
						C4, C5	Localized areas, High Unacceptable			
	C3	Low			—Impacts on population from reproductive endpoints could impact population	C7	Unacceptable			— Reproduction is an ecologically relevant endpoint; adverse effects on reproductive success can result in population-level effects
	C7	Moderate			— High uncertainty in results due to high control variability	C3, C8	Localized areas, Unacceptable			— Control samples for all toxicity tests met all acceptability criteria
	C1 and C2	High				C10	Indeterminate			
					C6, C9	Acceptable				
Compare individual sediment samples to site-specific dry weight growth-based toxicity thresholds (Chironomus dilutus)	Not evaluated	Not evaluated	Not evaluated	Not evaluated	—	C2	High Unacceptable	Low	Moderate/High	— EC values based on site-specific toxicity tests
						C1, C4	Localized areas, High Unacceptable			— Growth is an ecologically relevant endpoint; adverse effects on growth can result in population-level effects
					—	C3, C5, C7, C8, C10	Indeterminate			
Compare individual sediment samples to site-specific dry weight survival-based toxicity thresholds (C. dilutus)	All reaches	Negligible	Low	Moderate/ High	— EC values based on site-specific toxicity tests	C2	Localized areas, Unacceptable	Low	Low/Moderate	— EC values based on site-specific toxicity tests
						C1, C4	Indeterminate			— Survival is an ecologically relevant endpoint and can result in population-level effects, however it is generally less sensitive than growth or reproductive endpoints and is given lower weight
					— Survival endpoints are directly related to population sustainability	C3, C5 through C10	Acceptable			

Table AD-42. Summary of Potential Risks to Lower Trophic Level Receptors from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk
Anniston PCB Site, Anniston, Alabama
OU-4 BERA Addendum

Line Of Evidence	Exposure Unit	ARCADIS				Exposure Area	EPA			
		Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis		Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
Compare individual sediment samples to consensus-based toxicity benchmarks	C9	Low	High	Low	— Uncertainties associated with derivation of these benchmarks:	C9	Indeterminate		Agree	
	C1 through C8, C10	Moderate/High			— Do not reflect contaminant-specific response thresholds	C1 through C8, C10	Unacceptable		Low	
					— Do not account for site-specific factors that could influence bioavailability					
Evalute site-specific toxicity testing results from the three surface sediments collected	Not evaluated					C2; UAA C5; MAA C10; LAA	Unacceptable Acceptable Indeterminate	Low/Moderate	Moderate/High	— Site-specific estimate of impacts to the benthic invertebrate community
Compare measured site tissue concentrations to CTCs	UAA, MAA, LAA	Negligible	Moderate	Moderate	— CTCs are based on relatively small toxicity datasets and results in some cases had high variability	UAA	Unacceptable	Moderate	Low	— COPC concentrations measured in benthic invertebrates collected on-site
					— Values are species-specific	MAA, LAA ³	Indeterminate			— High variability in CTCs reported for benthic invertebrates in the literature.
					— Low end was selected if multiple values available					— HQs exceed 1.0 for molluscs in all three AAs, however site-specific toxicity testing indicates mussels are less sensitive than other benthic invertebrate species
Benthic Invertebrate Community Evaluation	UAA, MAA, LAA	No Impairment indicated	NA	Moderate	—Based on 158 site-specific observations	UAA	Unacceptable	Moderate/High potential to underestimate or overestimate population risk	Low	— Low replication -- only 2 samples and 2 replicates collected per habitat type per AA
					— Evaluation indicated some differences in abundance, taxa richness, and diversity, they were not considered significant	MAA, LAA	Indeterminate			— Different sampling methods used in different habitats. Results not strictly comparable
					— Overall, the results suggest no adverse effect of PCBs or other COPCs on benthic invertebrate community					— Considered a secondary LOE; more weight given to other site-specific measures (e.g., toxicity tests)
Benthic Invertebrate Community Evaluation, Up- to Downstream Condition	Not evaluated					UAA	Impairment	Moderate/ Moderate-high	Low	— Considered a secondary LOE; more weight given to other site-specific measures (e.g., toxicity tests)
						MAA, LAA	More similar to site-specific reference conditions			— Analysis partially based on ADEM WMB-1 protocol. Not all conditions for use of this protocol met
Compare surface water EPC to Alabama and/or National Water Quality Standards (applies to aquatic invertebrates rather than benthic invertebrates specifically)	C1, LAA	High	Moderate	Low	— Use of conservative Alabama water quality standards	C1, LAA	High Unacceptable		Agree	
	UAA, MAA	Moderate			— Considered to be adequately and sufficiently protective of aquatic life (including aquatic plants)	UAA, MAA	Unacceptable			
Compare surface water EPC to aquatic invertebrate-specific benchmarks (applies to aquatic invertebrates rather than benthic invertebrates specifically)	C1, UAA, MAA, LAA	Negligible	Moderate	Low	— EPC exceeds chronic criteria but not acute	C1, UAA, MAA, LAA	Acceptable		Low	
					— WQS not derived for protection of benthic species				Agree	
Weight of Evidence Conclusion						C1, C2, C7	Unacceptable	moderate	moderate/high	Conservatism and confidence varied widely among LoEs. Greatest weight given to LoEs with highest confidence and least to those with low.
						C3, C4, C5, C8, C10	Localized areas, Unacceptable			
						C6, C9	Acceptable			

Table AD-42. Summary of Potential Risks to Lower Trophic Level Receptors from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk
Anniston PCB Site, Anniston, Alabama
OU-4 BERA Addendum

Line Of Evidence	Exposure Unit	ARCADIS				Exposure Area	EPA			
		Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis		Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
Terrestrial Invertebrates										
Compare soil EPCs to terrestrial invertebrate benchmark	C1 East and C2 (all EUs) through C9 (all EUs)	Low to Negligible	High	Low	— Conservative literature-based benchmarks based on laboratory tests. The applicability of this benchmark is highly uncertain	C1 East and C2 (all EUs) through C9 (all EUs)	Indeterminate to Acceptable		Agree	
	C1 West	Moderate			— C1 West EPC based on the maximum detected concentration	C1 West	Unacceptable	High	Low	
Compare measured earthworm tissue EPCs to worm-based CTCs	UAA, MAA, LAA	Negligible	Moderate	Moderate	— CTCs are based on relatively small toxicity datasets and results in some cases had high variability —Low end selected when multiple values	UAA, MAA, LAA	Indeterminate	Moderate	Low	— COPC concentrations measured in earthworms collected on-site — High variability in CTCs reported for earthworms in the literature; very limited database. — Considered a secondary LOE; more weight given to other site-specific measures (e.g., toxicity tests)
Compare measured earthworm tissue EPCs to worm-based CTCs	Not evaluated at CTC based on EPA review of critical study					UAA	unacceptable	Moderate	Low	— EPA interpretation of the critical study results in a CTC of 38 mg/kg dw.
						MAA, LAA	Indeterminate			— Considered a secondary LOE; more weight given to other site-specific measures (e.g., toxicity tests)
Compare modeled earthworm tissue EPCs to worm-based CTCs	Not evaluated					C1 West	Unacceptable	Moderate	Low	— High variability in CTCs reported for earthworms in the literature; very limited database.
						C1 East, C2 North and riparian, C3 (all EUs), C4 (all EUs)	Indeterminate			
						C2 South and Central, C5 through C9 (all EUs)	Acceptable			— Considered a secondary LOE; more weight given to other site-specific measures (e.g., toxicity tests)
Compare site and reference invertebrate communities	OU-4	No Impairment indicated	NA	Low	— Based on Site-specific observations — Evaluation indicated that mean abundance, taxa diversity, and taxa dominance did not significantly differ by location (P > 0.05). Taxa richness is significantly higher in the Site than in the reference area	OU-4	NA	NA	Low	— Considered a secondary LOE — Cannot make conclusions on adverse effect of PCBs or other COPCs on the soil invertebrate community as chemistry was not measured in samples collected where community survey samples were taken
Weight of Evidence Conclusion						C1 (west only) C2, C3, C4, C10 C5, C6, C7, C8, C9	Unacceptable Indeterminate Acceptable	moderate/high	low	Most LOEs had moderate to high conservatism and all had low confidence and therefore were given equal weight. Field survey data were inconclusive. Average (or most frequent) conclusion of three LoEs selected as final conclusion.
Fish/Aquatic Life										
Compare surface water EPC to Alabama Water Quality Standards	C1, UAA, MAA, LAA	High	Moderate	Moderate	— Use of conservative Alabama water quality standards	C1, UAA, MAA, LAA	High	High	Agree	—
					— Considered to be adequately and sufficiently protective of aquatic life (including fish)					—
					— EPC exceeds chronic criteria but not acute					Low
Compare Surface water EPCs to fish-specific benchmarks	C1, UAA, MAA, LAA	Negligible	Moderate	Moderate	— Benchmark is receptor-specific	C1, UAA, MAA, LAA	Acceptable	High	Agree	—
					— Benchmark is literature-based and confidence is moderate				Low	—
Compare fish tissue EPCs to fish-based CTCs	Predator - all; bottom- UAA and LAA	Moderate	Moderate	Moderate	— Modeled tissue concentrations using site-specific BAFs; BAFs shown to be good predictors of the central tendency of the measured concentrations	Predator -- All; Bottom - All; Forage -- MAA; All Fish -- All	Unacceptable	Moderate	Moderate	— COPC concentrations measured in fish collected on-site
	Bottom - MAA; Forage - All	Low			— Toxicity values are very conservative and based on whole body concentrations in sheepshead minnows (ecologically relevant species)	Forage -- UAA, LAA	Indeterminate			— Numerous studies available that report NOEC and LOEC CTCs for PCBs in fish. Out of 10 published studies, LOEC concentrations range from 1.1 to 15 mg/kg wet weight; available CTC data are much less variable than for other organism groups.

Table AD-42. Summary of Potential Risks to Lower Trophic Level Receptors from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk
Anniston PCB Site, Anniston, Alabama
OU-4 BERA Addendum

Line Of Evidence	Exposure Unit	ARCADIS					EPA			
		Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis	Exposure Area	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
Compare Site and reference fish communities	OU-4	No Impairment indicated	NA	Low	—	OU-4	NA	NA	Low	— Considered a secondary LOE
					—					— Cannot make conclusions on adverse effect of PCBs or other COPCs on the fish community as chemistry was not measured in samples collected where community survey samples were taken
					—					
					—					
Weight of Evidence Conclusion					C1 through C10	Unacceptable	Moderate	Moderate	All viable LOEs were Low or moderately conservative with low or moderate confidence, and produce divergent results. The LOE with the highest confidence was given the highest weight. Field survey data were inconclusive.	

¹ Toxicity thresholds include EC0*, EC10*, EC20* for reproduction. Risk was considered negligible when 80% of samples or greater indicated negligible risk. For the low, moderate and high risk, categories assigned based on the largest percent in a particular category. Result category shown is when approximately 20% (or greater) of samples in a reach fell into a particular risk category. The complete endpoint-specific results are shown in Table 6-4a and Figure 6-1.

² Reach category reflects when greater than 20 % of samples fall into the specified category
For TEC and PEC comparisons, < TEC = negligible; between TEC and PEC = low; greater than PEC = high

³ HQs exceed 1.0 for molluscs in all three AAs, however site-specific toxicity testing indicates mussels are less sensitive than other benthic invertebrate species

Line of evidence with the relatively highest level of confidence in predicting potential risk for the receptor populations is in **bold text**

BAF = Bioaccumulation factor
COPC = Contaminant of potential concern
CTC = Critical tissue concentration
EU = Exposure unit
EPC = Exposure point concentration
LAA = Lower assessment area
MAA = Middle assessment area

NA = Not applicable
OU-4 = Operable Unit 4
P-value indicates statistical significance at a selected probablity, in this case 95% (or P < 0.05)
PEC = Probable effect concentration
TEC = Threshold effect concentration
UAA = Upper assessment area

Table AD-43. Summary of Potential Risks to Birds from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk
Anniston PCB Site, Anniston, Alabama
OU-4 BERA Addendum

ARCADIS INTERPRETATION						EPA INTERPRETATION				
Line Of Evidence	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
All Aquatic Birds										
Community Metric: Compare OU-4 and reference community data and/or comparison among OU-4 assessment areas	OU-4	No impairment indicated	NA	Low	—Based on site-specific observations	OU-4	Unknown	NA	Low	— Cannot state whether there are any effects of PCBs or other COPCs on the aquatic bird community as co-located COPC concentration data not collected
					— Mean bird abundance, richness, diversity and dominance did not differ significantly among Reaches					— No surveys conducted for aquatic birds at reference locations
					— Overall, the results suggest no effect of PCBs or other COPCs on the aquatic bird community					— High uncertainty with findings due to low sample size, unknown regarding experimental design and statistical analysis methods, lack of reference data, and lack of co-located COPC concentration data
					— High uncertainty with findings due to low sample size and lack of co-located COPC concentration data					
Reference Comparison: Compare OU-4 and reference sediment and prey tissues and/or comparison among OU-4 assessment areas	OU-4	Site elevated compared to reference conditions in all assessment areas	NA	NA	— This LOE indicates potential for exposure but does not speak to estimated risk	OU-4	Site elevated compared to reference conditions in all assessment areas	NA	NA	— This LOE indicates potential for exposure but does not speak to estimated risk
Weight of Evidence Conclusion						OU4	Unknown	NA	Low	Field survey data were inconclusive and cannot be used to support or refute a conclusion of risk.
Piscivores (belted kingfisher, great blue heron and osprey)										
HQ: Modeled diet - high sensitivity TRV	C6 and C9	Moderate	High	Low/Moderate	—High sensitivity TRVs based on chicken data, not ecologically relevant. Results given lower weight than mid-sensitivity TRV results	C1 through C5, C7, C8, C10	High Unacceptable	Moderate/High; potential to underestimate risk	Low/Moderate	—High sensitivity TRVs based on chicken data. Results given lower weight than mid-sensitivity TRV results
	C1 through C5, C7, C8, and C10	Unacceptable				— However, three wild species with high sensitivity to PCBs, European starling (<i>Sturnis vulgaris</i>), ruby-throated hummingbird (<i>Archilochus colubris</i>), and the gray catbird (<i>Dumetella carolinensis</i>) have been observed in OU-4 and others may be present				
						— Modeled tissue concentrations used 95%UCL of SWAC, not 95%UCL of measured sediment concentration. On average, total PCB EPCs derived as the 95%UCLs of the SWAC were 28% to 38% lower than EPCs derived as the 95%UCL of the measured concentrations. Modeled tissue concentrations may underestimate risk.				
						— Dose based on modeled fish tissue using BAFs for which no significant relationship found between sediment and tissue given lower weight than dose based on measured prey tissue				
HQ: Measured diet - high sensitivity TRV	All Reaches	High	High	Low/Moderate		C1 through C10	High Unacceptable	Moderate/High	Moderate	—High sensitivity TRVs based on chicken data. Results given lower weight than mid-sensitivity TRV results — Site-specific exposure based on measured fish tissue reduces uncertainty, given higher weight than dose based on modeled prey tissue
HQ: Modeled diet - mid- sensitivity TRV	C6	Negligible	Moderate	Moderate	— Mid-sensitivity TRVs based on mourning doves, ecologically relevant species	C1, C2	High Unacceptable	Moderate/High; potential to underestimate risk	Moderate	— Dose based on modeled fish tissue using BAFs for which no significant relationship found between sediment and tissue given lower weight than dose based on measured prey tissue
					C3, C4, C5, C7, C8, C10	Unacceptable	— Modeled tissue concentrations used 95%UCL of SWAC, not 95%UCL of measured sediment concentration. On average, total PCB EPCs derived as the 95%UCLs of the SWAC were 28% to 38% lower than EPCs derived as the 95%UCL of the measured concentrations. Modeled tissue concentrations may underestimate risk.			
	C9	Low					— Site-specific BAFs utilized to develop modeled tissue concentrations			
	C3, C4, C5, C7, C8 and C10	Moderate								
	C1 and C2	High				C6, C9	Indeterminate			— Mid-sensitivity TRVs based on mourning doves, ecologically relevant species

Table AD-43. Summary of Potential Risks to Birds from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk
Anniston PCB Site, Anniston, Alabama
OU-4 BERA Addendum

		ARCADIS INTERPRETATION				EPA INTERPRETATION				
Line Of Evidence	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
HQ: Measured diet - Mid-sensitivity TRV	All Reaches	Moderate	Moderate	Moderate/High		C1 through C10	Unacceptable	Low	Moderate/High	— Site-specific exposure based on measured fish tissue reduces uncertainty, given higher weight than dose based on modeled prey tissue
										— Mid-sensitivity TRVs based on mourning doves, ecologically relevant species
HQ: Modeled egg - high sensitivity egg TRV	C6 and C9	Moderate	High	Low	— Egg tissue concentrations were estimated using transfer coefficient factors and not measured. Egg-based HQs given lower weight than dietary HQs	C1 through C10	High Unacceptable	High	Low	— Egg tissue concentrations were estimated using transfer coefficient factors and not measured. Egg-based HQs given lower weight than dietary HQs
	C1 through C5, C7, C8, and C10	High			— High sensitivity TRVs based on chicken data, not ecologically relevant					— High sensitivity TRVs based on chicken data. However, a recent study indicates ecologically relevant species (grey catbird) may be as sensitive as chickens (Reported LD50 for chickens, PCB 126: 1.1 ug/kg; catbirds, 1.6 ug/kg) ¹
HQ: Modeled egg - mid-sensitivity egg TRV	C3 and C5 through C10	Negligible	Moderate	Low	— Mid-sensitivity TRVs based on kestrels and mallards, ecologically relevant species	C1, C2, C4	High Unacceptable	Moderate	Low	— Egg tissue concentrations were estimated using transfer coefficient factors and not measured. Egg-based HQs given lower weight than dietary HQs
	C4	Low				C3, C5, C7 through C10	Unacceptable			— Mid-sensitivity TRVs based on kestrels and mallards, ecologically relevant species
	C1 and C2	Moderate				C6	Indeterminate			— The mid-sensitivity PCB egg TRV is associated with an 83% reduction in hatching and 92% reduction in hatching. Any HQ greater than 1.0 indicates unacceptable (high) risk.
Weight of Evidence Conclusion						C1 to C10	Unacceptable	moderate	moderate/High	Conservatism and confidence varied widely among LoEs. Greatest weight given to the LoE with highest confidence and least to those with low.
Aquatic Insectivores/Invertivores (spotted sandpiper - 2)										
HQ: Modeled diet - high sensitivity TRV	All Reaches	High	High	Low/Moderate	—High sensitivity TRVs based on chicken data, not ecologically relevant. Results given lower weight than mid-sensitivity TRV results	C1 through C10	High Unacceptable	Moderate	Low/Moderate	—High sensitivity TRVs based on chicken data, not ecologically relevant. Results given lower weight than mid-sensitivity TRV results
										— Dose based on modeled tissue (i.e., 50% <i>Lumbriculus</i> for lab study) and 50% field BAF for which no significant relationship found between sediment and invertebrate tissue) given equal weight to dose-based on all measured tissue
										— Good relationship between <i>Lumbriculus</i> and sediment identified; model applied across full range of OU-4 concentrations

Table AD-43. Summary of Potential Risks to Birds from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk
Anniston PCB Site, Anniston, Alabama
OU-4 BERA Addendum

	ARCADIS INTERPRETATION					EPA INTERPRETATION				
Line Of Evidence	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
HQ: Measured diet - high sensitivity TRV	All Reaches	Moderate	High	Low/Moderate		C1 through C10	Unacceptable	Moderate/High potential to underestimate risk	Moderate	— Uncertainty with extrapolation from lab to field conditions
										— Uncertainty with representativeness of field collected invertebrates (mostly epibenthic) to full range of possible species
										— Risk conclusions based on HQs in Table 6-3b. However, it is highly uncertain whether the measured <i>Lumbriculus</i> tissue data was used in the FCMs. The EPA review team recreated models for this receptor using the 95%UCL of <i>Lumbriculus</i> concentrations from Appendix E and calculated HQs were significantly higher (Table AD6-27) than those presented in Table 6-3b; although basis is not stated in Appendix E, it is likely wet weight. Table 4-1b of the 8-2015 draft did not include <i>Lumbriculus</i> for this receptor and Table 6-2 of the 2015 draft has the same HQs as presented in the 10-2016 draft.
HQ: Measured diet- high sensitivity TRV and EPA FCM calculations					— Mid-sensitivity TRVs based on mourning doves, ecologically relevant species	UAA, MAA, LAA	High Unacceptable	Moderate/High potential to underestimate risk	Moderate	— The <i>Lumbriculus</i> data set is the best paired tissue/sediment data available for this BERA — Based on the EPA team models using measured <i>Lumbriculus</i> and aquatic invertebrate data (Table AD6-27), the <i>Lumbriculus</i> tissue may not have been included in the Arcadis dietary exposure model for this receptor.
HQ: Modeled diet - mid- sensitivity TRV	C6	Low	Moderate	Moderate/High	— Dose based on modeled tissue (i.e., 50% lumbriculus for lab study) and 50% field BAF for which no significant relationship found between sediment and invertebrate tissue) given equal weight to dose-based on all measured tissue	C1, C2	High Unacceptable	Moderate	Moderate	— Uncertainty with extrapolation from lab to field conditions, but <i>Lumbriculus</i> data set is the best paired tissue/sediment data available for this BERA
	C3, C4, C5, C7, C8, C9, and C10	Moderate			— Good relationship between Lmbriculus and sediment identified; model applied across full range of OU-4 concentrations	C3 through C10	Unacceptable			— Mid-sensitivity TRVs based on mourning doves, ecologically relevant species
	C1 and C2	High			— Uncertainty with extrapolation from lab to field conditions					— Dose based on modeled tissue (i.e., 50% <i>Lumbriculus</i> for lab study) and 50% field BAF for which no significant relationship found between sediment and invertebrate tissue) given equal weight to dose-based on all measured tissue
HQ: Measured diet - Mid-sensitivity TRV	C3 through C10	Negligible	Moderate	Moderate/High	— Uncertainty with representativeness of field collected invertebrates to full range of possible species	C1 through C4	Indeterminate	Moderate/ high potential to underestimate risk	Moderate	— Risk conclusions based on HQs in Table 6-3b. However, it is highly uncertain whether 95%UCL of measured <i>Lumbriculus</i> was used.
					C5 through C10	Acceptable				
HQ: Measured diet - Mid-sensitivity TRV and EPA FCM calculations	C1 and C2	Low					—	UAA, MAA, LAA	Unacceptable	Low
HQ: Modeled egg - high sensitivity egg TRV	C1 through C10	Negligible	High	Low	— Egg tissue concentrations were estimated using transfer coefficient factors and not measured. Egg-based HQs given lower weight than dietary HQs	C1	High Unacceptable	High	Low	— Egg tissue concentrations were estimated using transfer coefficient factors and not measured. Egg-based HQs given lower weight than dietary HQs
					— High sensitivity TRVs based on chicken data, not ecologically relevant	C2 through C5, C7, C8, C10	Unacceptable			— High sensitivity TRVs based on chicken data. However, a recent study indicates ecologically relevant species (grey catbird) may be as sensitive as chickens (Reported LD50 for chickens, PCB 126: 1.1 ug/kg; catbirds, 1.6 ug/kg) ¹
						C6, C9	Indeterminate			

Table AD-43. Summary of Potential Risks to Birds from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk
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ARCADIS INTERPRETATION						EPA INTERPRETATION				
Line Of Evidence	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
HQ: Modeled egg - mid-sensitivity egg TRV	C1 through C10	Negligible	Moderate	Low	— Mid-sensitivity TRVs based on kestrels and mallards, ecologically relevant species	C1, C2	Indeterminate	Moderate	Low	— Egg tissue concentrations were estimated using transfer coefficient factors and not measured. Egg-based HQs given lower weight than dietary HQs
							— Mid-sensitivity TRVs based on kestrels and mallards, ecologically relevant species			
					—	C3 through C10	Acceptable			— The mid-sensitivity PCB egg TRV is associated with an 83% reduction in hatching and 92% reduction in hatching. Any HQ greater than 1.0 indicates unacceptable (high) risk.
Weight of Evidence Conclusion						C1, C2	High Unacceptable	moderate	moderate	Conservatism and confidence varied widely among LoEs. High uncertainty associated with Lumbriculus data basis and inclusion. Greatest weight given to the LoEs with highest confidence.
						C3 through C10	Unacceptable			
Aerial Invertivores (Tree swallow)										
HQ: Modeled diet - high sensitivity TRV	C6 and C9	Negligible	High	Low/Moderate	—High sensitivity TRVs based on chicken data, not ecologically relevant. Results given lower weight than mid-sensitivity TRV results	C1 through C4	High Unacceptable	moderate	Low/Moderate	—High sensitivity TRVs based on chicken data, not ecologically relevant. Results given lower weight than mid-sensitivity TRV results
	C5, C7, C8, and C10	Low			— Mid-sensitivity TRVs based on mourning doves, ecologically relevant species	C8	Unacceptable			— Dose based on modeled emergent insect tissue using BAFs for which no significant relationship found between sediment and tissue given lower weight than dose based on measured prey tissue. However, BAF includes terrestrial Hymenoptera which likely underestimate the contribution of sediment to risks to aerial invertivores.
	C1 through C4	High			— Dose based on modeled emergent insect tissue using BAFs for which no significant relationship found between sediment and tissue given lower weight than dose based on measured prey tissue	C5, C7, C10	Indeterminate			
HQ: Measured diet - high sensitivity TRV	C7 to C10	Moderate	Moderate	Low/Moderate		C1 through C4	High Unacceptable	Moderate	Low/Moderate	
	C5, C6	Low			—High sensitivity TRVs based on chicken data, not ecologically relevant. Results given lower weight than mid-sensitivity TRV results					
	C1 through C4	High								C5 through C10
HQ: Modeled diet - mid- sensitivity TRV	C5 through C10	Negligible	High	Moderate		C1, C2	High Unacceptable	moderate	Low/Moderate	— Dose based on modeled emergent insect tissue using BAFs for which no significant relationship found between sediment and tissue given lower weight than dose based on measured prey tissue. However, BAF includes terrestrial Hymenoptera which likely underestimate the contribution of sediment to risks to aerial invertivores.
	C3, C4	Moderate				C3, C4	Unacceptable			
	C1, C2	High				C5 through C10	Acceptable			
HQ: Measured diet - Mid-sensitivity TRV	C5 through C10	Negligible	Moderate	Moderate		C1 through C4	Unacceptable	Moderate	Moderate/High	— Mid-sensitivity TRVs based on mourning doves, ecologically relevant species
	C1 through C4	Negligible				C5 through C10	Acceptable			
HQ: Modeled egg - high sensitivity egg TRV	C1 through C10	Negligible	High	Low		C1	High Unacceptable	High	Low	— Egg tissue concentrations were estimated using transfer coefficient factors and not measured. Egg-based HQs given lower weight than dietary HQs
					— Egg tissue concentrations were estimated using transfer coefficient factors and not measured. Egg-based HQs given lower weight than dietary HQs	C2, C4	Unacceptable			
					— High sensitivity TRVs based on chicken data, not ecologically relevant	C3	Indeterminate			— High sensitivity TRVs based on chicken data. However, a recent study indicates ecologically relevant species (grey catbird) may be as sensitive as chickens (Reported LD50 for chickens, PCB 126: 1.1 ug/kg; catbirds, 1.6 ug/kg) ¹
						C5 through C10	Acceptable			
HQ: Modeled egg - mid-sensitivity egg TRV	C1 through C10	Negligible	Moderate	Low	— Mid-sensitivity TRVs based on kestrels and mallards, ecologically relevant species	C1, C2	Indeterminate	Moderate	Low	— Egg tissue concentrations were estimated using transfer coefficient factors and not measured. Egg-based HQs given lower weight than dietary HQs
										— Mid-sensitivity TRVs based on kestrels and mallards, ecologically relevant species
					—	C3 through C10	Acceptable			— The mid-sensitivity PCB egg TRV is associated with an 83% reduction in hatching and 92% reduction in hatching. Any HQ greater than 1.0 indicates unacceptable (high) risk.
Weight of Evidence Conclusion						C1 to C4	Unacceptable	moderate	moderate	Conservatism and confidence varied widely among LoEs. Greatest weight given to LoE with highest confidence and least to those with low.
						C5 through C10	Acceptable			

Table AD-43. Summary of Potential Risks to Birds from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk
Anniston PCB Site, Anniston, Alabama
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ARCADIS INTERPRETATION						EPA INTERPRETATION				
Line Of Evidence	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
All Terrestrial Birds										
Community Metric: Compare OU-4 and reference community data and/or comparison among OU-4 assessment areas	OU-4	No impairment indicated	NA	Low	—Based on site-specific observations	OU-4	NA	NA	Low	— Cannot state whether there are any effects of PCBs or other COPCs on the terrestrial bird community as co-located COPC concentration data not collected
					— Mean abundance and species richness were significantly higher on-site than in the reference area					
					— Diversity and dominance did not significantly differ by location (P > 0.05).					
					— Overall, the results suggest no effect of PCBs or other COPCs on the terrestrial bird community					
					— High uncertainty with findings due to low sample size and lack of co-located COPC concentration data					— Considered a secondary LOE
Reference Comparison: Compare OU-4 and reference sediment and prey tissues and/or comparison among OU-4 assessment areas	OU-4	to reference conditions	NA	NA	— This LOE indicates potential for exposure but does not speak to estimated risk	OU-4	Site elevated compared to reference conditions in all assessment areas	NA	NA	— This LOE indicates potential for exposure but does not speak to estimated risk
Weight of Evidence Conclusion						OU4	NA	NA	Low	Field survey data were inconclusive and cannot be used to support or refute a conclusion of risk.
Herbivores (Mourning dove)										
HQ: Modeled diet - high sensitivity TRV	C2 South, C9 South	Negligible	High	Low/Moderate		C1 West, C3 South	High Unacceptable		Agree	
	C2 Central, C5 North and South, C6 North, C7 North and South, C8 North and South, C9 North	Low				C1 East, C2 North and Central, C3 North, C4 North and South, C5 South, C 6 North and South, C7 South, C8 North and South, C9 North	Unacceptable			
	C1 East, C2 North, C3 North, C4 North and South, C6 South	Moderate							Low/Moderate	
	C1 West, C3 South	High				C2 South, C5 North, C7 North, C9 South	Indeterminate			
HQ: Measured diet - high sensitivity TRV	C2 South and Central, C5 North and South, C6 North, C7 North and South, C8 North and South, C9 North and South	Negligible	High	Low/Moderate	—High sensitivity TRVs based on chicken data, not ecologically relevant. Results given lower weight than mid-sensitivity TRV results	C1 West	High Unacceptable		Agree	
	C2 North, C4 South, C6 South	Low			— Mid-sensitivity TRVs based on mourning doves, ecologically relevant species	C1 East, C2 North, C3 North and South, C4 North and South	Unacceptable			
	C1 East, C3 North and South, C4 North	Moderate			— Dose based on modeled plant tissue using BAFs for which no significant relationship found between sediment and tissue given lower weight than dose based on measured prey tissue	C2 South and Central, C5 through C9 (all EUs)	Indeterminate		Low/Moderate	
	C1 West	High			C1 West Soil EPC based on the maximum detected concentration - this EPC is given a lower weight than UCL-based EPCs					

Table AD-43. Summary of Potential Risks to Birds from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk
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	ARCADIS INTERPRETATION					EPA INTERPRETATION				
Line Of Evidence	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
HQ: Modeled diet - mid- sensitivity TRV	C2 (all EUs), C4 South through C9 (all EUs)	Negligible	Moderate	Low/Moderate		C1 West	High Unacceptable		Agree	
	C1 East, C3 North, C4 North	Low				C3 South	Unacceptable			
	C3 South	Moderate				C1 East, C2 North, C3 North, C4 North and South	Indeterminate		Low/Moderate	
	C1 West	High				C2 South and Central, C5 through C9 (all EUs)	Acceptable			
HQ: Measured diet - Mid-sensitivity TRV	All EUs except C1 West	Negligible	Moderate	Moderate/High		C1 West	Unacceptable	Moderate	Moderate/High	
						C3 South	Indeterminate			
	C1 West	Moderate				C1 East, C2 (all EUs), C3 North, C4 through C9 (all EUs)	Acceptable			
HQ: Modeled egg - high sensitivity egg TRV	C1 East, C2 (all EUs) through C9 (all EUs)	Negligible	High	Low	— Egg tissue concentrations were estimated using transfer coefficient factors and not measured. Egg-based HQs given lower weight than dietary HQs	C1 West	High Unacceptable	High	Agree	
						C1 East, C3 North and South	Unacceptable		Low	
						C2 North, C4 North and South	Indeterminate			
	C1 West	Moderate		Low	— High sensitivity TRVs based on chicken data, not ecologically relevant	C5 through C10 (all EUs)	Acceptable			
HQ: Modeled egg - mid-sensitivity egg TRV	C1 (all EUs) through C9 (all EUs)	Negligible	Moderate	Low	— Mid-sensitivity TRVs based on kestrels and mallards, ecologically relevant species	C1 West	Unacceptable	Moderate	Agree	
					—	C1 East, C2 through C10 (all EUs)	Acceptable		Low	
Weight of Evidence Conclusion						C1 West	Unacceptable	moderate	Moderate	Conservatism and confidence varied widely among LoEs. Greatest weight given to LoE with highest confidence and least to those with low.
					C3	Indeterminate				
					C2, C4 through C10	Acceptable				

Table AD-43. Summary of Potential Risks to Birds from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk
Anniston PCB Site, Anniston, Alabama
OU-4 BERA Addendum

		ARCADIS INTERPRETATION				EPA INTERPRETATION				
Line Of Evidence	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
Terrestrial Insectivores/Invertevores (Carolina Wren -1)										
HQ: Modeled diet - high sensitivity TRV	C2 South, C9 South	Low	High	Low/Moderate	—	C1 East and West, C2 North, C3 North and South, C4 North and South, C6 South	High unacceptable			
	C2 Central, C5 North and South, C6 North, C7 North and South, C8 North and South, C9 North	Moderate			—	C2 South and Central, C5 North and South, C6 North, C7 through C9 (all EUs)	Unacceptable		Agree	
	C1 East and West, C2 North, C3 North and South, C4 North and South, C6 South	High			—				Low/Moderate	
HQ: Measured diet - high sensitivity TRV	C5 through C9 (all EUs)	Moderate	High	Low/Moderate	—High sensitivity TRVs based on chicken data, not ecologically relevant. Results given lower weight than mid-sensitivity TRV results	C1 through C4	High unacceptable		Agree	
	C1 through C4 (all EUs)	High			— Mid-sensitivity TRVs based on mourning doves, ecologically relevant species	C5 through C9	Unacceptable		Low/Moderate	
HQ: Modeled diet - mid- sensitivity TRV	C2 South, C5 North, C7 North, C9 South	Negligible	Moderate	Moderate	— Dose based on modeled tissue given lower weight than dose based on measured prey tissue. Modeled tissue based over 50% on BAFs for which no significant relationship found between soil and tissue (i.e., 45% grasshopper and 9% plants) and 31% on terrestrial spiders for which earthworms used as surrogate for estimate	C1 West, C3 South	High unacceptable		Agree	
	C2 Central, C5 South, C6 North and South, C7 South, C8 North and South, C9	Low			—	C1 East, C2 North, C3 North, C4 North and South	Unacceptable			
	C1 East, C2 North, C3 North, C4 North and South	Moderate			—	C2 Central, C5 North and South, C6 North and South, C7 South, C8 North and South, C9 North	Indeterminate		Moderate	
	C1 West, C3 South	High			—	C2 South, C7 North, C9 South	Acceptable			
HQ: Measured diet - Mid-sensitivity TRV	C5 through C9 (all EUs)	Negligible	Moderate	Moderate	—	C1 through C4	Unacceptable	Moderate	Moderate/High	
	C1 through C4 (all EUs)	Moderate			—	C5 through C9	Indeterminate			
HQ: Modeled egg - high sensitivity egg TRV	C1 East, C2 (all EUs) through C9 (all EUs)	Negligible	High	Low	— Egg tissue concentrations were estimated using transfer coefficient factors and not measured. Egg-based HQs given lower weight than dietary HQs	C1 West	High Unacceptable		Agree	
						C1 East, C3 North and South	Unacceptable			
						C2 North, C4 North and South	Indeterminate		Low	
	C1 West	Moderate			— High sensitivity TRVs based on chicken data, not ecologically relevant	C2 South and Central, C5 through C9 (all EUs)	Acceptable			

Table AD-43. Summary of Potential Risks to Birds from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk
Anniston PCB Site, Anniston, Alabama
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	ARCADIS INTERPRETATION					EPA INTERPRETATION				
Line Of Evidence	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
HQ: Modeled egg - mid-sensitivity egg TRV	C1 (all EUs) through C9 (all EUs)	Negligible	Moderate	Low	— Mid-sensitivity TRVs based on kestrels and mallards, ecologically relevant species	C1 West	Unacceptable		Agree	
						C1 East, C2 through C9 (all EUs)	Acceptable		Low	
Weight of Evidence Conclusion						C1 to C4	Unacceptable	moderate	Moderate	Conservatism and confidence varied widely among LoEs. Greatest weight given to LoE with highest confidence and least to those with low.
						C5 through C9	Indeterminate			
Terrestrial Omnivores (Blue jay)										
HQ: Modeled diet - high sensitivity TRV	C9 South	Negligible	High	Low/Moderate		C1 East and West, C3 North and South, C4 North	High Unacceptable			
	C2 South, C5 North, C7 North	Low				C2 North and Central, C4 South, C5 North and South, C6 North and South, C7 South, C8 North and South, C9 North	Unacceptable		Agree	
	C2 North and Central, C4 South, C5 South, C6 North and South, C7 South, C8 North and South, C9 North	Moderate				C2 South, C7 North, C9 South	Indeterminate		Low/Moderate	
	C1 East and West, C3 North and South, C4 North	High								
HQ: Measured diet - high sensitivity TRV	C5 through C9 (all EUs)	Low	High	Low/Moderate	—High sensitivity TRVs based on chicken data, not ecologically relevant. Results given lower weight than mid-sensitivity TRV results	C1 West, C3 South	High Unacceptable		Agree	
	C1 East, C2 (all EUs), C3 North, C4 North and South	Moderate			— Mid-sensitivity TRVs based on mourning doves, ecologically relevant species	C1 East, C2 (all EUs), C3 North, C4 through C9 (all EUs)	Unacceptable			
	C1 West, C3 South	High			— Dose based on modeled tissue given lower weight than dose based on measured prey tissue. Modeled tissue based over 78% on BAFs for plants which no significant relationship found between soil and tissue.				Low/Moderate	
HQ: Modeled diet - mid- sensitivity TRV	C2 South and Central, C5 through C9 (all EUs)	Negligible	Moderate	Moderate		C1 West	High Unacceptable		Agree	
	C1 East, C2 North, C4 North and South	Low				C1 East, C3 North and SOUth, C4 North	Unacceptable			
	C1 West, C3 North and South	Moderate				C2 North, C4 South	Indeterminate		Low/Moderate	
	C1 West	High				C2 South and Central, C5 through C9 (all EUs)	Acceptable			

Table AD-43. Summary of Potential Risks to Birds from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk
Anniston PCB Site, Anniston, Alabama
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	ARCADIS INTERPRETATION					EPA INTERPRETATION				
Line Of Evidence	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
HQ: Measured diet - Mid-sensitivity TRV	C5 through C9 (all EUs)	Negligible	Moderate	Moderate/High		C1 West	Unacceptable		Moderate	
	C1 East, C2 (all EUs), C3 North and South, C4 North and South	Low				C1 East, C2 through C4 (all EUs)	Indeterminate			
	C1 West	Moderate				C5 through C9 (all EUs)	Acceptable			
HQ: Modeled egg - high sensitivity egg TRV	C1 East, C2 (all EUs) through C9 (all EUs)	Negligible	High	Low	— Egg tissue concentrations were estimated using transfer coefficient factors and not measured. Egg-based HQs given lower weight than dietary HQs	C1 West	high Unacceptable		Agree	
						C1 East, C3 North and South, C4 North	Unacceptable			
						C2 North, C4 South	Indeterminate		Low	
	C1 West	Negligible			— High sensitivity TRVs based on chicken data, not ecologically relevant	C2 South and Central, C5 through C9 (all EUs)	Acceptable			
HQ: Modeled egg - mid-sensitivity egg TRV	C1 (all EUs) through C9 (all EUs)	Negligible	Moderate	Low	— Mid-sensitivity TRVs based on kestrels and mallards, ecologically relevant species	C1 West	Unacceptable		Agree	
						C1 East, C2 through C9 (all EUs)	Acceptable		Low	
Weight of Evidence Conclusion						C1	Unacceptable		low/moderate	Conservatism and confidence varied widely among LoEs. Greatest weight given to LoEs with high or moderate confidence and least to those with low.
						C2, C3, C4	Indeterminate	moderate		
						C5 through C9	Acceptable			
Carnivores (Red-tailed hawk)										
HQ: Modeled diet - high sensitivity TRV	C9 South	Low	High	Low/Moderate		C1 through C4 (all EUs)	High Unacceptable		Low/moderate	— Dose based on modeled tissue given higher weight than dose based on measured prey tissue. Hawk diet assumed to contain 87% small mammal tissue. Modeled small mammal tissue based regression for which a statistically significant relationship between site-specific soil and tissue was identified
	C5 through C8 (all EUs), C9 North	Moderate				C5 through C9 (all EUs)	Unacceptable			—High sensitivity TRVs based on chicken data, not ecologically relevant. Results given lower weight than mid-sensitivity TRV results
	C1 through C4 (all EUs)	High								
HQ: Measured diet - high sensitivity TRV	C1 through C9 (all EUs)	High	High	Low/Moderate	—High sensitivity TRVs based on chicken data, not ecologically relevant. Results given lower weight than mid-sensitivity TRV results	C1 through C9 (all EUs)	High unacceptable		Agree	—High sensitivity TRVs based on chicken data, not ecologically relevant. Results given lower weight than mid-sensitivity TRV results

Table AD-43. Summary of Potential Risks to Birds from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk
Anniston PCB Site, Anniston, Alabama
OU-4 BERA Addendum

		ARCADIS INTERPRETATION				EPA INTERPRETATION				
Line Of Evidence	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
HQ: Modeled diet - mid- sensitivity TRV	C5 North, C6 through C9 (all EUs)	Negligible	Moderate	Moderate/High	— Mid-sensitivity TRVs based on mourning doves, ecologically relevant species	C1 East and West	High Unacceptable	Moderate	Moderate	— Mid-sensitivity TRVs based on mourning doves, ecologically relevant species
	C3 (all EUs), C5 South	Low			— Dose based on modeled tissue given higher weight than dose based on measured prey tissue. Hawk diet assumed to contain 87% small mammal tissue. Modeled small mammal tissue based regression for which a statistically significant relationship between site-specific soil and tissue was identified	C2 through C4 (all EUs)	Unacceptable			— Dose based on modeled tissue given higher weight than dose based on measured prey tissue. Hawk diet assumed to contain 87% small mammal tissue. Modeled small mammal tissue based regression for which a statistically significant relationship between site-specific soil and tissue was identified
	C1 East, C2 (all EUs), C4 (all EUs)	Moderate			— Modeled tissue provides greater coverage for risk estimates across OU-4	C5 North and South, C8 North	Indeterminate			— There is uncertainty associated with modeled small mammal tissue concentration, as shrews (where highest measured concentration of PCBs) were not included in the BAF regression. Additionally, small mammals were not captured in the high PCB EUs.
	C1 West	High				C6 and C7 (all EUs), C8 South, C9 North and South	Acceptable			
HQ: Measured diet - Mid-sensitivity TRV	C7 through C9 (all EUs)	Low	Moderate	Moderate		C1 through C9 (all EUs)	Unacceptable		Moderate	— Measured diet given less weight than modeled diet
	C1 through C6 (all EUs)	Moderate								
HQ: Modeled egg - high sensitivity egg TRV	C2 South and Central, C3 (all EUs), through C8 (all EUs)	Moderate	High	Low	— Egg tissue concentrations were estimated using transfer coefficient factors and not measured. Egg-based HQs given lower weight than dietary HQs	C1 through C4 (all EUs)	high Unacceptable		Agree	
	C1 (all EUs) and C2 North	High			— High sensitivity TRVs based on chicken data, not ecologically relevant	C5 through C9 (all EUs)	Unacceptable		Low	
HQ: Modeled egg - mid-sensitivity egg TRV	C1 East, C2 (all EUs) through C9 (all EUs)	Negligible	High	Low	— Mid-sensitivity TRVs based on kestrels and mallards, ecologically relevant species	C1 West	High Unacceptable		Agree	
						C1 East, C2 (all EUs), C3 North and South, C4 North and South	Unacceptable		Low	
						C5 North and South	Indeterminate			
	C1 West	Low		Low	— EPC based on the maximum detected concentration	C6 through C9 (all EUs)	Acceptable			
						C1	High Unacceptable	moderate	Moderate	Conservatism and confidence varied widely among LoEs. Greatest weight given to LoE with highest confidence and least to those with low.
Weight of Evidence Conclusion						C2, C3, C4	Unacceptable			
						C5, C8	Indeterminate			
						C6, C7, C9	Acceptable			

Table AD-43. Summary of Potential Risks to Birds from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk
Anniston PCB Site, Anniston, Alabama
OU-4 BERA Addendum

		ARCADIS INTERPRETATION				EPA INTERPRETATION				
Line Of Evidence	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
Mixed Diet Omnivores (Carolina wren - 2, spotted sandpiper-1)										
HQ: Modeled diet - high sensitivity TRV	C9 South	Low	High	Low		C1 through C4 (all EUs)	High Unacceptable	Moderate/High; potential to underestimate risk	Low/Moderate	— For Reach C1, the 95%UCL for UAA riparian soil was used as the EPC. Dietary exposure models were re-run using data from soils collected within 100 feet on either side of Snow Creek, even though these samples were not labelled riparian in the data base (Issue 6 of the BERA addendum). Use of the UAA 95%UCL for Reach C1 underestimated potential risk to mixed diet omnivores
	C5 through C8 (all EUs), C9 North	Moderate				C5 through C8 (all EUs), C9 North	Unacceptable			
	C1 through C4 (all EUs)	High				C9 South	Indeterminate			
HQ: Measured diet - high sensitivity TRV	C5 through C9 (all EUs)	Moderate	High	Low		C1 through C4	High Unacceptable	Moderate/High; potential to underestimate risk	Low/Moderate	— For Reach C1, the 95%UCL for UAA riparian soil was used as the EPC. Dietary exposure models were re-run using data from soils collected within 100 feet on either side of Snow Creek, even though these samples were not labelled riparian in the data base (Issue 6 of the BERA addendum). Use of the UAA 95%UCL for Reach C1 underestimated potential risk to mixed diet omnivores
	C1 through C4 (all EUs)	High				C5 through C9	Unacceptable			
HQ: Modeled diet - mid- sensitivity TRV	C5 through C7 (all EUs), C8 South, C9 North and South	Negligible	Moderate	Low	—High sensitivity TRVs based on chicken data, not ecologically relevant. Results given lower weight than mid-sensitivity TRV results	C1 West	High Unacceptable	Moderate/High; potential to underestimate risk	Low/Moderate	— For Reach C1, the 95%UCL for UAA riparian soil was used as the EPC. Dietary exposure models were re-run using data from soils collected within 100 feet on either side of Snow Creek, even though these samples were not labelled riparian in the data base (Issue 6 of the BERA addendum). Use of the 95%UCL for Reach C1 underestimated potential risk to mixed diet omnivores
	C8 North	Low			— Mid-sensitivity TRVs based on mourning doves, ecologically relevant species	C1 East, C2 through C4 (all EUs)	Unacceptable			
	C1 East, C2 through C4 (all EUs)	Moderate			— Dose based on modeled tissue given lower weight than dose based on measured prey tissue. Modeled tissue based over 50% on BAFs for which no significant relationship found between soil and tissue (i.e., 45% grasshopper and 9% plants) and 31% on terrestrial spiders for which earthworms used as surrogate for estimate	C5 South, C6 South, C7 South, C8 North and South	Indeterminate			
	C1 West	High				C5 North, C6 North, C7 North, C9 North and South	Acceptable			
HQ: Measured diet - Mid-sensitivity TRV	C5 through C9 (all EUs)	Negligible	Moderate	Low/Moderate		C1 through C4	Unacceptable	Moderate/High; potential to underestimate risk	Low/Moderate	— For Reach C1, the 95%UCL for UAA riparian soil was used as the EPC. Dietary exposure models were re-run using data from soils collected within 100 feet on either side of Snow Creek, even though these samples were not labelled riparian in the data base (Issue 6 of the BERA addendum). Use of the UAA 95%UCL for Reach C1 underestimated potential risk to mixed diet omnivores
	C1 through C4 (all EUs)	Moderate				C5 through C9	Indeterminate			

Table AD-43. Summary of Potential Risks to Birds from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk
Anniston PCB Site, Anniston, Alabama
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		ARCADIS INTERPRETATION				EPA INTERPRETATION				
Line Of Evidence	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
HQ: Modeled egg - high sensitivity egg TRV	C9 (all EUs)	Low	High	Low	— Egg tissue concentrations were estimated using transfer coefficient factors and not measured. Egg-based HQs given lower weight than dietary HQs	C1 East and West, C3 South	Unacceptable	Moderate/High	Low	— High sensitivity TRVs based on chicken data. However, a recent study indicates ecologically relevant species (grey catbird) may be as sensitive as chickens (Reported LD50 for chickens, PCB 126: 1.1 ug/kg; catbirds, 1.6 ug/kg) ¹
	C2 South and Central, C3 (all EUs), through C8 (all EUs)	Moderate				C2 (all EUs), C3 North, C4 North	Indeterminate			— Egg tissue concentrations were estimated using transfer coefficient factors and not measured. Egg-based HQs given lower weight than dietary HQs
	C1 (all EUs) and C2 North	High				C4 South, C5 through C9 (all EUs)	Acceptable			
HQ: Modeled egg - mid-sensitivity egg TRV	C1 East, C2 (all EUs) through C9 (all EUs)	Negligible	High	Low	— Mid-sensitivity TRVs based on kestrels and mallards, ecologically relevant species	C1 West	Indeterminate	Moderate/High	Low	— Mid-sensitivity TRVs based on kestrels and mallards, ecologically relevant species
	C1 West	Low		Low	— EPC based on the maximum detected concentration	C1 East, C2 through C9 (all EUs)	Acceptable			— The mid-sensitivity PCB egg TRV is associated with an 83% reduction in hatching and 92% reduction in hatching. Any HQ greater than 1.0 indicates unacceptable (high) risk.
Weight of Evidence Conclusion						C1	High Unacceptable	moderate	low/moderate	Conservatism and confidence varied widely among LoEs. Greatest weight given to LoEs with highest confidence and least to those with low.
						C2, C3, C4	Unacceptable			
						C5 through C9	Indeterminate			

Weight of evidence presented for receptor within each feeding guild that had highest predicted risk

Line of evidence with the relatively highest level of confidence in predicting potential risk for the receptor populations is in **bold text**

BAF = Bioaccumulation factor

COPC = Contaminant of potential concern

EU = Exposure unit

EPC = Exposure point concentration

HQ = Hazard quotient

LOE = Line of evidence

NA = Not applicable

OU-4 = Operable Unit 4

P-value indicates statistical significance at a selected probablity, in this case 95% (or P < 0.05)

PCBs = Polychlorinated biphenyls

TRVs = Toxicity reference values

¹ Chicken LD50: Head, J. A. and S. W. Kennedy "Correlation between an in vitro and an in vivo measure of dioxin sensitivity in birds." Ecotoxicology Advance access published on September 26, 2009; doi:10.1007/s10646-009-0421-3. Grey catbird LD50: Eng, M. L., C. A. Bishop, et al. (2017). "The catbird is the new chicken: high sensitivity to a dioxin-like compound in a wildlife species." Environ. Sci. Technol. 51(9): 5252-5258.

Table AD-44. Summary of Potential Risks to Mammals from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk
Anniston PCB Site, Anniston, Alabama
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Line Of Evidence	Exposure Unit	ARCADIS INTERPRETATION				EPA INTERPRETATION				
		Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
All Aquatic Mammals										
Community Metric: Compare OU-4 and reference community data and/or comparison among OU-4 assessment areas	OU-4	No impairment indicated	NA	Low	—Based on site-specific observations	OU-4	Unknown	NA	Low	— Cannot state whether there are any effects of PCBs or other COPCs on the aquatic mammal community as co-located COPC concentration data not collected
					— Mean mammal richness, diversity and dominance did not differ significantly among Reaches					— No surveys conducted for aquatic mammals at reference locations
					— Abundance was significantly lower in the MAA than in the UAA and LAA					
					— Overall, the results suggest no effect of PCBs or other COPCs on the aquatic mammal community					
					— High uncertainty with findings due to low sample size and lack of co-located COPC concentration data					— High uncertainty with findings due to low sample size, unknown regarding experimental design and statistical analysis methods, lack of reference data, and lack of co-located COPC concentration data
Reference Comparison: Compare OU-4 and reference sediment and prey tissues and/or comparison among OU-4 assessment areas	OU-4	Site elevated compared to reference conditions in all assessment areas	NA	NA	— This LOE indicates potential for exposure but does not speak to estimated risk	OU-4	Site elevated compared to reference conditions in all assessment areas	NA	NA	— This LOE indicates potential for exposure but does not speak to estimated risk
Weight of Evidence Conclusion						OU4	Unknown	NA	Low	Field survey data were inconclusive and cannot be used to support or refute a conclusion of risk.
Piscivores (mink and river otter)										
HQ: Modeled diet - growth-based mink TRV	C6 and C9	Moderate	High	Low/Moderate		C1 through C5, C7, C8, C10	High unacceptable	Moderate	Moderate	— TRV based on mink. Growth is an ecologically relevant endpoint; adverse effects on growth can result in population-level effects. Growth TRV is given more weight than reproduction TRV.
	C1 through C5, C7, C8, and C10	High			— TRVs based on mink, uncertain as study based on co-contaminanted compounds and considered artificially low	C6 and C9	Unacceptable			— Dose based on modeled fish tissue using BAFs for which no significant relationship found between sediment and tissue given lower weight than dose based on measured tissue.
HQ: Measured diet - growth-based mink TRV										— Dose based on measured tissue given higher weight
	All Reaches	High	High	Low/Moderate	— Reproduction TRV given higher weight for potential population-level effects than growth TRV	C1 through C10	High unacceptable	Low/Moderate	Moderate/High	— Growth TRV is valid and defensible. Falls within range of TRVs reported in Bursian et al. 2013 and EC20 value calculated from dose-response regression for reproductive success based on 50 published mink studies from Fuchsman et al. 2008.
HQ: Modeled diet - reproduction-based mink TRV	C5 through C7, C9 and C10	Moderate	Moderate	Moderate	— Dose based on modeled fish tissue using BAFs for which no significant relationship found between sediment and tissue given lower weight than dose based on measured tissue	C1 through C4, C8	High unacceptable	Moderate	Moderate	— Dose based on modeled fish tissue using BAFs for which no significant relationship found between sediment and tissue given lower weight than dose based on measured tissue.
	C1 through C4	High			— Habitat suitability is limited, this species and other piscivorous mammals not directly observed on-site, but evidence of mink and otter was observed	C5, C6, C7, C9, C10	Unacceptable			— Reproduction TRV is dietary concentration at which kit survival at six weeks of age was only 13%. Any exceedance of this LOAEL TRV should be considered high unacceptable.
HQ: Measured diet - reproduction-based mink TRV	All Reaches	High	Moderate	Moderate/High		C1 through C10	High unacceptable	Low/Moderate	Moderate/High	— Dose based on measured tissue given higher weight
Weight of Evidence Conclusion						C1 thorough C10	High unacceptable	Low/Moderate	Moderate/High	Conservative and confidence ranged from low/Moderate to Moderate/High, and risk conclusions similar for all LOEs. Greatest weight given to the LOEs with the highest confidence level
Aerial Invertivores (brown bat)										
HQ: Modeled diet - reproduction-based small mammal TRV	C5 through C10	Negligible	Moderate	Moderate		C1, C2, C4	High unacceptable	moderate/potential to underestimate risk	Low/Moderate	— Dose based on modeled emergent insect tissue using BAFs for which no significant relationship found between sediment and tissue given lower weight than dose based on measured prey tissue. However, BAF includes terrestrial Hymenoptera which likely underestimate the contribution of sediment to risks to aerial invertivores.
	C3	Moderate			— TRVs considered appropriate for small mammals (based on multigenerational mice studies)	C3	Unacceptable			
	C1, C2 and C4	High			— Dose based on modeled emergent insect tissue using BAFs for which no significant relationship found between sediment and tissue given lower weight than dose based on measured prey tissue	C5 through C10	Acceptable			

Table AD-44. Summary of Potential Risks to Mammals from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk
Anniston PCB Site, Anniston, Alabama
OU-4 BERA Addendum

Line Of Evidence	Exposure Unit	ARCADIS INTERPRETATION				EPA INTERPRETATION				
		Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
HQ: Measured diet - reproduction-based small mammal TRV	C5 through C10	Negligible	Moderate	Moderate/High	— Two special status bat species (indiana bat and grey bat) may be present in Calhoun County but have not been observed in OU-4	C1 through C4	Unacceptable	Low/Moderate	Moderate/High	— Dose based on measured tissue given higher weight
	C1 through C4	Moderate			—	C5 through C9	Acceptable			
Weight of Evidence Conclusion						C1 through C4	Unacceptable	Moderate	Moderate/High	Conservative and confidence ranged from low/Moderate to Moderate/High, and risk conclusions similar for both LOEs. Greatest weight given to the LOE with the highest confidence level
						C5 through C10	Acceptable			
All Terrestrial Mammals										
Compare OU-4 and reference community data	OU-4	No impairment indicated	NA	Low	—Based on site-specific observations	OU-4	Unknown	NA	Low	— Cannot state whether there are any effects of PCBs or other COPCs on the terrestrial mammal community as co-located COPC concentration data not collected
					— Mean abundance, species richness, diversity and dominance did not significantly differ between Site and reference locations					— High uncertainty with findings due to low sample size, unknown regarding experimental design and statistical analysis methods, lack of reference data, and lack of co-located COPC concentration data
					— Overall, the results suggest no effect of PCBs or other COPCs on the terrestrial mammal community					
					— High uncertainty with findings due to low sample size and lack of co-located COPC concentration data					
Reference Comparison: Compare OU-4 and reference soil and prey tissues and/or comparison among OU-4 assessment areas	OU-4	Site elevated compared to reference conditions in all assessment areas	NA	NA	— This LOE indicates potential for exposure but does not speak to estimated risk	OU-4	Site elevated compared to reference conditions in all assessment areas	NA	NA	— This LOE indicates potential for exposure but does not speak to estimated risk
Weight of Evidence Conclusion						OU4	NA	NA	Low	Field survey data were inconclusive and cannot be used to support or refute a conclusion of risk.
Herbivores (White-tailed deer)										
HQ: Modeled diet - reproduction-based small mammal TRV	C1 East and C2 through C9 (all EUS)	Negligible	Moderate	Moderate	— TRVs considered appropriate for small mammals (based on multigenerational mice studies)	C1 West	Unacceptable		Moderate	— Dose based on modeled plant tissue using BAFs for which no significant relationship found between soil and tissue given lower weight than dose based on measured terrestrial plant tissue
	C1 West	Moderate			— Dose based on modeled plant tissue using BAFs for which no significant relationship found between soil and tissue given lower weight than dose based on measured terrestrial plant tissue	C1 East, C2 through C9 (all Eus)	Acceptable		Agree	
HQ: Measured diet - reproduction-based small mammal TRV	All Eus	Negligible	Moderate	Moderate/High	—	All EUs	Acceptable	Moderate	Moderate/High, Agree	— Dose based on measured tissue given higher weight
Weight of Evidence Conclusion						All EUs, C1 to C9	Acceptable	Moderate	Moderate/High	Greatest weight given to the LOE with the highest confidence level

Table AD-44. Summary of Potential Risks to Mammals from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk
Anniston PCB Site, Anniston, Alabama
OU-4 BERA Addendum

Line Of Evidence	Exposure Unit	ARCADIS INTERPRETATION				EPA INTERPRETATION				
		Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
Terrestrial Insectivores/Invertivores (Short-tailed shrew-1)										
HQ: Modeled diet - reproduction-based small mammal TRV	North, and C9 South	Negligible				C1 West, C3 South	High Unacceptable	moderate	moderate	— TRVs considered appropriate for small mammals (based on multigenerational mice studies)
	C2 Central, C5 North and South, C6 North, C7 South, C8 North and South, C9 North	Low				C1 East, C2 North, C3 North, C4 North and South, C6 South, C8 North	Unacceptable			
	C1 East, C2 North, C3 North, C4 North andSouth, C6 South	Moderate			— TRVs considered appropriate for small mammals (based on multigenerational mice studies)	C2 Central, C5 North and South, C6 North, C7 North and South, C8 South, C9 North	Indeterminate			— Dose based on modeled tissue given lower weight than dose based on measured tissue. Modeled tissue based 25% on BAFs for which no significant relationship found between soil and tissue (i.e., 26% grasshoppers) and 26% terrestrial spiders for which earthworms used as a surrogate for estimate.
	C1 West and C3 South	High			— Dose based on modeled tissue given lower weight than dose based on measured tissue. Modeled tissue based 25% on BAFs for which no significant relationship found between soil and tissue (i.e., 26% grasshoppers) and 26% terrestrial spiders for which earthworms used as a surrogate for estimate.	C2 South, C9 South	Acceptable			
HQ: Measured diet - reproduction-based small mammal TRV	C5 through C9 (all Eus)	Low	Moderate	Moderate/High	— Tissue-based exposure model given higher weight than dietary models due to uncertainites associated with estimating prey exposure	C1 through C4	Unacceptable	moderate	Moderate/High	— Dose based on measured tissue given higher weight
	C1 through C4 (all Eus)	Moderate				C5 through C9	Indeterminate			
HQ: Measured tissue - reproduction-based small mammal CTC; assuming reported CTC is wet weight	All AAs	Negligible	Moderate	High	— Measured site-specific tissue is a direct measure of exposure	UAA	Acceptable	High/potential for underestimation of risk	Low	— Very limited database for CTCs in small mammal tissue; high uncertainty
										— High uncertainty in whether reported basis is dry or wet weight
					— TRVs based on multigenerational studies for small mammals	LAA, MAA	Indeterminate			— Considered a secondary LOE; more weight given to other site-specific measures
HQ: Measured tissue - reproduction-based small mammal CTC; assuming reported CTC is dry weight						UAA	Indeterminate	Moderate/High	Low	— High uncertainty in whether reported basis is dry or wet weight
						LAA, MAA	Unacceptable			— Considered a secondary LOE; more weight given to other site-specific measures
Weight of Evidence Conclusion						C1 through C4	Unacceptable	Moderate	Moderate/High	Greatest weight given to the LOE with the highest confidence level
						C5 through C9	Indeterminate			

Table AD-44. Summary of Potential Risks to Mammals from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk
Anniston PCB Site, Anniston, Alabama
OU-4 BERA Addendum

Line Of Evidence	Exposure Unit	ARCADIS INTERPRETATION				EPA INTERPRETATION					
		Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis	
Terrestrial Insectivores/Invertivores (Short-tailed shrew-2) Arcadis part added by KK - Not included in their table											
HQ: Modeled diet - reproduction-based small mammal TRV	C7 North and C9 South	Negligible	Moderate	Moderate		C1 West, C3 South	High Unacceptable	moderate	Moderate	— TRVs considered appropriate for small mammals (based on multigenerational mice studies) — Dose based on modeled tissue given lower weight than dose based on measured tissue. Modeled tissue based 25% on BAFs for which no significant relationship found between soil and tissue (i.e., 26% grasshoppers) and 26% terrestrial spiders for which earthworms used as a surrogate for estimate.	
	C5 North and South, C6 North an South, C7 South, C8 North and South, C9 North	Low				C1 East, C2 (all Eus), C3 North, C4 North and South, C6 South, C8 North	Unacceptable				
	C1 East, C2 (all Eus), C3 North, C4 North and South	Moderate				— TRVs considered appropriate for small mammals (based on multigenerational mice studies)	C5 North and South, C6 North, C7 North and South, C8 South, C9 North				Indeterminate
	C1 West and C3 South	High				— Dose based on modeled tissue given lower weight than dose based on measured tissue. Modeled tissue based 25% on BAFs for which no significant relationship found between soil and tissue (i.e., 26% grasshoppers) and 26% terrestrial spiders for which earthworms used as a surrogate for estimate.	C9 South				Acceptable
HQ: Measured diet - reproduction-based small mammal TRV	C5 through C9 (all Eus)	Low	Moderate	Moderate/High	— Tissue-based exposure model given higher weight than dietary models due to uncertainties associated with estimating prey exposure	C1 through C4	Unacceptable	moderate	Moderate/High	— Dose based on measured tissue given higher weight	
	C1 through C4 (all Eus)	Moderate				C5 through C9	Indeterminate				
HQ: Measured tissue - reproduction-based small mammal CTC; assuming reported CTC is wet weight	All AAs	Negligible	Moderate	High	— Measured site-specific tissue is a direct measure of exposure	UAA	Acceptable	High/potential for underestimation of risk	Low	— Very limited database for CTCs in small mammal tissue; high uncertainty	
										— High uncertainty in whether reported basis is dry or wet weight	
					— TRVs based on multigenerational studies for small mammals	LAA, MAA	Indeterminate			— Considered a secondary LOE; more weight given to other site-specific measures	
HQ: Measured tissue - reproduction-based small mammal CTC; assuming reported CTC is dry weight						UAA	Indeterminate	High	Low	— High uncertainty in whether reported basis is dry or wet weight	
						LAA, MAA	Unacceptable			— Considered a secondary LOE; more weight given to other site-specific measures	
Weight of Evidence Conclusion						C1 through C4	Unacceptable	Moderate	Moderate/High	Dietary Exposure LOEs had moderate conservatism and moderate to high confidence. Tissue concentration CTC had low confidence, greater weight given to the dietary LOE with the highest confidence	
						C5 through C10	Indeterminate				
Terrestrial Carnivores (Long-tailed weasel and red fox)											
HQ: Modeled diet - reproduction-based small mammal TRV	C2 (all Eus), C5 through C9 (all Eus)	Negligible	Moderate	Moderate/High	— TRVs considered appropriate for small mammals (based on multigenerational mice studies)	C1 West, C3 South	Unacceptable	Moderate	Agree	— Dose based on modeled tissue given higher weight than dose based on measured tissue. Weasel diet assumed to contain 100% small mammal tissue. Modeled small mammal tissue based regression for which a statistically significant relationship between site-specific soil and tissue was identified	
	C1 East, C3 and C4 (all Eus)	Low			— Dose based on modeled tissue given higher weight than dose based on measured tissue. Weasel diet assumed to contain 100% small mammal tissue. Modeled small mammal tissue based regression for which a statistically significant relationship between site-specific soil and tissue was identified	C1 East, C2 North, C3 North, C4 North and South	Indeterminate				
	C1 West	Moderate		Moderate/High	— Modeled tissue provides greater coverage for risk estimates across OU-4	C2 South and Central, C5 through C9 (all Eus)	Acceptable		Moderate/High		
HQ: Measured diet - reproduction-based small mammal TRV	C1 through C9 (all Eus)	Low	Moderate	Moderate		C1 West, C5 through C9 (all Eus)	Unacceptable	Moderate	Moderate	— Dose based on measured tissue given lower weight	
						C1 East, C2 through C4 (all Eus)	Indeterminate				

Table AD-44. Summary of Potential Risks to Mammals from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk
Anniston PCB Site, Anniston, Alabama
OU-4 BERA Addendum

Line Of Evidence	Exposure Unit	ARCADIS INTERPRETATION				EPA INTERPRETATION				
		Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
Weight of Evidence Conclusion						C1 West, C3 South	Unacceptable	Moderate	Moderate/High	Greatest weight given to the LOE with the highest confidence level
						C1 East, C3 North, C4	Indeterminate			
						C2, C5 through C9 (all EUs)	Acceptable			
Mixed Diet Omnivores exposed to riparian soil and sediment (Raccoon-2)										
HQ: Modeled diet - reproduction-based small mammal TRV	Riparian and Floodplain Eus	Negligible	Moderate	Moderate	— TRVs considered appropriate for small mammals (based on multigenerational mice studies) — Dose based on modeled tissue using BAFs for which no significant relationship found between soil/sediment and tissue given lower weight than dose based on measured tissue	C1 Riparian, C2 Riparian,	Unacceptable	Moderate	Moderate	— Dose based on modeled tissue using BAFs for which no significant relationship found between soil/sediment and tissue given lower weight than dose based on measured tissue
	C2 and C3 North Floodplain Eus, C4 all Eus, C3 Riparian	Low				C3 Riparian, C4 Riparian, C8 Riparian	Indeterminate			
	C1 and C2 Riparian, C1 East and C3 South Floodplain Eus	Moderate				C5 through C7 Riparian, C9 Riparian, C10 Riparian	Acceptable			
	C1 West floodplain EU	High								
HQ: Measured diet - reproduction-based small mammal TRV	C1 through C10 Riparian, C1 through C4 floodplain Eus	Low	High	Moderate/High		C1 through C10	Indeterminate	Moderate	Moderate/high	— Dose based on measured tissue given higher weight
	C5 through C10 Floodplain Eus	Negligible	High	Moderate/High						
Weight of Evidence Conclusion						C1 through C10	Indeterminate	Moderate	Moderate/High	Greatest weight given to the LOE with the highest confidence level
Mixed Diet Omnivores exposed to riparian soil and sediment (Mink-1) Arcadis part added by KK -- raccoon was identified as most sensitive, but mink is more sensitive										
HQ: Modeled diet - growth-based mink TRV	C5 through C10	Moderate				C1 Riparian through C4 Riparian	High Unacceptable	Moderate	Moderate	— TRV based on mink. Growth is an ecologically relevant endpoint; adverse effects on growth can result in population-level effects. Growth TRV is given more weight than reproduction TRV. — Dose based on modeled tissue using BAFs for which no significant relationship found between soil/sediment and tissue, except for small mammals, given lower weight than dose based on measured tissue
	C1 through C4	High				C5 through C10 Riparian	Unacceptable			
HQ: Measured diet - growth-based mink TRV	C1 through C10	High				C1 through C10 Riparian	High Unacceptable	Moderate	Moderate/High	— Dose based on measured tissue given higher weight — Growth TRV is valid and defensible. Falls within range of TRVs reported in Bursian et al. 2013 and EC20 value calculated from dose-response regression for reproductive success based on 50 published mink studies from Fuchsman et al. 2008.
HQ: Modeled diet - reproduction-based mink TRV	C6, C9	Low				C1 Riparian, C2 Riparian	High Unacceptable	Moderate	Moderate	— Reproduction TRV is dietary concentration at which kit survival at six weeks of age was only 13%. Any exceedance of this LOAEL TRV should be considered high unacceptable.
	C3, C4, C5, C7, C8, C10	Moderate				C3 through C10 Riparian	Unacceptable			
	C1, C2	High								
HQ: Measured diet - reproduction-based mink TRV	C1 through C10	Moderate				C1 through C10 Riparian	Unacceptable	Moderate	Moderate/High	— Reproduction TRV is dietary concentration at which kit survival at six weeks of age was only 13%. Any exceedance of this LOAEL TRV should be considered high unacceptable. — Dose based on measured tissue given higher weight
Weight of Evidence Conclusion						C1 Riparian through C10 Riparian	High Unacceptable	Moderate	Moderate/High	Greatest weight given to the LOEs with the highest confidence level

Table AD-44. Summary of Potential Risks to Mammals from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk
Anniston PCB Site, Anniston, Alabama
OU-4 BERA Addendum

	Exposure Unit	ARCADIS INTERPRETATION				EPA INTERPRETATION				
		Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction				Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	
Line Of Evidence					Basis	Exposure Unit	Potential Risk			Basis

Weight of evidence presented for receptor within each feeding guild that had highest predicted risk (receptor noted in blue text)
Line of evidence with the relatively highest level of confidence in predicting potential risk for the receptor populations is in **bold text**
BAF = Bioaccumulation factor NA = Not applicable
COPC = Contaminant of potential concern OU-4 = Operable Unit 4
EU = Exposure unit P-value indicates statistical significance at a selected probablity, in this case 95% (or P < 0.05)
EPC = Exposure point concentration PCBs = Polychlorinated biphenyls
LOE = Line of evidence TRVs = Toxicity reference values
LAA = Lower Assessment Area UAA = Upper Assessment Area
MAA = Middle Assessment Area

Table AD-45. Hazard Quotient Calculation Checks, Anniston
BERA Birds, PCBs

95%UCL

Spotted Sandpiper - 2

INITIAL SETTINGS

0.753

0.17

0

Location	Type	Conc. in Sediment ^A	Sediment Ingestion Rate	Total Intake through Sediment	Conc. In Surface Water	Water Ingestion Rate	Total Intake through Water	Conc. in EWs _B	Percent of Diet Ews
		mg/kg dw	kg/kg BW/dayday dw	mg/day	mg/L	L/kg BW/day	mg/kgBW.day	mg/kg dw	
UAA	PCBs	5.61	0.753	4.22433		0.17	0		0
MAA	PCBs	1.46	0.753	1.09938		0.17	0		0
LAA	PCBs	0.919	0.753	0.692007		0.17	0		0
UAA	PCBs	5.61	0.753	4.22433		0.17	0		0
MAA	PCBs	1.46	0.753	1.09938		0.17	0		0
LAA	PCBs	0.919	0.753	0.692007		0.17	0		0

^A Sediment 95%UCL concentrations from Table AD5-1

^B Aquatic invertebrate tissue concentrations from Table 6-11 of BERA

mg/kg d.w. = milligrams per kilogram dry weight
mg/kg w.w. = milligrams per kilogram wet weight
kg = kilogram
mg/kg/day = milligrams per kilogram body weight per day
µg/L = micrograms per liter

dw = dry weight
ww = wet weight
AUF = Area Use Factor
LOAEL = Lowest observed adverse effect level
NOAEL = No observed adverse effect level

HQ = Hazard Quotient
mg/L = milligrams per liter
EWs = Earthworms

Table AD-45. (cont.) Hazard Quotient Calculation Checks, Anniston
BERA Birds, PCBs

0.18		50	0.18		50	0.18		
Food Ingestion Rate	Conc. in Aquatic Inverts ^C	Percent of Diet Aquatic Inverts	Food Ingestion Rate	Conc. in Lumbriculus	Percent of Diet Lumbriculus	Food Ingestion Rate	Total Intake through Food	Total Intake
kg/kg BW/day dw	mg/kg dw		kg/kg BW/day dw	mg/kg dw.		kg/kg BW/day dw	mg/day dw	mg/day
0.18	2.65	50	0.18	65.18	50	0.18	6.1047000	10.32903
0.18	1.83	50	0.18	65.18	50	0.18	6.0309000	7.13028
0.18	1.09	50	0.18	65.18	50	0.18	5.9643000	6.65631
0.18	2.65	50	0.18	65.18	50	0.18	6.1047000	10.32903
0.18	1.83	50	0.18	65.18	50	0.18	6.0309000	7.13028
0.18	1.09	50	0.18	65.18	50	0.18	5.9643000	6.65631

^C Lumbriculus 95%UCL concentration calculated from data in Appendix E using ProUCL version 5.1. Basis not stated in Appendix E, but values are similar to values in Appendix 1 of Ingersoll et al. (2014); page 39 of Ingersoll et al. (2014) states the PCB tissue concentrations are wet weight. Use of the values from Appendix E , which are likely wet weight, underestimates this EPC.

mg/kg d.w. = milligrams per kilogram dry weight
mg/kg w.w. = milligrams per kilogram wet weight
kg = kilogram
mg/kg/day = milligrams per kilogram body weight per d
µg/L = micrograms per liter

dw = dry weight
ww = wet weight
AUF = Area Use Factor
LOAEL = Lowest observed adverse effect level
NOAEL = No observed adverse effect level

HQ = Hazard Quotient
mg/L = milligrams per liter
EWs = Earthworms

Table AD-45. (cont.) Hazard Quotient Calculation Checks, Anniston
BERA Birds, PCBs

1 0.043

AUF	Body Weight	Dose	LOAEL	HQ LOAEL	NOAEL	HQ NOAEL
	kg	mg/kg/day	mg/kg/day		mg/kg/day	
1	0.043	10.3290300	0.13	79.45	0.043	240.21
1	0.043	7.1302800	0.13	54.85	0.043	165.82
1	0.043	6.6563070	0.13	51.20	0.043	154.80
1	0.043	10.3290300	1.4	7.38	0.47	21.98
1	0.043	7.1302800	1.4	5.09	0.47	15.17
1	0.043	6.6563070	1.4	4.75	0.47	14.16

mg/kg d.w. = milligrams per kilogram dry weight
mg/kg w.w. = milligrams per kilogram wet weight
kg = kilogram
mg/kg/day = milligrams per kilogram body weight per day
µg/L = micrograms per liter

dw = dry weight
ww = wet weight
AUF = Area Use Factor
LOAEL = Lowest observed adverse effect level
NOAEL = No observed adverse effect level

HQ = Hazard Quotient
mg/L = milligrams per liter
EWs = Earthworms

Table AD-46. Weight of Evidence Evaluation Summary for PCBs
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

			UAA				MAA		LAA			
Assessment Endpoint	Conservatism / confidence	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	
Aquatic Plants/ Aquatic Life	<i>moderate/high</i> <i>moderate/low</i>	Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Terrestrial Plants	<i>moderate/high</i> <i>low</i>	Unacceptable (C1 West only)	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Benthic Invertebrates/Aquatic Invertebrates	<i>moderate</i> <i>Moderate/High</i>	Unacceptable	Unacceptable	Generally Acceptable, Local Areas Unacceptable	Generally Acceptable, Local Areas Unacceptable	Generally Acceptable, Local Areas Unacceptable	Acceptable	Unacceptable	Generally Acceptable, Local Areas Unacceptable	Acceptable	Generally Acceptable, Local Areas Unacceptable	
Terrestrial Invertebrates	<i>Moderate/high</i> <i>Low</i>	Unacceptable (C1 West only)	Indeterminate	Indeterminate	Indeterminate	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Indeterminate	
Fish/Aquatic Life	<i>moderate</i> <i>Moderate</i>	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	
Avian Piscivore	<i>moderate</i> <i>Moderate</i>	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	
Avian aquatic insectivore	<i>moderate</i> <i>Moderate</i>	High Unacceptable	High Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	
Avian aerial insectivore	<i>moderate</i> <i>Moderate</i>	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Avian Herbivore	<i>moderate</i> <i>low/Moderate</i>	Unacceptable (C1 West only)	Acceptable	Indeterminate	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Avian terrestrial insectivore	<i>moderate</i> <i>Moderate</i>	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate		
Avian terrestrial omnivore	<i>moderate</i> <i>low/Moderate</i>	Unacceptable	Indeterminate	Indeterminate	Indeterminate	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable		
Avian terrestrial carnivore	<i>moderate</i> <i>Moderate</i>	High Unacceptable	Unacceptable	Unacceptable	Unacceptable	Indeterminate	Acceptable	Acceptable	Indeterminate	Acceptable		
Avian mixed diet omnivore	<i>moderate</i> <i>low/moderate</i>	High Unacceptable	Unacceptable	Unacceptable	Unacceptable	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate		
Mammalian Piscivore	<i>Low/Moderate /</i> <i>Moderate/High</i>	High Unacceptable	High Unacceptable	High Unacceptable	High Unacceptable	High Unacceptable	High Unacceptable	High Unacceptable	High Unacceptable	High Unacceptable	High Unacceptable	
Mammalian Aerial Insectivore	<i>Moderate /</i> <i>Moderate/High</i>	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Mammalian Herbivore	<i>Moderate/</i> <i>Moderate/High</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable		
Mammalian Insectivore/ Invertivore	<i>Moderate /</i> <i>Moderate/High</i>	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate		
Mammalian Carnivore	<i>Moderate/</i> <i>Moderate/High</i>	Unacceptable (C1 West only)	Acceptable	Unacceptable (C3 South only)	Indeterminate	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable		
Mammalian mixed diet omnivore (raccoon)	<i>Moderate /</i> <i>Moderate/High</i>	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	
Mammalian mixed diet omnivore (Mink)	<i>Moderate /</i> <i>Moderate/High</i>	High Unacceptable	High Unacceptable	High Unacceptable	High Unacceptable	High Unacceptable	High Unacceptable	High Unacceptable	High Unacceptable	High Unacceptable	High Unacceptable	

Table AD-47. Weight of Evidence Evaluation Summary for Barium
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

			UAA			MAA		LAA			
Assessment Endpoint	Conservatism /	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
	confidence										
Aquatic Plants/ Aquatic Life	<i>moderate/high</i> <i>moderate/low</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Terrestrial Plants	<i>high</i> <i>low</i>	Indeterminate	Unacceptable	Unacceptable	Unacceptable	Acceptable	Acceptable	Acceptable	Unacceptable	Acceptable	Acceptable
Benthic Invertebrates/Aqua tic Invertebrates	<i>high</i> <i>low</i>	Unacceptable	Unacceptable	Unacceptable	Acceptable	Unacceptable	Unacceptable	Acceptable	Acceptable	Acceptable	Unacceptable
Terrestrial Invertebrates	<i>moderate/high</i> <i>Moderate</i>	Indeterminate	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Fish/Aquatic Life	<i>high</i> <i>low</i>	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable
Avian Piscivore	<i>moderate</i> <i>Moderate</i>	Unacceptable	Unacceptable	Acceptable	Acceptable	Unacceptable	Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable
Avian aquatic insectivore	<i>moderate</i> <i>Moderate</i>	Unacceptable	Acceptable	Acceptable	Acceptable	Unacceptable	Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable
Avian aerial insectivore	<i>moderate</i> <i>Moderate</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Avian Herbivore	NA	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Avian terrestrial insectivore	NA	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Avian terrestrial omnivore	NA	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Avian terrestrial carnivore	NA	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Avian mixed diet omnivore	NA	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Mammalian Piscivore	<i>Moderate /</i> <i>Moderate/High</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Mammalian Aerial Insectivore	<i>Moderate /</i> <i>Moderate/High</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Mammalian Insectivore/ Invertivore	<i>Moderate /</i> <i>Moderate/High</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Mammalian mixed diet omnivore (raccoon)	<i>Moderate /</i> <i>Moderate/High</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Mammalian mixed diet omnivore (Mink)	<i>Moderate /</i> <i>Moderate/High</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

Table AD-48. Weight of Evidence Evaluation Summary for Chromium
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

Assessment Endpoint		UAA				MAA		LAA			
	<i>Conservatism /</i>	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
	<i>confidence</i>										
Aquatic Plants/ Aquatic Life	<i>moderate/high</i> <i>moderate</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Terrestrial Plants	<i>high</i> <i>low</i>	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate
Benthic Invertebrates/Aqua tic Invertebrates	<i>high</i> <i>low</i>	Unacceptable	Acceptable	Acceptable	Acceptable	Unacceptable	Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable
Terrestrial Invertebrates	<i>moderate/high</i> <i>Low</i>	Indeterminate	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Acceptable	Unacceptable	Unacceptable	Acceptable	Acceptable
Fish/Aquatic Life	<i>high</i> <i>low</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Avian Piscivore	<i>moderate</i> <i>Moderate</i>	Unacceptable	Unacceptable	Acceptable	Acceptable	Unacceptable	Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable
Avian aquatic insectivore	<i>moderate</i> <i>Moderate</i>	Unacceptable	Acceptable	Unacceptable	Acceptable	Unacceptable	Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable
Avian aerial insectivore	<i>moderate</i> <i>Moderate</i>	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable
Avian Herbivore	<i>NA</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Avian terrestrial insectivore	<i>NA</i>	Acceptable	Acceptable	Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Avian terrestrial omnivore	<i>NA</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Avian terrestrial carnivore	<i>NA</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Avian mixed diet omnivore	<i>NA</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Mammalian Piscivore	<i>Moderate /</i> <i>Moderate/High</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Mammalian Aerial Insectivore	<i>Moderate /</i> <i>Moderate/High</i>	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable
Mammalian Insectivore/ Invertivore	<i>Moderate /</i> <i>Moderate/High</i>	Acceptable	Acceptable	Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Mammalian mixed diet omnivore (raccoon)	<i>Moderate /</i> <i>Moderate/High</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Mammalian mixed diet omnivore (Mink)	<i>Moderate /</i> <i>Moderate/High</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

Table AD-49. Weight of Evidence Evaluation Summary for Cobalt
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

			UAA				MAA		LAA			
Assessment Endpoint	Conservatism /	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	
	confidence											
Aquatic Plants/ Aquatic Life	<i>moderate/high</i> <i>moderate/low</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Terrestrial Plants	<i>high</i> <i>low</i>	Indeterminate	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Unacceptable	Acceptable	Acceptable	Acceptable	
Benthic Invertebrates/Aqua tic Invertebrates	<i>high</i> <i>low</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Terrestrial Invertebrates	<i>moderate/high</i> <i>Moderate</i>	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	
Fish/Aquatic Life	<i>high</i> <i>low</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Avian Piscivore	<i>moderate</i> <i>Moderate</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Avian aquatic insectivore	<i>moderate</i> <i>Moderate</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Avian aerial insectivore	<i>moderate</i> <i>Moderate</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Avian Herbivore	NA	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Avian terrestrial insectivore	NA	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Avian terrestrial omnivore	NA	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Avian terrestrial carnivore	NA	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Avian mixed diet omnivore	NA	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Mammalian Piscivore	<i>Moderate /</i> <i>Moderate/High</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Mammalian Aerial Insectivore	<i>Moderate /</i> <i>Moderate/High</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Mammalian Insectivore/ Invertivore	<i>Moderate /</i> <i>Moderate/High</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Mammalian mixed diet omnivore (raccoon)	<i>Moderate /</i> <i>Moderate/High</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Mammalian mixed diet omnivore (Mink)	<i>Moderate /</i> <i>Moderate/High</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	

Table AD-50. Weight of Evidence Evaluation Summary for Lead
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

			UAA				MAA		LAA			
Assessment Endpoint	Conservatism /	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	
	confidence											
Aquatic Plants/ Aquatic Life	<i>moderate/high</i> <i>moderate/low</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Terrestrial Plants	<i>high</i> <i>low</i>	Indeterminate	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Benthic Invertebrates/Aqua tic Invertebrates	<i>high</i> <i>low</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Terrestrial Invertebrates	<i>moderate/high</i> <i>Moderate</i>	Indeterminate	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Fish/Aquatic Life	<i>high</i> <i>low</i>	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	
Avian Piscivore	<i>moderate</i> <i>Moderate</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Avian aquatic insectivore	<i>moderate</i> <i>Moderate</i>	Unacceptable	Unacceptable	Acceptable	Acceptable	Unacceptable	Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Avian aerial insectivore	<i>moderate</i> <i>Moderate</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Avian Herbivore	NA	Indeterminate	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Avian terrestrial insectivore	NA	Indeterminate	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Acceptable	Acceptable	Unacceptable	Acceptable	Acceptable	
Avian terrestrial omnivore	NA	Indeterminate	Acceptable	Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Avian terrestrial carnivore	NA	Indeterminate	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Avian mixed diet omnivore	NA	Indeterminate	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Mammalian Piscivore	<i>Moderate /</i> <i>Moderate/High</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Mammalian Aerial Insectivore	<i>Moderate /</i> <i>Moderate/High</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Mammalian Insectivore/ Invertivore	<i>Moderate /</i> <i>Moderate/High</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Mammalian mixed diet omnivore (raccoon)	<i>Moderate /</i> <i>Moderate/High</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Mammalian mixed diet omnivore (Mink)	<i>Moderate /</i> <i>Moderate/High</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	

Table AD-51. Weight of Evidence Evaluation Summary for Vanadium
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

			UAA				MAA		LAA			
Assessment Endpoint	Conservatism /	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	
	confidence											
Aquatic Plants/ Aquatic Life	<i>moderate/high</i> <i>moderate/low</i>	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	
Terrestrial Plants	<i>high</i> <i>low</i>	Indeterminate	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Benthic Invertebrates/Aqua tic Invertebrates	<i>high</i> <i>low</i>	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	
Terrestrial Invertebrates	<i>moderate/high</i> <i>Moderate</i>	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	
Fish/Aquatic Life	<i>high</i> <i>low</i>	Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Avian Piscivore	<i>moderate</i> <i>Moderate</i>	Unacceptable	Unacceptable	Acceptable	Acceptable	Unacceptable	Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Avian aquatic insectivore	<i>moderate</i> <i>Moderate</i>	High Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Acceptable	Acceptable	Unacceptable	Unacceptable	
Avian aerial insectivore	<i>moderate</i> <i>Moderate</i>	Unacceptable	Acceptable	Acceptable	Acceptable	Unacceptable	Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Avian Herbivore	NA	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Avian terrestrial insectivore	NA	Indeterminate	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Indeterminate	
Avian terrestrial omnivore	NA	Acceptable	Acceptable	Acceptable	Acceptable	Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Avian terrestrial carnivore	NA	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Avian mixed diet omnivore	NA	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Mammalian Piscivore	<i>Moderate /</i> <i>Moderate/High</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Mammalian Aerial Insectivore	<i>Moderate /</i> <i>Moderate/High</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Mammalian Insectivore/ Invertivore	<i>Moderate /</i> <i>Moderate/High</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Mammalian mixed diet omnivore (raccoon)	<i>Moderate /</i> <i>Moderate/High</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Mammalian mixed diet omnivore (Mink)	<i>Moderate /</i> <i>Moderate/High</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	

Table AD-52. Weight of Evidence Evaluation Summary for Dioxin/Furan & Dioxin-Like PCBs TEQ
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

			UAA				MAA		LAA			
Assessment Endpoint	Conservatism /	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	
	confidence											
Aquatic Plants/ Aquatic Life	<u>moderate/high</u> <u>moderate/low</u>	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	
Terrestrial Plants	<u>high</u> <u>low</u>	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	
Benthic Invertebrates/Aqua tic Invertebrates	<u>Moderate</u> <u>low</u>	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	
Terrestrial Invertebrates	<u>moderate/high</u> <u>Moderate</u>	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	
Fish/Aquatic Life	<u>high</u> <u>low</u>	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	
Avian Piscivore	<u>moderate</u> <u>Moderate</u>	High Unacceptable	High Unacceptable	High Unacceptable	High Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Avian aquatic insectivore	<u>moderate</u> <u>Moderate</u>	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Avian aerial insectivore	<u>moderate</u> <u>Moderate</u>	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Avian Herbivore	NA	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Acceptable	
Avian terrestrial insectivore	NA	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Acceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Acceptable	
Avian terrestrial omnivore	NA	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Acceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Acceptable	
Avian terrestrial carnivore	NA	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Acceptable	
Avian mixed diet omnivore	NA	High Unacceptable	High Unacceptable	High Unacceptable	High Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Mammalian Piscivore	<u>Moderate /</u> <u>Moderate/High</u>	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Mammalian Aerial Insectivore	<u>Moderate /</u> <u>Moderate/High</u>	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Mammalian Insectivore/ Invertivore	<u>Moderate /</u> <u>Moderate/High</u>	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Mammalian mixed diet omnivore (raccoon)	<u>Moderate /</u> <u>Moderate/High</u>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Mammalian mixed diet omnivore (Mink)	<u>Moderate /</u> <u>Moderate/High</u>	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	

Table AD-53. Weight of Evidence Evaluation Summary for Mercury
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

			UAA				MAA		LAA			
Assessment Endpoint	Conservatism /	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	
	confidence											
Aquatic Plants/ Aquatic Life	<i>moderate/high</i> <i>moderate/low</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Terrestrial Plants	<i>high</i> <i>low</i>	Indeterminate	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	
Benthic Invertebrates/Aqua tic Invertebrates	<i>high</i> <i>low</i>	Acceptable	Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Terrestrial Invertebrates	<i>moderate/high</i> <i>Moderate</i>	Indeterminate	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	
Fish/Aquatic Life	<i>high</i> <i>low</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Avian Piscivore	<i>moderate</i> <i>Moderate</i>	Unacceptable	High Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Avian aquatic insectivore	<i>moderate</i> <i>Moderate</i>	Unacceptable	High Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	
Avian aerial insectivore	<i>moderate</i> <i>Moderate</i>	Acceptable	High Unacceptable	Unacceptable	Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Avian Herbivore	<i>NA</i>	Indeterminate	Acceptable	Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable	Unacceptable	Acceptable	Acceptable	
Avian terrestrial insectivore	<i>NA</i>	Indeterminate	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Acceptable	Acceptable	
Avian terrestrial omnivore	<i>NA</i>	Indeterminate	Unacceptable	Unacceptable	Unacceptable	Acceptable	Unacceptable	Acceptable	Unacceptable	Acceptable	Acceptable	
Avian terrestrial carnivore	<i>NA</i>	Indeterminate	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Avian mixed diet omnivore	<i>NA</i>	Acceptable	High Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Mammalian Piscivore	<i>Moderate /</i> <i>Moderate/High</i>	Acceptable	Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Mammalian Aerial Insectivore	<i>Moderate /</i> <i>Moderate/High</i>	Acceptable	High Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Mammalian Insectivore/ Invertivore	<i>Moderate /</i> <i>Moderate/High</i>	Indeterminate	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Acceptable	Acceptable	
Mammalian mixed diet omnivore (raccoon)	<i>Moderate /</i> <i>Moderate/High</i>	Indeterminate	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Mammalian mixed diet omnivore (Mink)	<i>Moderate /</i> <i>Moderate/High</i>	Acceptable	Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	

Table AD-54. Summary of Toxicity Benchmarks, TRVs, and CTCs for Ecological Receptors Anniston PCB Site, Anniston, Alabama

Media	Receptor	PCBs			Mercury ^b			Barium			Chromium			Cobalt			Lead			Vanadium		
		(low)	(high)	Reference	(low)	(high)	Reference	(low)	(high)	Reference	(low)	(high)	Reference	(low)	(high)	Reference	(low)	(high)	Reference	(low)	(high)	Reference
Media-Based Toxicity Benchmarks																						
Sediment (mg/kg dw)		TEC	PEC		TEC	PEC		TEC	PEC		TEC	PEC		TEC	PEC		TEC	PEC		TEC	PEC	
	Benthic invertebrates*	0.060	0.68	MacDonald et al. (2000)	0.18	1.1	MacDonald et al. (2000)	NA	NA	--	43	111	MacDonald et al. (2000)	NA	NA	--	36	128	MacDonald et al. (2000)	NA	NA	--
Soil (mg/kg dw)		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL	
	Terrestrial plants	40	NA	Efroymson et al. (1997a)	0.30	NA	Efroymson et al. (1997a)	--	--	Not a soil COPC	1.0	NA	Efroymson et al. (1997a)	--	--	Not a soil COPC	120	NA	USEPA (2005c)	2.0	NA	Efroymson et al. (1997a)
	Terrestrial invertebrates	3.6	36	USEPA (2015) ⁱ	0.10	0.23	Efroymson et al. (1997b) / Son et al. 1997	--	--	Not a soil COPC	0.40	NA	Efroymson et al. (1997b)	--	--	Not a soil COPC	1700	NA	USEPA (2005c)	NA	NA	--
Water (µg/L)		Acute	Chronic		Acute	Chronic		Acute	Chronic		Acute	Chronic		Acute	Chronic		Acute	Chronic		Acute	Chronic	
	Aquatic life (water column invertebrates, fish, and amphibians)	0.60	0.014	ADEM (2015) ^a , USEPA (2016)	2.4 1.4	0.012 0.77	ADEM (2015) ^g USEPA (2016) ^h	110	4.0	Suter and Tsao (1996)	1005	131	ADEM (2015) ^c , USEPA (2016)	1500	23	Suter and Tsao (1996)	136	5	ADEM (2015) ^c , USEPA (2016)	280	20	Suter and Tsao (1996)
	Aquatic plants	NA	0.14	Suter and Tsao (1996)	NA	5.0	Suter and Tsao (1996)	NA	NA	--	NA	400	Suter and Tsao (1996)	NA	NA	--	NA	500	Suter and Tsao (1996)	NA	NA	--
	Aquatic invertebrates	NA	1.2	Suter and Tsao (1996)	NA	0.87	Suter and Tsao (1996)	NA	NA	--	NA	NA	--	NA	4.4	Suter and Tsao (1996)	NA	NA	--	NA	430	Suter and Tsao (1996)
	Fish	NA	0.4	Suter and Tsao (1996)	NA	0.87	Suter and Tsao (1996)	NA	NA	--	NA	89	Suter and Tsao (1996)	NA	810	Suter and Tsao (1996)	NA	22	Suter and Tsao (1996)	NA	41	Suter and Tsao (1996)
Dietary Toxicity Reference Values		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL	
Dietary TRV (mg/kg bw-d; dw)	Birds - high sensitivity	0.043	0.13	Lillie et al. (1974)	0.023	0.068	Spalding et al. (2000)	21	42	Sample et al. (1996)	2.7	2.8	USEPA (2008) ^d	7.6	7.8	USEPA (2005b) ^d	1.6	3.3	USEPA (2005c) ^d	0.34	0.70	USEPA (2005d) ^d
	Birds - mid-range sensitivity	0.47	1.4	Koval et al. (1987)																		
	Small mammals	0.23	0.68	McCoy et al. (1995)	0.075	0.15	Dansereau et al. (1999)	52	121	USEPA (2005a) ^d	2.4	2.8	USEPA (2008) ^d	7.3	10	USEPA (2005b) ^d	4.7	8.9	USEPA (2005c) ^d	4.2	8.3	USEPA (2005d) ^d
	Mink	0.050	0.10	Restum et al. (1998)																		
	Mink (alternate)	NA	0.05	Restum et al. (1998) ^k																		
Tissue Critical Tissue Concentrations (dry weight basis) ^f		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL	
Benthic Invertebrates	Oligochaetes	541	659	converted to dw assuming 17% solids (Landrum et al. 2004)	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
	Emergent Insects	21	NA	converted to dw assuming 31% solids (OU-4 data)	24	NA	converted to dw assuming 31% solids	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
	Odonata/Epibenthic	158	422	converted to dw assuming 18% solids (OU-4 data)	56	90	converted to ww assuming 18% solids (OU-4 data)	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
	Molluscs	1263	1875	converted to dw assuming 8% solids (OU-4 data)	8	150	converted to dw assuming 8% solids	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
	Crayfish	21	57	converted to dw assuming 28% solids (OU-4 data)	0.92	16	converted to ww assuming 10% solids (Biesinger et al. 1984)	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
Terrestrial Invertebrates	Earthworms	78	83	converted to ww assuming 22% solids (Rodriguez-Grau et al. 1989)	15	NA	converted to ww assuming 29% solids (OU-4 data)	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
	Grasshoppers/Crickets	307	480	converted to dw assuming 30% solids (Paine et al. 1993)	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
Amphibians and Reptiles	Frogs	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
	Snakes	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--

Table AD-54. Summary of Toxicity Benchmarks, TRVs, and CTCs for Ecological Receptors Anniston PCB Site, Anniston, Alabama

Media	Receptor	PCBs			Mercury ^b			Barium			Chromium			Cobalt			Lead			Vanadium		
		(low)	(high)	Reference	(low)	(high)	Reference	(low)	(high)	Reference	(low)	(high)	Reference	(low)	(high)	Reference	(low)	(high)	Reference	(low)	(high)	Reference
Bird Eggs (mg/kg dw)	Birds - high sensitivity	2.1	4.5	Britton and Houston (1973)	0.44	0.80	Jackson et al. (2011)	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
	Birds - mid-range sensitivity	28	66	NOAEL : McLane and Hughes (1980) LOAEL : Peakall and Peakall (1973), Peakall et al. (1972)				NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
Mammal Tissue (mg/kg dw)	Small mammals	10	23	McCoy et al. (1995) ^e	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
Fish Tissue (mg/kg dw)	Non-salmonid	7.0	34	Hansen et al. (1974)	0.85	0.93	Webber and Haines 2003/Friedmann et al. 1976	NA	NA	--	NA	NA	--	NA	NA	--	9.3	15	Holcombe et al. (1976)	0.090	2.1	Hilton and Bettger (1988)
Tissue Critical Tissue Concentrations (wet weight basis) ^f		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL	
Benthic Invertebrates (mg/kg ww)	Oligochaetes	92	112	Fisher et al. 1999	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
	Emergent Insects	6.5	NA	Sanders and Chandler 1974	7.5	NA	Saouter et al. 1993	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
	Odonata/Epibenthic	28	76	Borgman et al. 1990; Nebeker and Puglisi 1974	10	16	Borgmann et al. 1993	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
	Molluscs	101	150	Lowe et al. 1972	0.6	12	LOAEL: Thain et al. 1984 NOAEL: Dillon et al. 1977; acute-to-chronic UF (0.1)	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
	Crayfish	6.0	16	Sanders and Chandler 1974; Duke et. al 1970	0.092	1.6	Biesinger et al. 1982	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
Terrestrial Invertebrates (mg/kg ww)	Earthworms	17	18	Rodriguez-Grau et al. 1989, acute-to-chronic UF (0.1)	4.4	NA	Burton et al. 2006	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
	Grasshoppers/Crickets	92	144	Paine et al. 1993	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
Amphibians and Reptiles (mg/kg ww)	Frogs	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
	Snakes	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
Bird Eggs (mg/kg ww)	Birds - high sensitivity	0.52	1.1	Britton and Houston (1973)	0.11	0.20	Jackson et al. (2011)	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
	Birds - mid-range sensitivity	7.1	17	NOAEL : McLane and Hughes (1980) LOAEL : Peakall and Peakall (1973), Peakall et al. (1972)				NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
Mammal Tissue (mg/kg ww)	Small mammals	3.3	7.2	McCoy et al. (1995) ^e	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
Fish Tissue (mg/kg ww)	Non-salmonid	1.9	9.3	Hansen et al. (1974)	0.23	0.25	Webber and Haines 2003/Friedmann et al. 1976	NA	NA	--	NA	NA	--	NA	NA	--	2.5	4	Holcombe et al. (1976)	0.024	0.554	Hilton and Bettger (1988)

Table AD-54. Summary of Toxicity Benchmarks, TRVs, and CTCs for Ecological Receptors Anniston PCB Site, Anniston, Alabama

- Notes:**
- a. No ADEM low value available. Screening value from Tier II Secondary Acute Value (Suter and Tsao 1996) for Aroclor 1254.
 - b. Mercury values based on total, inorganic, or methylmercury depending on media.
 - c. Ambient water quality criteria were adjusted for hardness = 200 mg/L, which represents a mid-range of site hardness data.
 - d. LOAELs selected from USEPA EcoSSL datasets were selected as the lowest LOAEL in the dataset for reproduction, growth, or survival that was above the selected NOAEL. Values were used as presented in the EcoSSL dataset. Specific underlying studies were note reviewed. See Appendix D for details on development of specific TRVs.
 - e. Study results assumed to be in dw.
 - f. Tissue-based CTCs were available on wet weight basis, as reported in the studies, but converted to dw for the risk assessment using site-specific percent solids data where available, or using appropriate literature values (see text).
 - g. Value based on methylmercury but applies to total mercury
 - h. Value based on total mercury but also applies to methylmercury
 - i. Soil benchmark calculated using equilibrium partitioning approach from USEPA (2015) using a LOAEL water quality criteria based on freshwater aquatic invertebrate Final Chronic Value (0.54 ug/L), as calculated by Fuchsman et al. (2006). An uncertainty factor of 10 was applied to estimate the NOAEL-equivalent benchmark.
 - j. Based on reproductive endpoint
 - k. Based on kit growth endpoint
- * Site-specific PCB toxicity values for benthic invertebrates are presented in Table 5-2a.

ADEM: Alabama Department of Environmental Management	mg/L: milligrams per liter	
BERA: Baseline Ecological Risk Assessment	mg/kg bw-d: milligrams per kilogram body weight per day	--: not applicable
COPC: constituent of potential concern	NA: value not available	
CTC: Common toxicity criteria	NOAEL: no-observed adverse effects level	
dw: dry weight	PCB: polychlorinated biphenyl	
EcoSSL = ecological soil screening level	PEC: probable effects concentration	
high: selected high toxicity benchmark	TEC: threshold effects concentration	
LOAEL: lowest-observed adverse effects level	TRV: toxicity reference value	
low: selected low toxicity benchmark	USEPA: United States Environmental Protection Agency	
mg/kg dw: milligrams per kilogram of dry weight	µg/L: micrograms per liter	

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Table AD-54. Summary of Toxicity Benchmarks, TRVs, and CTCs for Ecological Receptors Anniston PCB Site, Anniston, Alabama

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Table AD-55. Summary of bioassay results for surface sediment samples from Anniston OU4 as presented in Ingersoll et al. (2014)¹
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

				Percent of Bioassay Responses with Toxicity Categories					
				<i>Hyalella azteca</i>			<i>Chironomus dilutus</i>		
Station ID	AA	Reach	ΣPCBs (μg/kg) ²	Not Toxic ^{3,4}	Moderately Toxic ^{3,4}	Highly Toxic ^{3,4}	Not Toxic ^{3,5}	Moderately Toxic ^{3,5}	Highly Toxic ^{3,5}
TXR1 ⁶	Reference	Reference	<32 to 62	100%	0%	0%	100%	0%	0%
TX50-01-P	Upper	C2	770,000	31%	0%	69%	33%	0%	67%
TX50-02-P	Upper	C2	1,200,000	25%	0%	75%	11%	0%	89%
TX50-04-P	Upper	C2	240,000	62%	0%	38%	58%	8%	33%
TX50-05-P	Upper	C2	410,000	31%	0%	69%	100%	0%	0%
		Mean	655,000	37%	0%	63%	51%	2%	47%
TX20-01-P	Middle	C5	220	85%	8%	8%	100%	0%	0%
TX20-03-P	Middle	C5	310	92%	8%	0%	92%	8%	0%
		Mean	265	89%	8%	4%	96%	4%	0%
TX10-01-P	Lower	C10	91.2	15%	31%	54%	67%	33%	0%

Notes

1. Results from Table C4-1 and C4-2 from Ingersoll et al. (2014)
2. ΣPCBs calculated as sum of 10 congeners; from Ingersoll et al. (2014)
3. Toxicity of sample as determined by Ingersoll et al. (2014) using response-specific reference envelopes; not toxic=samples with effect values
4. Toxicity was evaluated based on 13 different effect metrics.
5. Toxicity was evaluated based on 12 different effect metrics.
6. Results represent 5 reference samples; Results for all 5 samples were 100% not toxic

Reference :

Ingersoll, C. G., J. A. Steevens, et al. (2014). Evaluation of toxicity to the amphipod, *Hyalella azteca* , and to the midge, *Chironomus dilutus* ; and bioaccumulation by the oligochaete, *Lumbriculus variegatus* , with exposure to PCB-contaminated sediments from Anniston, Alabama. U.S. Geological Survey Scientific Investigations Report 2013-5125. <http://pubs.usgs.gov/sir/2013/5125/pdf/sir2013-5125.pdf>. 122 pp.

Table AD-56. Comparison of Correct Classification Rates for the TT_{LR} and the TT_{HR} using Reliable TTs for Whole Sediment and for Pore Water
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

COPC	Pore Water				Sediment			
	TT _{LR} (µg/L)	TT _{HR} (µg/L)	Correct classification rate for TT _{LR}	Correct classification rate for TT _{HR}	TT _{LR} (µg/kg)	TT _{HR} (µg/kg)	Correct classification rate for TT _{LR}	Correct classification rate for TT _{HR}
<i>Chironomus dilutus</i> , adult emergence								
Total monochlorobiphenyls	1.71	7.87	85	78	292	1,340	85	89
Total dichlorobiphenyls	0.00536	0.0625	96	89	473	1,940	85	89
Total trichlorobiphenyls	1.1	2.87	85	89	410	1,420	85	89
Total pentachlorobiphenyls	0.0191	0.0484	85	85	260	821	85	85
Total hexachlorobiphenyls	0.000423	0.00565	85	85	279	871	85	85
Total heptachlorobiphenyls	0.00346	0.00107	81	89	137	420	85	89
Total Octachlorobiphenyls	0.000011	0.0000753	85	85	56.2	169	85	81
Σ Mono- and di-chlorobiphenyls	0.675	4.16	85	81	789	3,360	85	89
Σ Tetra- and penta-chlorobiphenyls	0.91	2.59	85	89	526	1,670	85	85
Σ Tri-, tetra-, and penta-chlorobiphenyls	0.0116	0.0478	85	85	945	3,120	85	85
Total PCBs (homologs)	4.31	14.1	85	81	1,870	7,110	85	89
<i>Hyaella azteca</i> , reproduction, young per female normalized to survival								
Total monochlorobiphenyls	0.435	1.14	88	88	242	562	88	88
Total dichlorobiphenyls	0.00287	0.0106	88	92	468	997	88	88
Total trichlorobiphenyls	0.0863	0.208	88	88	284	565	88	88
Total pentachlorobiphenyls	0.0068	0.0133	84	88	201	373	88	88
Total heptachlorobiphenyls	0.000131	0.000264	92	88	69	121	88	88
Σ Mono- and di-chlorobiphenyls	0.967	2.53	88	88	701	1,550	88	88
Σ Mono-, di-, and tri-chlorobiphenyls	0.231	0.727	88	84	876	1,880	88	88
Σ Tetra- and penta-chlorobiphenyls	0.142	0.354	88	84	421	792	88	88
Σ Tri-, tetra-, and penta-chlorobiphenyls	0.0389	0.085	88	84	728	1,400	88	88

Bold, italicized numbers indicate reliable TTs

TT_{LR} = Toxicity threshold, low risk

TT_{HR} = Toxicity threshold, high risk

µg/L = micrograms per liter

µg/kg = micrograms per kilogram

Reliable TTs and correct classification rates for porewater are from Tables C5-8 and C5-10 of Ingersoll et al. 2014

Reliable TTs and correct classification rates for sediment are from Tables C5-5 and C5-7 of Ingersoll et al. 2014

Reference:

Ingersoll, C. G., J. A. Steevens, et al. (2014). Evaluation of toxicity to the amphipod, *Hyaella azteca* , and to the midge, *Chironomus dilutus* ; and bioaccumuation by the oligochaete, *Lumbriculus variegatus* , with exposure to PCB-contaminated sediments from Anniston, Alabama. U.S. Geological Survey Scientific Investigations Report 2013-5125. <http://pubs.usgs.gov/sir/2013/5125/pdf/sir2013-5125.pdf>. 122.

Table AD-57. Weight of Evidence Evaluation Summary for PCBs
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

			UAA				MAA		LAA			
Assessment Endpoint	Conservatism / confidence	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	
Aquatic Plants/ Aquatic Life	<i>moderate/high</i> <i>moderate/low</i>	Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Terrestrial Plants	<i>moderate/high</i> <i>low</i>	Unacceptable (C1 West only)	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Benthic Invertebrates/Aquatic Invertebrates	<i>moderate</i> <i>Moderate/High</i>	Unacceptable	Unacceptable	Generally Acceptable, Local Areas Unacceptable	Generally Acceptable, Local Areas Unacceptable	Generally Acceptable, Local Areas Unacceptable	Acceptable	Unacceptable	Generally Acceptable, Local Areas Unacceptable	Acceptable	Generally Acceptable, Local Areas Unacceptable	
Terrestrial Invertebrates	<i>Moderate/high</i> <i>Low</i>	Unacceptable (C1 West only)	Indeterminate	Indeterminate	Indeterminate	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Indeterminate	
Fish/Aquatic Life	<i>moderate</i> <i>Moderate</i>	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	
Avian Piscivore	<i>moderate</i> <i>Moderate</i>	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	
Avian aquatic insectivore	<i>moderate</i> <i>Moderate</i>	High Unacceptable	High Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable	
Avian aerial insectivore	<i>moderate</i> <i>Moderate</i>	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Avian Herbivore	<i>moderate</i> <i>low/Moderate</i>	Unacceptable (C1 West only)	Acceptable	Indeterminate	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Avian terrestrial insectivore	<i>moderate</i> <i>Moderate</i>	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate		
Avian terrestrial omnivore	<i>moderate</i> <i>low/Moderate</i>	Unacceptable	Indeterminate	Indeterminate	Indeterminate	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable		
Avian terrestrial carnivore	<i>moderate</i> <i>Moderate</i>	High Unacceptable	Unacceptable	Unacceptable	Unacceptable	Indeterminate	Acceptable	Acceptable	Indeterminate	Acceptable		
Avian mixed diet omnivore	<i>moderate</i> <i>low/moderate</i>	High Unacceptable	Unacceptable	Unacceptable	Unacceptable	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate		
Mammalian Piscivore	<i>Low/Moderate /</i> <i>Moderate/High</i>	High Unacceptable	High Unacceptable	High Unacceptable	High Unacceptable	High Unacceptable	High Unacceptable	High Unacceptable	High Unacceptable	High Unacceptable	High Unacceptable	
Mammalian Aerial Insectivore	<i>Moderate /</i> <i>Moderate/High</i>	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	
Mammalian Herbivore	<i>Moderate/</i> <i>Moderate/High</i>	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable		
Mammalian Insectivore/ Invertivore	<i>Moderate /</i> <i>Moderate/High</i>	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate		
Mammalian Carnivore	<i>Moderate/</i> <i>Moderate/High</i>	Unacceptable (C1 West only)	Acceptable	Unacceptable (C3 South only)	Indeterminate	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable		
Mammalian mixed diet omnivore (raccoon)	<i>Moderate /</i> <i>Moderate/High</i>	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Indeterminate	
Mammalian mixed diet omnivore (Mink)	<i>Moderate /</i> <i>Moderate/High</i>	High Unacceptable	High Unacceptable	High Unacceptable	High Unacceptable	High Unacceptable	High Unacceptable	High Unacceptable	High Unacceptable	High Unacceptable	High Unacceptable	

**Table AD-62. Summary Statistics for COPCs in OU-4 Surface Water
Anniston PCB Site, Anniston, Alabama**

Reach or AA ¹	COPC	Total Sample Size (n)	Detects	NumNDs	% FOD	Minimum (mg/L)	Maximum (mg/L)	Mean (mg/L)	Median	SD	CV	UCL ^{1,2} (mg/L)	EPC ³ (mg/L)	EPC Basis
C1	Barium	4	4	0	100%	0.0241	0.201	0.086	0.059	0.083	0.97	--	0.20	Maximum
C1	Chromium	4	4	0	100%	0.002	0.0329	0.012	0.0065	0.015	1.2	--	0.033	Maximum
C1	Cobalt	4	2	2	50%	0.005	0.0122	0.0086	0.0086	0.0051	0.59	--	0.012	Maximum
C1	Lead	4	4	0	100%	0.0042	0.0964	0.034	0.017	0.043	1.3	--	0.096	Maximum
C1	Vanadium	4	4	0	100%	0.0041	0.0339	0.015	0.011	0.014	0.94	--	0.034	Maximum
C1	Mercury	4	2	2	50%	0.00015	0.00043	0.00029	0.00029	0.00020	0.68	--	0.00043	Maximum
C1	Total Homolog PCBs	3	3	0	100%	0.000175	0.000498	0.00036	0.00040	0.00017	0.46	--	0.00050	Maximum
UAA	Barium	4	4	0	100%	0.0251	0.0319	0.030	0.031	0.0030	0.10	--	0.032	Maximum
UAA	Chromium	4	4	0	100%	0.000575	0.0017	0.0011	0.0011	0.00046	0.42	--	0.0017	Maximum
UAA	Cobalt	4	0	4	0%	NA	NA	NA	NA	NA	NA	--	--	ND
UAA	Lead	4	4	0	100%	0.00048	0.00084	0.00063	0.00060	0.00016	0.26	--	0.00084	Maximum
UAA	Vanadium	4	4	0	100%	0.000495	0.0013	0.0010	0.0012	0.00036	0.35	--	0.0013	Maximum
UAA	Mercury	15	0	15	0%	NA	NA	NA	NA	NA	NA	--	--	ND
UAA	Total Homolog PCBs	15	11	4	73%	0.000016	0.000132	0.000068	0.000064	0.000036	0.53	0.000083	0.000083	UCL
MAA	Barium	2	2	0	100%	0.0248	0.0428	0.034	0.034	0.013	0.38	--	0.043	Maximum
MAA	Chromium	2	1	1	50%	0.004	0.004	0.0040	0.0040	NA	NA	--	0.0040	Maximum
MAA	Cobalt	2	1	1	50%	0.0022	0.0022	0.0022	0.0022	NA	NA	--	0.0022	Maximum
MAA	Lead	2	2	0	100%	0.00058	0.0048	0.0027	0.0027	0.0030	1.1	--	0.0048	Maximum
MAA	Vanadium	2	2	0	100%	0.00057	0.0031	0.0018	0.0018	0.0018	0.98	--	0.0031	Maximum
MAA	Mercury	12	0	12	0%	NA	NA	NA	NA	NA	NA	--	--	ND
MAA	Total Homolog PCBs	12	12	0	100%	0.0000476	0.000172	0.000087	0.000085	0.000032	0.37	0.00011	0.00011	UCL
LAA	Barium	1	1	0	100%	0.0244	0.0244	0.024	0.024	NA	NA	--	0.024	Maximum
LAA	Chromium	1	1	0	100%	0.00067	0.00067	0.00067	0.00067	NA	NA	--	0.00067	Maximum
LAA	Cobalt	1	0	1	0%	NA	NA	NA	NA	NA	NA	--	--	ND
LAA	Lead	1	1	0	100%	0.00034	0.00034	0.00034	0.00034	NA	NA	--	0.00034	Maximum
LAA	Vanadium	1	1	0	100%	0.00039	0.00039	0.00039	0.00039	NA	NA	--	0.00039	Maximum
LAA	Mercury	13	1	12	8%	0.000069	0.000069	0.000069	0.000069	NA	NA	--	0.000069	Maximum
LAA	Total Homolog PCBs	13	13	0	100%	0.000024	0.000309	0.000073	0.000054	0.000072	1.0	0.00016	0.00016	UCL
Sitewide	Barium	11	11	0	100%	0.0241	0.201	0.050	0.030	0.054	1.1	0.12	0.12	UCL
Sitewide	Chromium	11	10	1	91%	0.000575	0.0329	0.0057	0.0019	0.010	1.8	0.018	0.018	UCL
Sitewide	Cobalt	11	3	8	27%	0.0022	0.0122	0.0065	0.0050	0.0052	0.80	--	0.012	Maximum
Sitewide	Lead	11	11	0	100%	0.00034	0.0964	0.013	0.00084	0.029	2.2	0.067	0.067	UCL
Sitewide	Vanadium	11	11	0	100%	0.00039	0.0339	0.0061	0.0013	0.010	1.7	0.017	0.017	UCL
Sitewide	Mercury	44	3	41	7%	0.000069	0.00043	0.00022	0.00015	0.00019	0.88	--	0.00043	Maximum
Sitewide	Total Homolog PCBs	43	39	4	91%	0.000016	0.000498	0.00010	0.000069	0.00010	1.0	0.00016	0.00016	UCL

**Table AD-62. Summary Statistics for COPCs in OU-4 Surface Water
Anniston PCB Site, Anniston, Alabama**

Notes:

¹ Datasets with "NA" for UCL did not have enough samples for ProUCL to calculate a UCL.

² ProUCL 5.1 (USEPA 2016) was used to calculate summary statistics and UCL values.

³ EPC based on the UCL when available, otherwise based on the maximum detected concentration.

Datasets with "NA" for UCL did not have enough samples for ProUCL to calculate a UCL.

ProUCL 4.1 (USEPA 2011) was used to calculate summary statistics and UCL values.

EPC based on the UCL when available, otherwise based on the maximum detected concentration.

COPC: constituent of potential concern

CV: coefficient of variation

EPC: exposure point concentration

LAA: lower assessment area

MAA: middle assessment area

MAD: median absolute deviation

MAD/0.675: Robust estimate of variability (standard deviation)

Maximum: Maximum value

Mean: Sample average value

Median: Median value

mg/L: milligram per liter

Minimum: Minimum value

n: sample size

NA: not available

ND: nondetect

Num Obs: Number of Observations

NumNDs: Number of Nondetects

SD: Classical sample standard deviation

UAA: upper assessment area

UCL: 95% upper confidence limit

USEPA: United States Environmental Protection Agency

% FOD: Frequency of Detection

Reference:

USEPA. 2016. ProUCL 5.1.A Statistical Software for Environmental Applications for Data Sets with and without non detect observations. National Exposure Research Lab, EPA, Las Vegas Nevada, May 2016. <http://www.epa.gov/osp/hstl/tsc/softwaredocs.htm>

Table AD-63a Polychlorinated Biphenyl and Mercury Remedial Goal Options¹ for Benthic Invertebrates

	Basis	<i>C. dilutus</i>		<i>H. azteca</i>	
		Reproduction	Survival	Reproduction	Survival
		Remedial Goal Options ² for Benthic Invertebrates			
PCBs	EC0*	2.0	14	1.4	31
	EC10*	6.8	76	2.6	105
	EC20*	14	123	4.4	152
Mercury	EC0*	0.9	3.6	0.4	2.4
	EC10*	3.0	9.2	0.7	8.1
	EC20*	4.7	13	1.0	11

Notes:

¹All Values are mg/kg sediment dry weight.

²RGOs represent the value for the most sensitive endpoint within each category from site-specific toxicity testing.

EC0*, EC10*, EC20*: the regression-predicted PCB concentrations that would cause an additional 0%, 10%, or 20% effect beyond the lowest response measured in the reference sediments (i.e., 1×, 0.9×, and 0.8× the response at the “bottom” of the reference envelope).

mg/kg: milligram per kilogram

**Table AD-63b. Lowest Observable Effects Concentration Tissue-residue Based Remedial Goal
Options in Sediment for Benthic Invertebrates and Fish**

Anniston PCB Site, Anniston, Alabama

Original Baseline Ecological Risk Assessment with Critical Tissue Concentrations.

COPC	Units	Based on P/S LOECs						Based on P/S NOECs					
		Bottom Fish	Forage Fish	Predatory Fish	All Fish	Emergent Insects	Crayfish ^A	Bottom Fish	Forage Fish	Predatory Fish	All Fish	Emergent Insects ^A	Crayfish ^A
Total PCBs	mg/kg dw	1.1	2	0.6	2	NA	17 - 61	0.2	0.4	0.1	0.3	10 - 31	6 - 23
Dioxins, Furans & Dioxin-like PCBs	Fish TEQ, ng/kg dw	NA	NA	NA	79	NA	NA	NA	NA	NA	NA	NA	NA

Addendum to Baseline Ecological Risk Assessment with Critical Tissue Concentrations Recommended by the EPA.

COPC	Units	Based on EPA LOECs						Based on EPA NOECs					
		Bottom Fish	Forage Fish	Predatory Fish	All Fish	Benthic Invertebrates in General	Mollusks	Bottom Fish	Forage Fish	Predatory Fish	All Fish	Benthic Invertebrates in General	Mollusks
Total PCBs	mg/kg dw	0.8	1.5	0.4	1.2	6	0.7	0.2	0.4	0.1	0.3	3	0.3
Dioxins, Furans & Dioxin-like PCBs	Fish TEQ, ng/kg dw	NA	NA	NA	25	NA	NA	NA	NA	NA	NA	NA	NA

Preliminary Remedial Goals to Protect Fish Using Critical Tissue Concentrations Agreed to by EPA and Pharmacia LLC and Solutia Inc.

COPC	Units	EPA & P/S LOECs				EPA & P/S NOECs			
		Bottom Fish	Forage Fish	Predatory Fish	All Fish	Bottom Fish	Forage Fish	Predatory Fish	All Fish
Mercury	mg/kg dw	2.3	3.0	0.7	2.2	2.1	2.7	0.6	2.0
Vanadium	mg/kg dw	43	13	75	43	1.8	0.6	3.2	1.8

Notes:

A: The lower end of the reported range reflects dry weight assumption when the source of the critical tissue concentration did not report weight basis.

The higher the lipid content in the fish, the more dilution.

P/S: Pharmacia LLC and Solutia Inc.

COPC: constituent of potential concern

LOEC: lowest observed effect concentration

mg/kg dw: milligram per kilogram dry weight

ng/kg dw: nanograms per kilogram dry weight

**Table AD-63c. Concentrations of PCBs and Dioxin-Like Compounds in Sediments and Fish
Total Dioxin-Like Compound Equivalents for Fish**

Anniston PCB Site, Anniston, Alabama

Assessment Area	Reach	PCBs and Dioxin-Like Compound TEQs for Fish in Sediment, ng/g OC			PCBs and Dioxin-Like Compound TEQs for Fish in Fish Tissue, ng/g-lipid								
					Forage Fish			Bottom Fish			Predator Fish		
		Sediment Location ID	TOC, %	TEQ Fish in Sediment, ng/g OC	Sample ID	TEQ Fish in Tissue, ng/g-lipid	Lipids, %	Sample ID	TEQ Fish in Tissue, ng/g-lipid	Lipids, %	Sample ID	TEQ Fish in Tissue, ng/g-lipid	Lipids, %
Upper	C2	CU-006-03	0.11	0.012	C60579	0.040	3.2				C60515	0.08	2.4
		CU-008-03	1.2	2.60	C60511	0.024	2.9						
		CU-008-04	1.7	3.51	C60582	0.029	2.5						
		CU-010-01	0.79	0.050	C60581	0.024	6.5						
		CU-010-02	1.5	0.00072									
		CU-010-04	5.2	0.62									
		EUA-01-24	0.64	1.04									
	C3	EUA-02-43	1.0	0.62	C60586	0.062	1.8						
		EUA-02-43	0.15	3.48	C60588	0.055	1.7						
	C4	NA			C60589	0.059	2.0						
		NA			C60594	0.063	1.3						
Middle	C5	EMA-01-02	0.23	0.25	C60549	0.12	2.6	C60576	0.23	6.5			
		EMA-02-09	1.2	0.32	C60552	0.17	3.5						
		EMA-03-35	3.7	0.42									
Lower	C7	ELA-02-61	2.5	0.57	C60537	3.12	3.0	C60545	0.47	2.1	C60541	0.24	2.7
		ELA-02-66	0.40	0.49	C60538	0.38	2.8						
					C60595	0.31	2.9						

NA - Not available

Table AD-64. Summary of Aquatic Remedial Goal Options

Anniston PCB Site, Anniston, Alabama

COPC	Lower Trophic Levels	Based on CTCs	Based on Dietary TRVs							
			Birds							
	Benthic Invertebrates	Fish & Aquatic Life	Tree Swallow	Carolina Wren - 2	Spotted Sandpiper - 1	Spotted Sandpiper - 2	Kingfisher - 1	Kingfisher - 2	Great Blue Heron	Osprey
		Modeled HQ	Measured HQ	Measured HQ	Measured HQ	Measured HQ	Measured HQ	Measured HQ	Measured HQ	Measured HQ
NOAEL-Based Remedial Goal Options (mg/kg)										
tPCB□	See Table AD-63a	See Table AD-63b	0.32	0.59	5.7	1.2	0.22	0.28	0.14	0.32
tPCB (Alternative TRV) ²			0.03	0.06	0.5	0.1	0.02	0.03	0.01	0.03
tPCBs (mink/otter)	NA	NA	--	--	--	--	--	--	--	--
Barium	NA	NA	829	109	319	159	408	213	633	2161
Chromium	43	NA	20	33	88	44	35	41	66	201
Cobalt	NA	NA	1156	130	140	70	2414	1755	642	2450
Dioxin/Furans & Dioxin-like PCBs	NA	See Table AD-63b	1929	68	2997	1498	685	883	647	1551
Lead	36	NA	317	5.4	49	25	121	107	209	1,328
Mercury	0.18	NA	1.5	0.25	0.9	0.5	1.0	1.0	0.5	1.4
Vanadium	NA	NA	52	6.5	13	6.4	29	28	26	87
LOAEL-Based Remedial Goal Options (mg/kg)										
tPCB	See Table AD-63a	See Table AD-63b	0.96	1.8	17	3.7	0.7	0.8	0.4	1.0
tPCB (Alternative TRV)			0.09	0.2	1.6	0.3	0.06	0.08	0.04	0.09
tPCBs (mink/otter)	NA	NA	--	--	--	--	--	--	--	--
Barium	NA	NA	1661	219	639	320	817	427	1269	4333
Chromium	111	NA	21	34.9	93	46	37	43	70	212
Cobalt	NA	NA	1184	133	144	72	2475	1799	658	2511
Dioxin/Furans & Dioxin-like PCBs	NA	See Table AD-63b	NA	NA	NA	NA	NA	NA	NA	NA
Lead	128	NA	634	11	99	49	241	215	418	2,655
Mercury	1.1	NA	5	0.8	3	1.4	3	3	1.6	4
Vanadium	NA	NA	106	13.3	26	13	58	56	52	177

Table AD-64. Summary of Aquatic Remedial Goal Options

Anniston PCB Site, Anniston, Alabama

COPC	Based on Dietary TRVs					
	Mammals					
	Bat	Mink - 1	Mink - 2	Otter	Raccoon - 1	Raccoon - 2
	Measured HQ	Measured HQ	Measured HQ	Measured HQ	Measured HQ	Measured HQ
NOAEL-Based Remedial Goal Options (mg/kg)						
tPCB ¹	0.21	0.22	0.09	0.06	5	1.3
tPCB (Alternative TRV) ²	0.05	NA	NA	NA	1.2	0.3
tPCBs (mink/otter)	--	0.22	0.09	0.06	--	--
Barium	2795	3131	2776	7924	7549	3328
Chromium	25	165	113	282	2649	270
Cobalt	1508	3794	32878	6832	49911	1487
Dioxin/Furans & Dioxin-like PCBs	1431	5247	1456		75681	594
Lead	1,237	1661	1,234	4,561	9542	924
Mercury	7	17	13	8	104	14
Vanadium	854	2241	1,557	2,637	12890	998
LOAEL-Based Remedial Goal Options (mg/kg)						
tPCB	0.63	0.45	0.17	0.13	16	3.9
tPCB (Alternative TRV)	0.09	0.22	0.09	0.06	2.4	0.6
tPCBs (mink/otter)	--	0.45	0.17	0.13	--	--
Barium	6529	7314	6484	18510	17634	7775
Chromium	29	194	133	332	3113	317
Cobalt	2057	5175	44854	9320	68092	2028
Dioxin/Furans & Dioxin-like PCBs	13855	50793	14094	21071	732590	5752
Lead	2,343	3144	2,337	8,637	18069	1750
Mercury	14	34	25	17	208	27
Vanadium	1,706	4477	3,110	5,268	25748	1995

Notes:

The great blue heron has a small proportion of dietary exposure from soil, however, RGO calculated from sediment dietary dose only.

² Alternate LOAEL-based toxicity reference values (TRVs) for mink were selected from Restum *et al.* (1998) based on growth.

Alternative TRVs for birds were from Lillie *et al.* (1974).

Alternative TRVs for mammals other than mink & otter were from Restum *et al.* (1998) based on reproduction.

COPC: constituent of potential concern

LOAEL: lowest observed adverse effect level

mg/kg: milligram per kilogram

NOAEL: no observed adverse effect level

Table AD-65. Summary of Terrestrial Remedial Goal Options

Anniston PCB Site, Anniston, Alabama

Constituent	Terrestrial Plants	Terrestrial Invertebrates	Based on Dietary TRVs						
			Birds						
			Mourning Dove	Blue Jay	Carolina Wren -1	Carolina Wren - 2	Spotted Sandpiper - 1	Hawk	Hawk
	Literature Benchmark	Literature Benchmark	Measured HQ	Measured HQ	Measured HQ	Measured HQ	Measured HQ	Measured HQ	Modeled HQ
NOAEL-based Remedial Goal Options (mg/kg)									
tPCB	40	3.6	16	5.3	1.1	3.2	1.4	2.2	1.8
tPCB (Alternative TRV)	--	--	1.5	0.5	0.1	0.3	0.1	0.2	0.2
Chromium	0.4	0.4	77	55	20	53	28	140	105
Dioxin/Furans & Dioxin-like PCBs, ng/kg	--	5,000,000	7234	876	146	903	397	14,969	NA
Lead	120	1,700	81	20	3.8	12	5	101	143
Mercury	0.3	0.1	0.9	0.3	0.1	0.3	0.2	1.2	4.3
Vanadium	--	--	17	12	4.0	9.3	5.6	75	15
LOAEL-based Remedial Goal Options (mg/kg)									
tPCB (mid-range sensitivity)	--	36	48	16	3	10	4	7	5
tPCB (high sensitivity)	--	--	4.5	1.5	0.3	0.9	0.4	0.6	0.5
tPCB (mink)	--	--	--	--	--	--	--	--	NA
Chromium	--	--	81	58	21	56	29	148	477
Dioxin/Furans & Dioxin-like PCBs, ng/kg	--	--	NA	NA	NA	NA	NA	NA	--
Lead	--	--	162	40	8	24	11	202	3515
Mercury	--	0.23	2.7	1	0.2	1	1	4	11
Vanadium	--	--	34	24	8	19	11	153	102

Table AD-65. Summary of Terrestrial Remedial Goal Options

Anniston PCB Site, Anniston AL

Constituent	Based on Dietary TRVs										
	Mammals										
	Shrew - 1	Shrew - 2	Mink - 1	Raccoon - 1	Raccoon - 2	Weasel	Weasel	Fox - 1	Fox - 1	Fox - 2	Fox - 2
	Measured HQ	Measured HQ	Measured HQ	Measured HQ	Measured HQ	Modeled HQ	Measured HQ	Modeled HQ	Measured HQ	Modeled HQ	Measured HQ
NOAEL-based Remedial Goal Options (mg/kg)											
tPCB	0.8	0.8	2	10	49	3.0	4	5.9	6.7	7.0	6.7
tPCB (Alternative TRV)	0.2	0.2	NA	2	11	0.2	0.9	0.5	1.5	0.5	1.5
Chromium	33	33	507	266	2,163	118.2	162	202.0	261	200.2	277
Dioxin/Furans & Dioxin-like PCBs, ng/kg	11	12	24,745	298	105,658	NA	3,328	NA	558	NA	6,142
Lead	16	17	1,485	238	6,342	562.8	385	951.5	416	1026.1	680
Mercury	0.4	0.4	129	8	550	15.3	14	16.3	12	29.1	26
Vanadium	105	111	NA	778	NA	207.5	1,630	384.9	2,351	356.3	3,884
LOAEL-based Remedial Goal Options (mg/kg)											
tPCB (mid-range sensitivity)	2	2	5	29	144	20	12	27	20	45	20
tPCB (high sensitivity)	0.4	0.3	2.5	4	21	0.7	1.8	1.6	2.9	1.6	2.9
tPCB (mink)	--	--	5	--	--	--	--	--	--	--	--
Chromium	38	39	595	313	2,542	139	191	237	307	235	325
Dioxin/Furans & Dioxin-like PCBs, ng/kg			239,530	2,889	1,022,774	NA		NA		NA	
Lead	31	33	2,812	450	12,009	1,066	730	1,802	788	1,943	1,288
Mercury	0.8	0.8	257	15	1,099	31	28	33	24	58	52
Vanadium	209	222	NA	1,555	NA	415	3,256	769	4,697	712	7,758

Notes:

¹ Unacceptable risk not predicted for terrestrial plants and soil invertebrates; RGOs not calculated.

The hawk had a small proportion of dietary exposure from sediment, however, RGO calculated from soil dietary dose only.

COPC: constituent of potential concern

LOAEL: lowest observed adverse effect level

mg/kg: milligram per kilogram

NA: not available

NOAEL: no observed adverse effect level

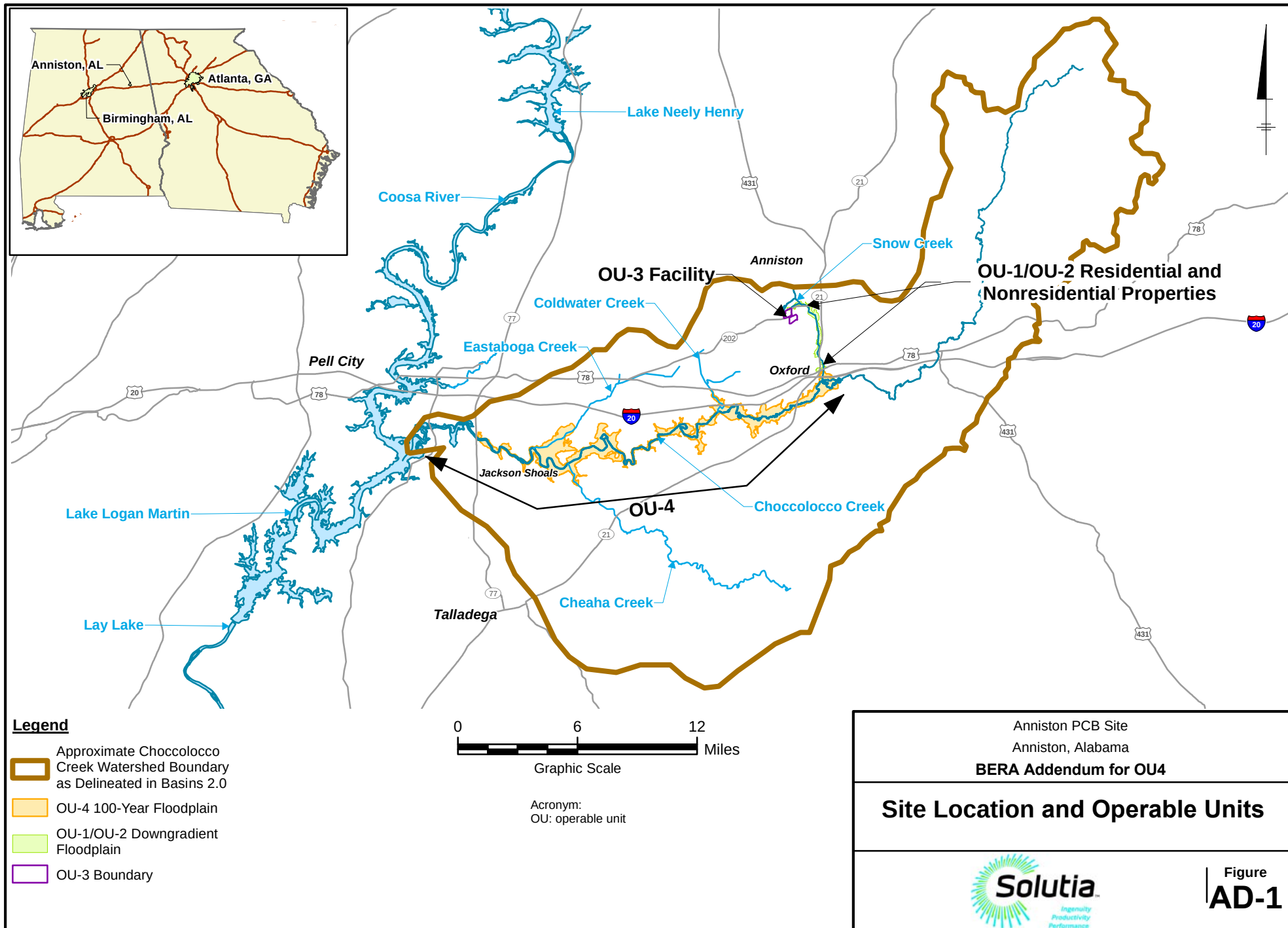
tPCB: total polychlorinated biphenyls

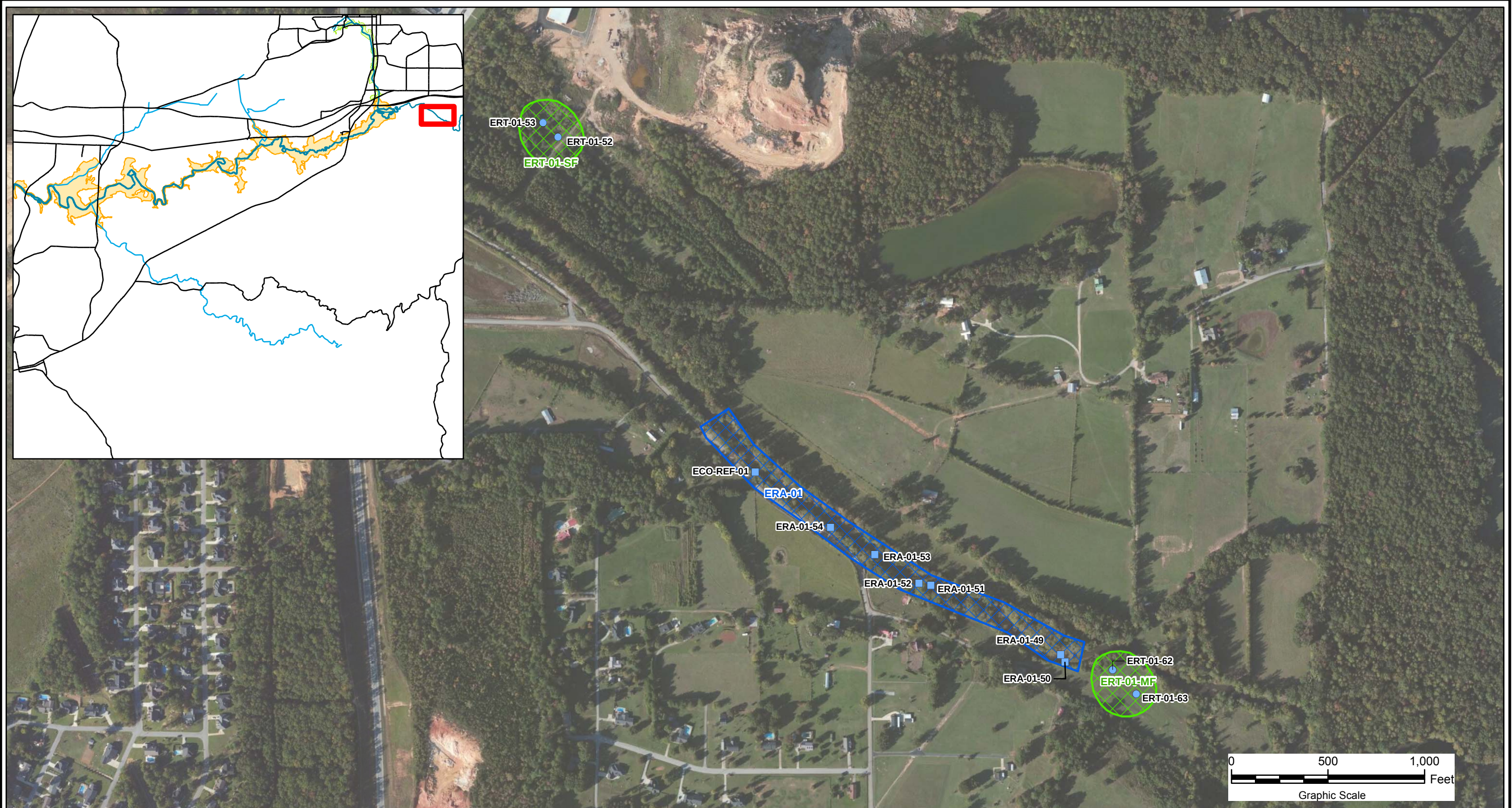
TRV: toxicity reference value

--: not applicable

FIGURES

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Figure AD-20a	Summary of <i>Hyaella azteca</i> Toxicity Threshold Exceedance, Reproduction Endpoint (embedded in document)
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Legend	
Surface ¹ Sediment Sample Location PCB Result (mg/kg)	Surface ² Soil Sample Location PCB Result (mg/kg)
■ < 1	● < 1
■ 1.00- 1.99	● 1.00- 1.99
■ 2.00 - 4.99	● 2.00 - 4.99
■ 5.00 - 9.99	● 5.00 - 9.99
■ ≥ 10	● ≥ 10
 Approximate Area of Aquatic BSA - OU-4 Phase 2 Ecological Sampling ³	 Approximate Area of Terrestrial BSA - OU-4 Phase 2 Ecological Sampling ³

- Notes:
1. Surface sediments were collected primarily from the 0- to 2-inch interval (63% of samples) and the 0- to 6-inch interval (26% of samples). A limited number of samples (11%) were collected from various intervals with a top depth of 0 inches and a bottom depth of not more than 6 inches.
 2. Surface soils were collected primarily from the 0- to 6-inch interval (93% of samples). A limited number of samples (7%) were collected from various intervals with a top depth of 0 inches and a bottom depth of not more than 24 inches.
 3. Paired biota and soil or sediment data collected in the BSA areas.
3. Imagery provided by NAIP imagery service licensed through ESRI product software.
- Acronyms:
BSA: biological sampling area
in: inches
MF: maintained field
mg/kg: milligrams per kilogram
SF: successional field

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**Biological Sample Areas and Locations
Reference Area 1
ERA-01 and ERT-01**



Figure
AD-2a



Legend	
Surface ¹ Sediment Sample Location PCB Result (mg/kg)	Surface ² Soil Sample Location PCB Result (mg/kg)
■ < 1	● < 1
■ 1.00- 1.99	● 1.00- 1.99
■ 2.00 - 4.99	● 2.00 - 4.99
■ 5.00 - 9.99	● 5.00 - 9.99
■ ≥ 10	● ≥ 10
 Approximate Area of Aquatic BSA - OU-4 Phase 2 Ecological Sampling ³	 Approximate Area of Terrestrial BSA - OU-4 Phase 2 Ecological Sampling ³

- Notes:
1. Surface sediments were collected primarily from the 0- to 2-inch interval (63% of samples) and the 0- to 6-inch interval (26% of samples). A limited number of samples (11%) were collected from various intervals with a top depth of 0 inches and a bottom depth of not more than 6 inches.
 2. Surface soils were collected primarily from the 0- to 6-inch interval (93% of samples). A limited number of samples (7%) were collected from various intervals with a top depth of 0 inches and a bottom depth of not more than 24 inches.
 3. Paired biota and soil or sediment data collected in the BSA areas.

3. Imagery provided by NAIP imagery service licensed through ESRI product software.

Acronyms:
BSA: biological sampling area
FF: forested floodplain
in: inches
MF: maintained field
mg/kg: milligrams per kilogram
OU: operable unit
SF: successional field

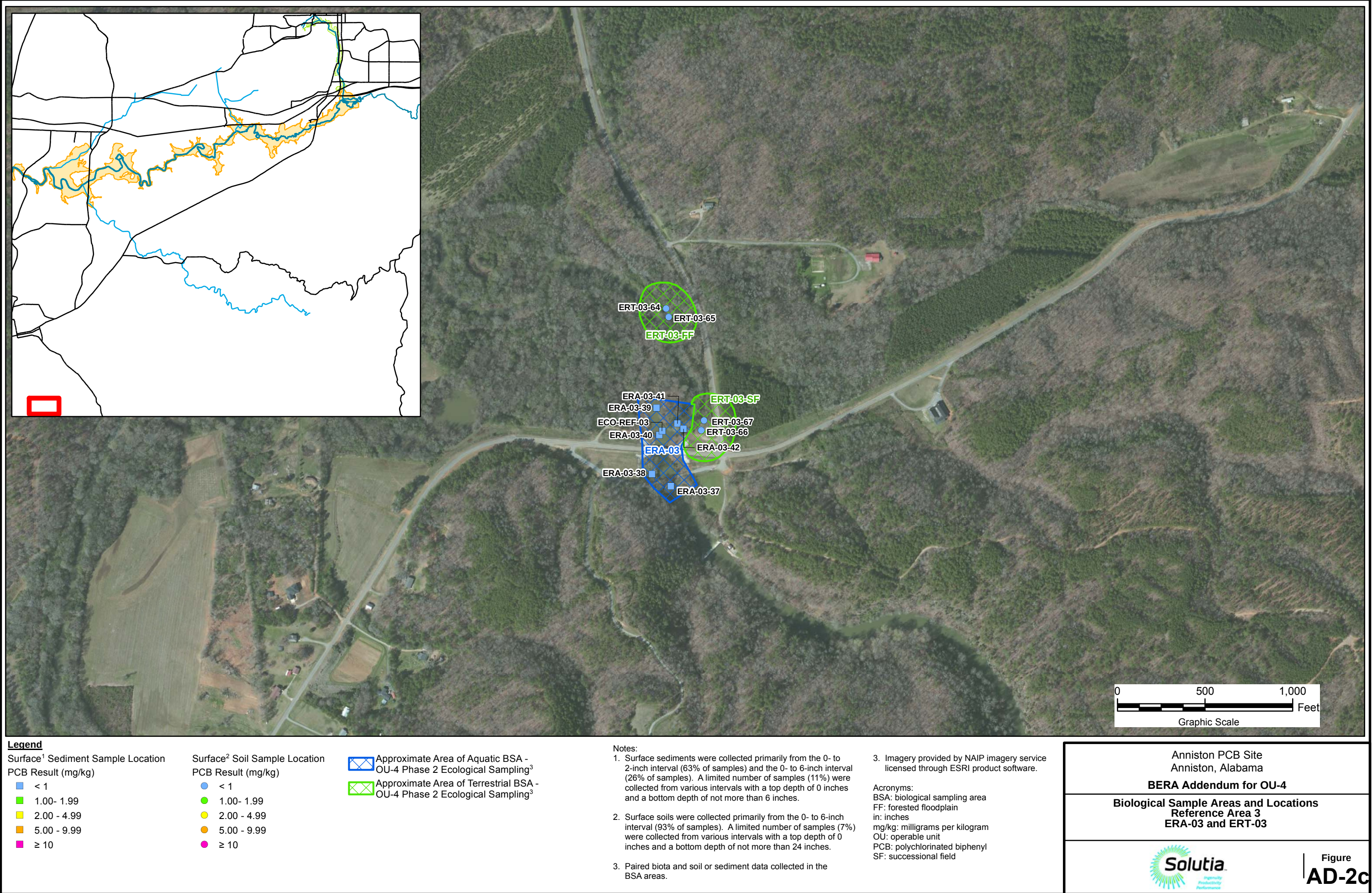
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Anniston, Alabama
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**Biological Sample Areas and Locations
Reference Area 2
ERA-02 and ERT-02**



Figure
AD-2b

City: SYR Div/Group: SWG Created By: K.lives Last Saved By: kives
Anniston
O:\Anniston_PCB_site\AnnistonAL\MXDs_Printfiles\Reports\OU4_BERA.mxd\EcoFigure_ReferenceAreas_Map3_v2.mxd 3/6/2015 9:47:15 AM



Legend

Surface ¹ Sediment Sample Location PCB Result (mg/kg)	Surface ² Soil Sample Location PCB Result (mg/kg)	Approximate Area of Aquatic BSA - OU-4 Phase 2 Ecological Sampling ³
■ < 1	● < 1	▨ Approximate Area of Aquatic BSA - OU-4 Phase 2 Ecological Sampling ³
■ 1.00 - 1.99	● 1.00 - 1.99	▨ Approximate Area of Terrestrial BSA - OU-4 Phase 2 Ecological Sampling ³
■ 2.00 - 4.99	● 2.00 - 4.99	
■ 5.00 - 9.99	● 5.00 - 9.99	
■ ≥ 10	● ≥ 10	

- Notes:
1. Surface sediments were collected primarily from the 0- to 2-inch interval (63% of samples) and the 0- to 6-inch interval (26% of samples). A limited number of samples (11%) were collected from various intervals with a top depth of 0 inches and a bottom depth of not more than 6 inches.
 2. Surface soils were collected primarily from the 0- to 6-inch interval (93% of samples). A limited number of samples (7%) were collected from various intervals with a top depth of 0 inches and a bottom depth of not more than 24 inches.
 3. Paired biota and soil or sediment data collected in the BSA areas.

3. Imagery provided by NAIP imagery service licensed through ESRI product software.

Acronyms:
BSA: biological sampling area
FF: forested floodplain
in: inches
mg/kg: milligrams per kilogram
OU: operable unit
PCB: polychlorinated biphenyl
SF: successional field

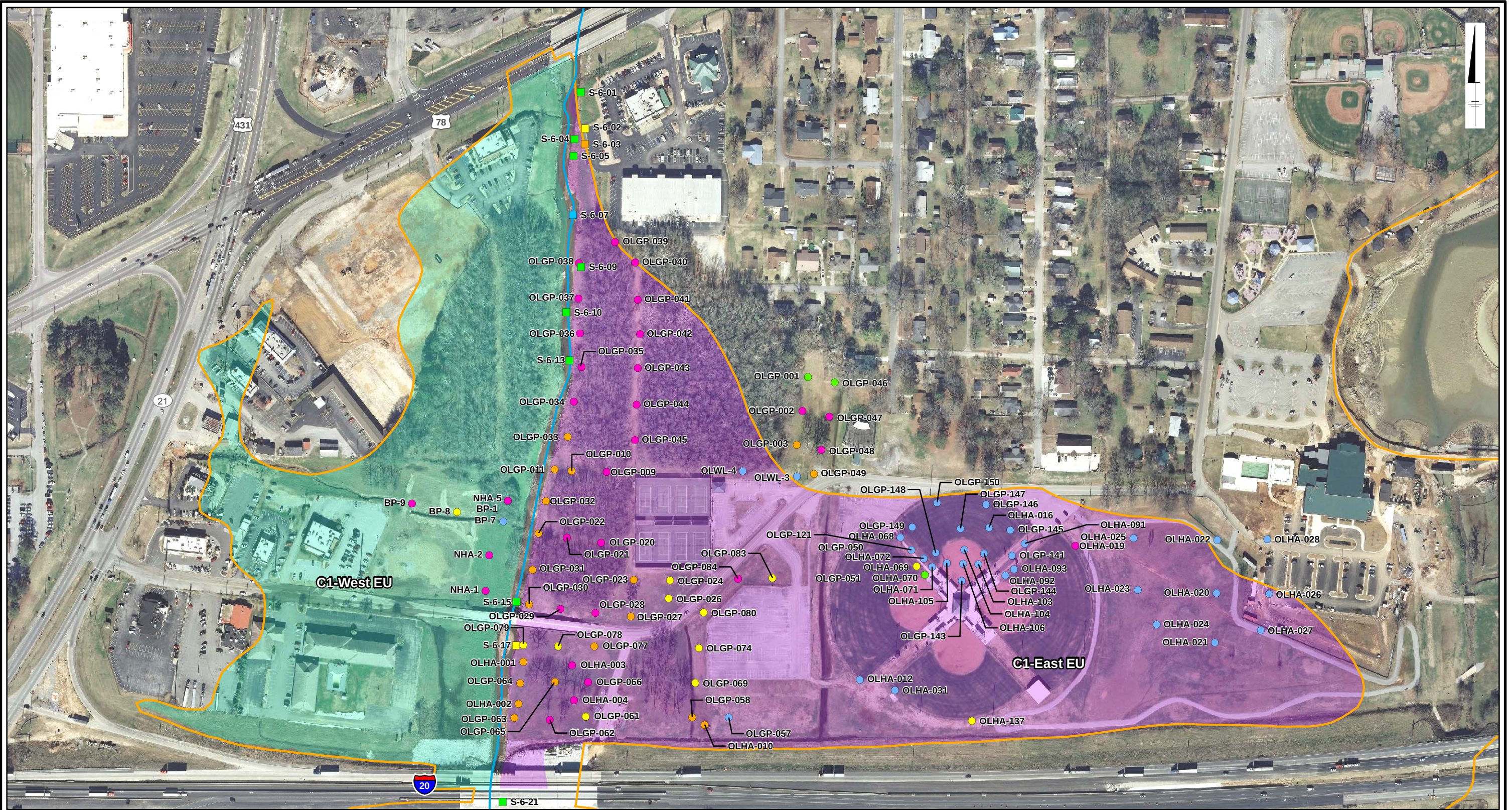
Anniston PCB Site
Anniston, Alabama

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**Biological Sample Areas and Locations
Reference Area 3
ERA-03 and ERT-03**



Figure
AD-2c



Legend

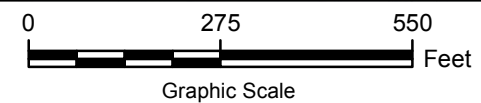
Surface¹ Sediment Sample Location
Total PCB Concentration (mg/kg)

- < 1
- 1.00 - 4.99
- 5.00 - 9.99
- 10.00 - 49.99

Surface² Soil Sample Location
Total PCB Concentration (mg/kg)

- < 1
- 1.00 - 1.99
- 2.00 - 4.99
- 5.00 - 9.99
- ≥ 10

- Snow Creek Centerline
- C1-East EU
- C1-West EU
- OU-4 100-Year Floodplain



Notes:

- Surface sediments were collected primarily from the 0- to 2-inch interval (63% of samples) and the 0- to 6-inch interval (26% of samples). A limited number of samples (11%) were collected from various intervals with a top depth of 0 inches and a bottom depth of not more than 6 inches.
- Surface soils were collected primarily from the 0- to 6-inch interval (93% of samples). A limited number of samples (7%) were collected from various intervals with a top depth of 0 inches and a bottom depth of not more than 24 inches.

- Aerial imagery provided by Calhoun and Talladega Counties.

Acronyms:
EU: exposure unit
mg/kg: milligrams per kilogram
OU: operable unit
PCB: polychlorinated biphenyl

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PCB Soil and Sediment Results for C1-East EU and C1-West EU



Figure
AD-3

Figure AD-4a. Benthic Macroinvertebrate Community Survey Indices, Riffles
2006 Data

Reference Locations and OU-4 Assessment Areas

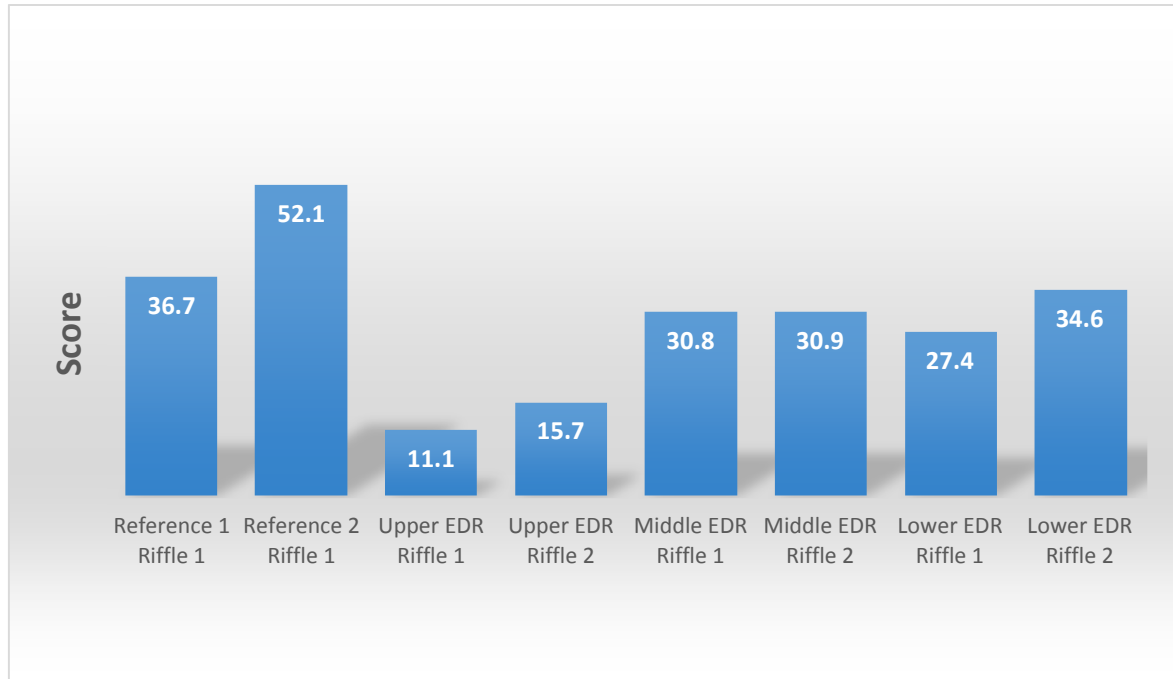
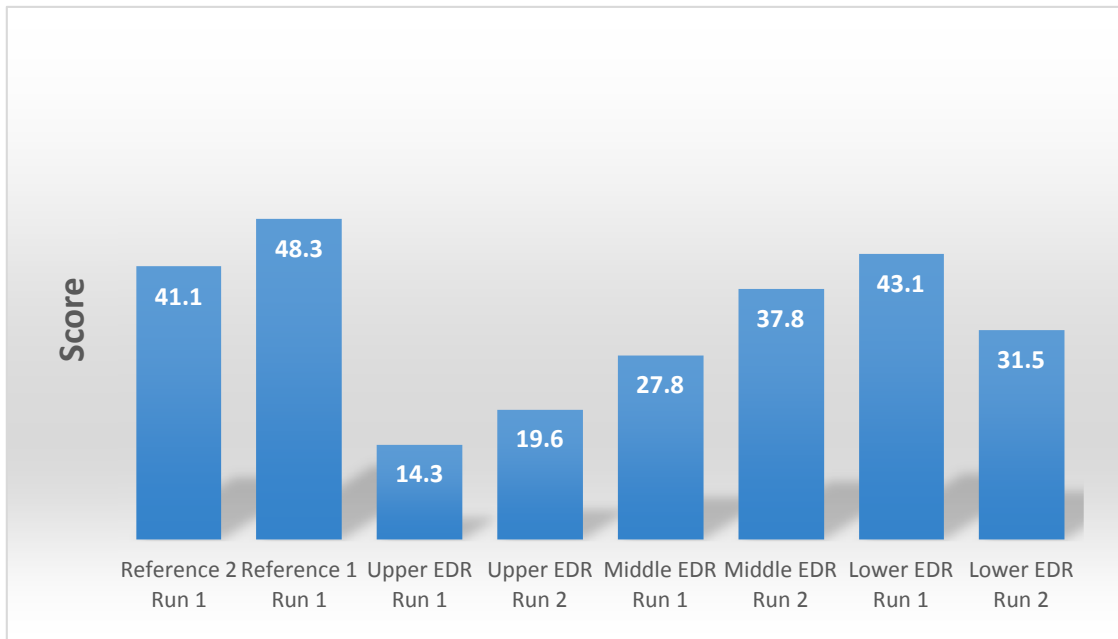
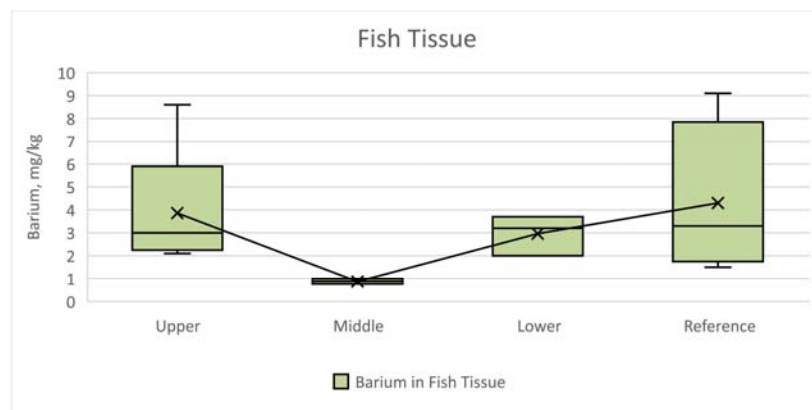
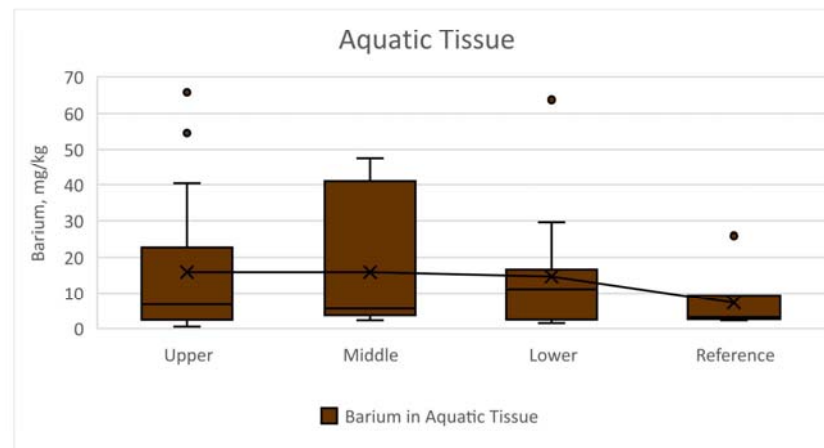
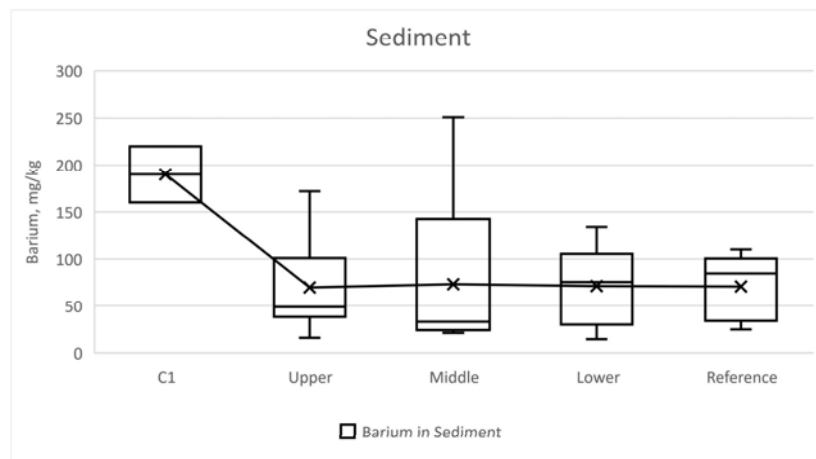


**Figure AD-4b. Benthic Macroinvertebrate Community Survey Indices, Runs
2007 Data
Reference Locations and OU-4 Assessment Areas**





Notes:

Tissue data are in wet weight.

Non-detected concentrations are excluded.

Upper, middle, and lower refer to assessment area.

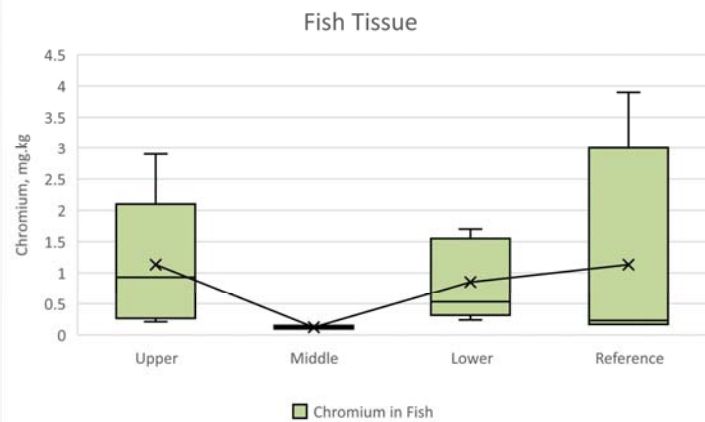
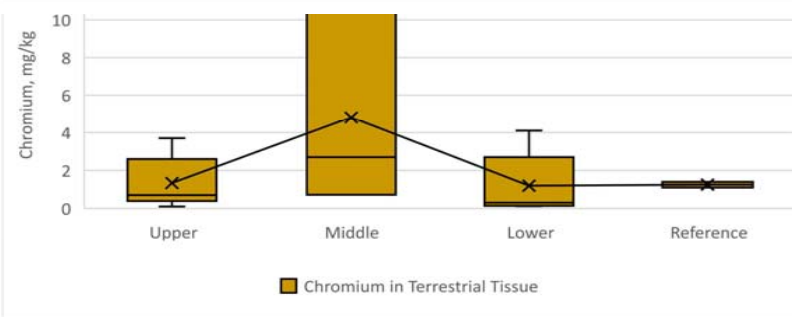
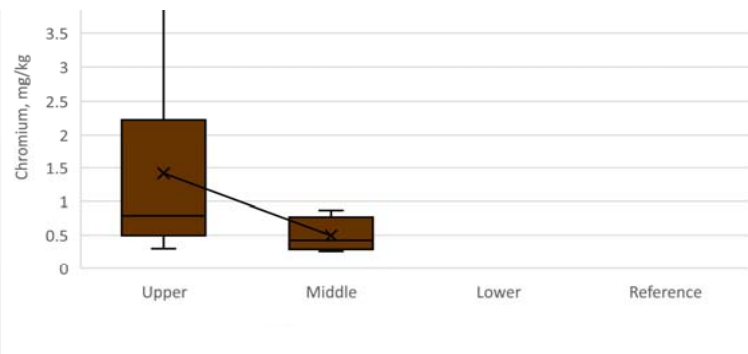
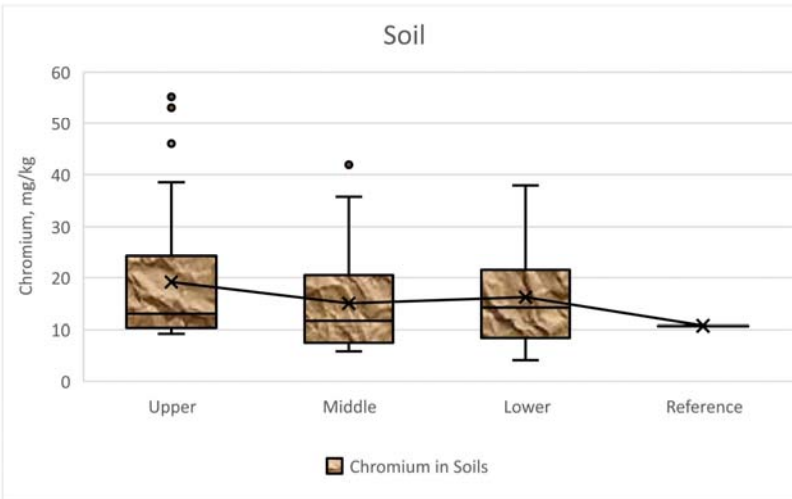
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**Mean Barium Concentrations for Tissue Data
by Ecological Area**



FIGURE

AD-5



Notes:

Tissue data are in wet weight.

Non-detected concentrations are excluded.

Upper, middle, and lower refer to assessment area.

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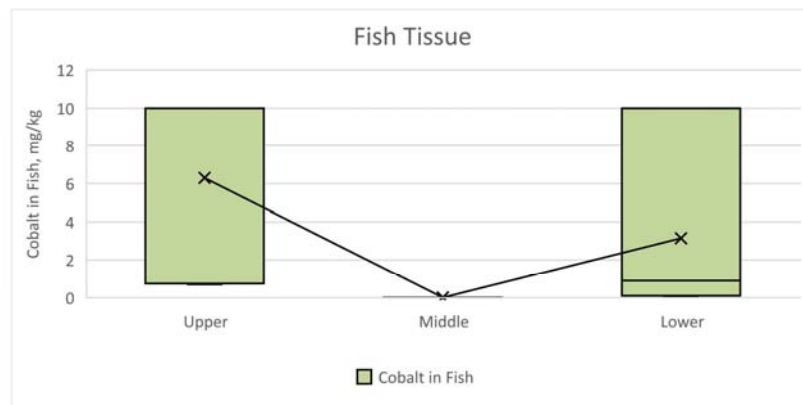
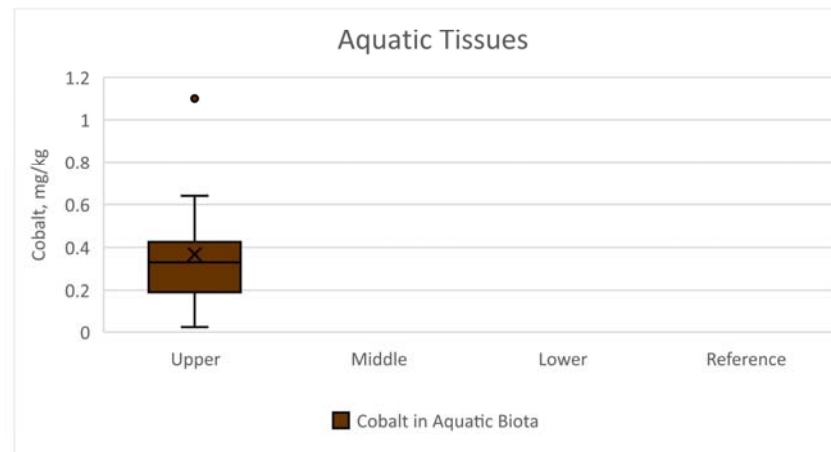
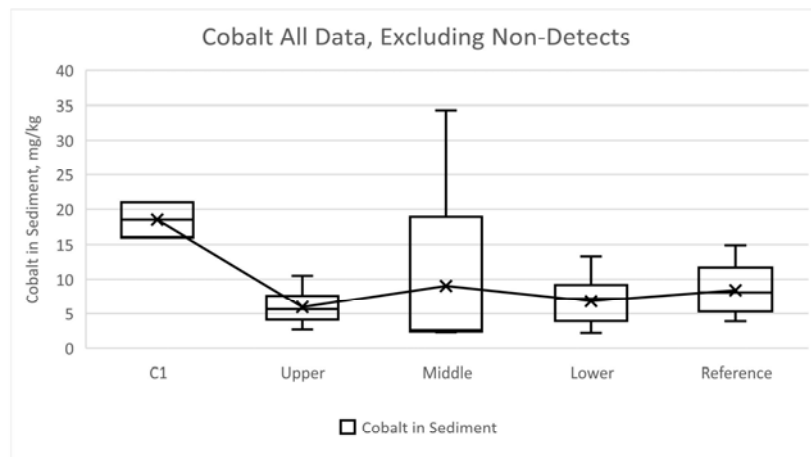
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**Mean Chromium Concentrations for Tissue
Data by Ecological Area**



FIGURE

AD-6



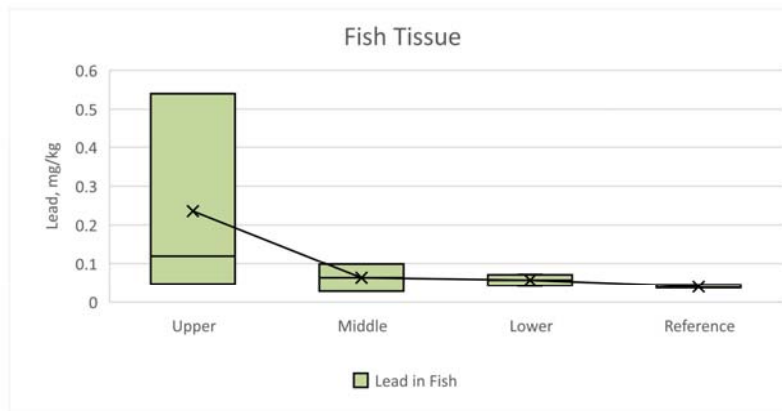
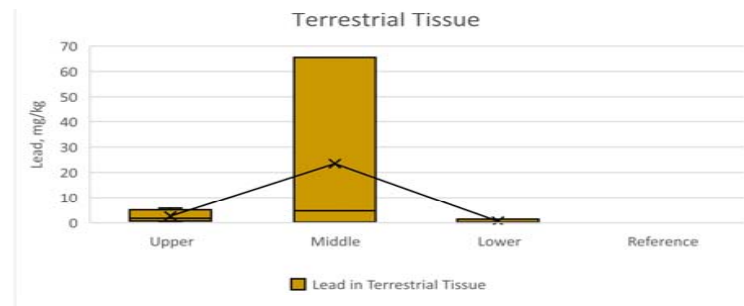
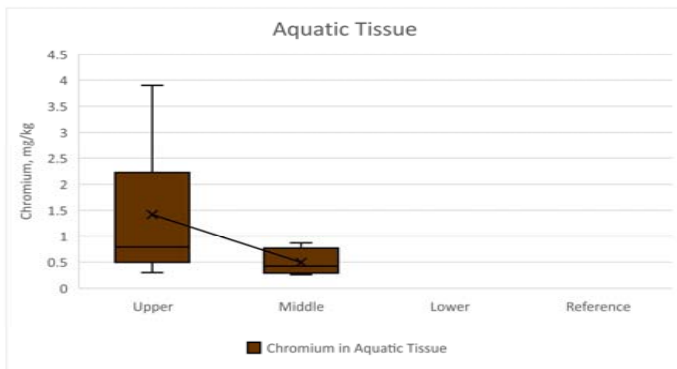
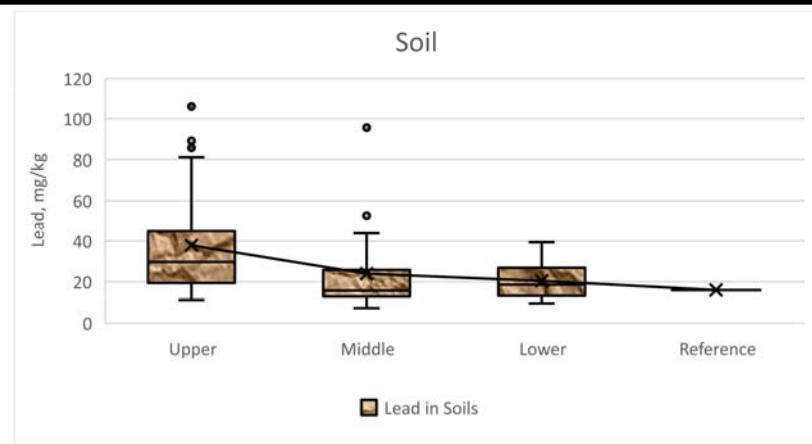
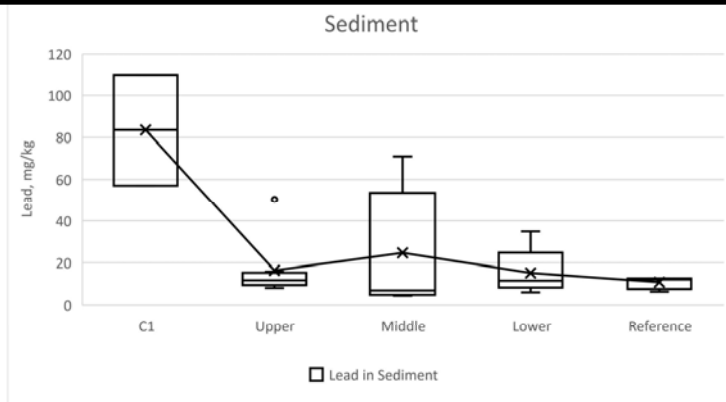
Notes:

Tissue data are in wet weight.

Non-detected concentrations are excluded.

Upper, middle, and lower refer to assessment area.

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Mean Cobalt Concentrations for Tissue Data by Ecological Area	
	FIGURE AD-7



Notes:

Tissue data are in wet weight.

Non-detected concentrations are excluded.

Upper, middle, and lower refer to assessment area.

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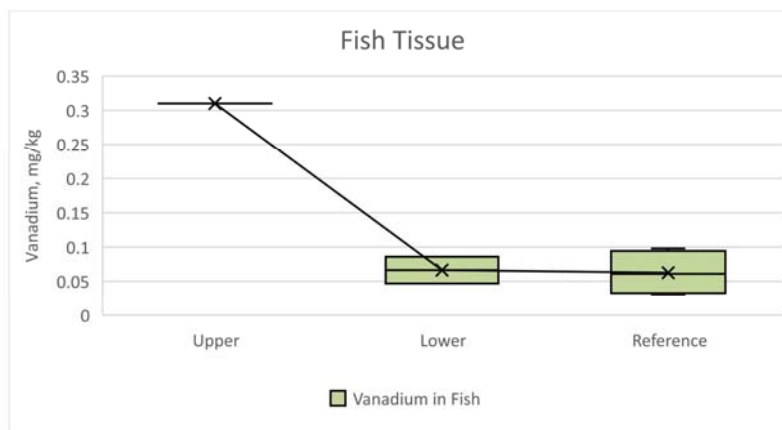
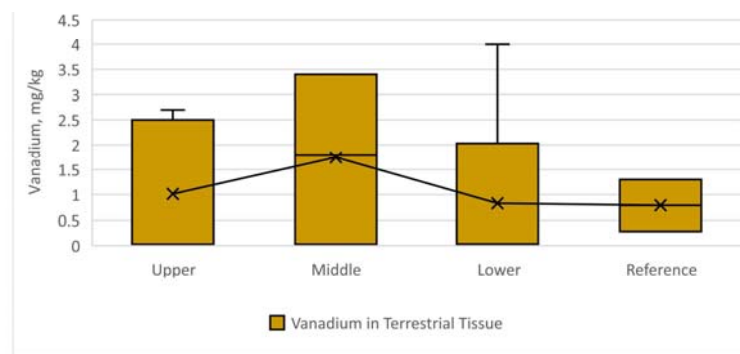
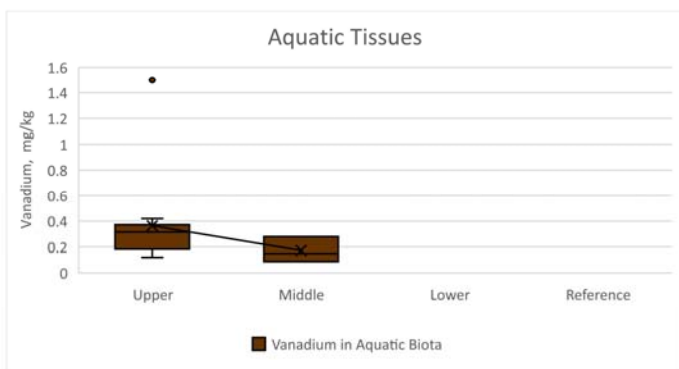
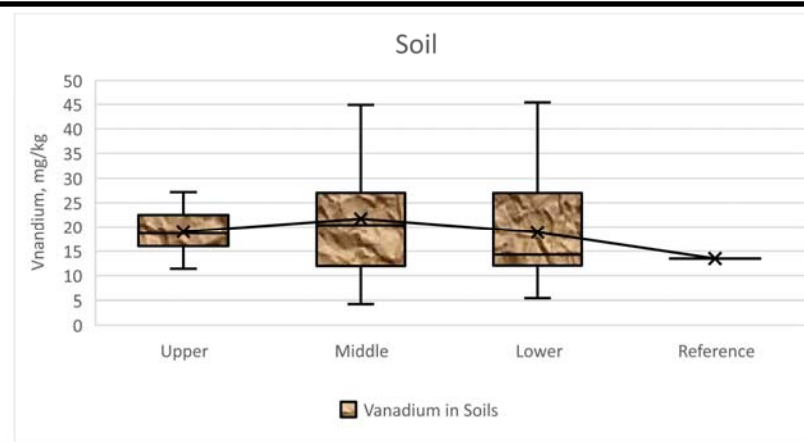
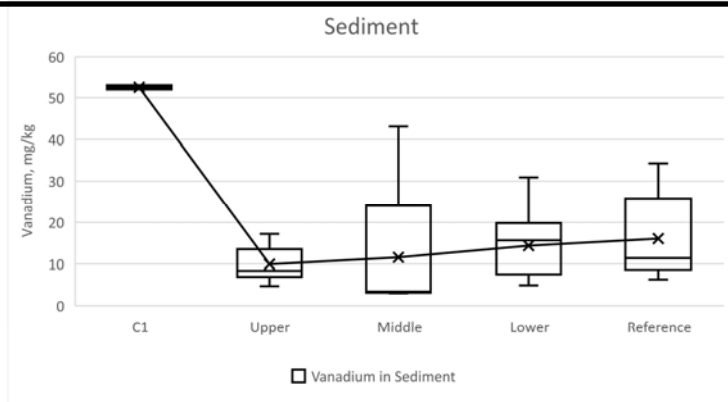
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**Mean Lead Concentrations for Tissue Data
by Ecological Area**



FIGURE

AD-8



Notes:

Tissue data are in wet weight.

Non-detected concentrations are excluded.

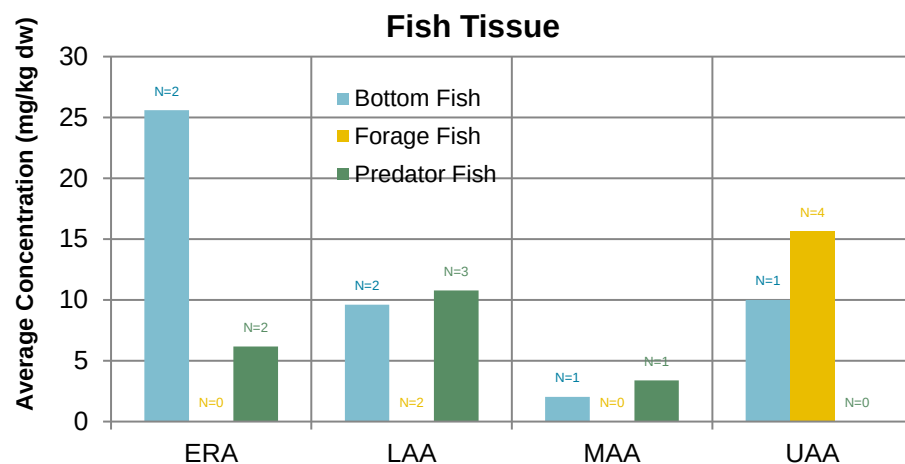
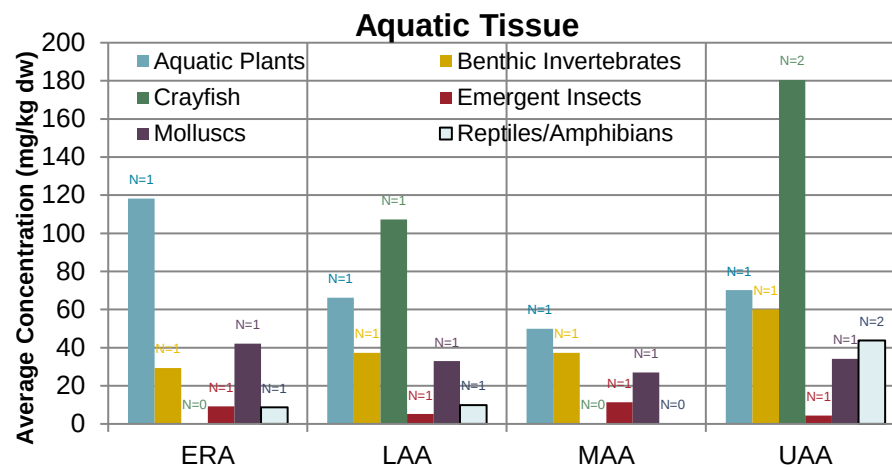
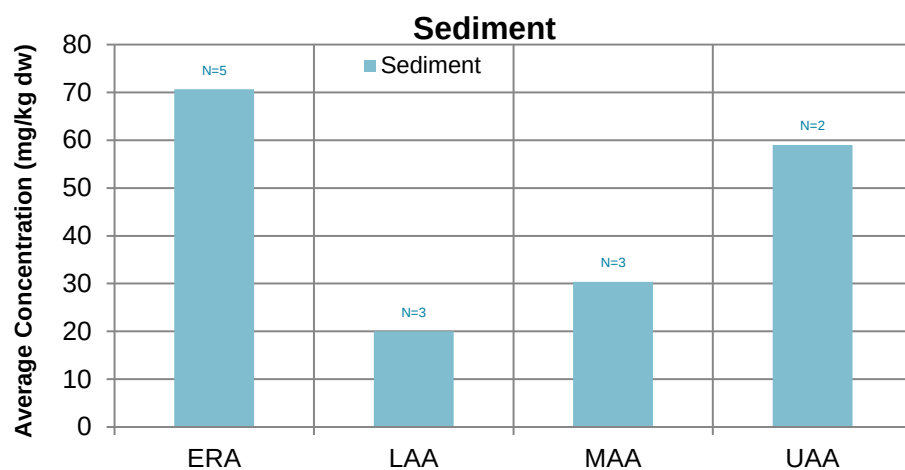
Upper, middle, and lower refer to assessment area.

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**Mean Vanadium Concentrations for Tissue
Data by Ecological Area**



FIGURE
AD-9



Notes:

1. Averages are Kaplan-Meier estimates of the mean.
2. If results are all non-detect in a given media/tissue for a given location, concentration is plotted as zero.

COPC: constituent of potential concern

dw: dry weight

ERA: ecological reference area

LAA: lower assessment area

MAA: middle assessment area

mg/kg: milligrams per kilogram

N: sample number

UAA: upper assessment area

Anniston PCB Site

Anniston, Alabama

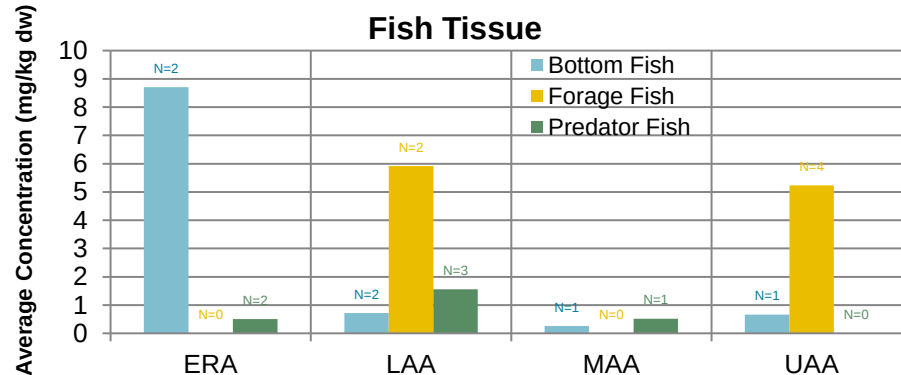
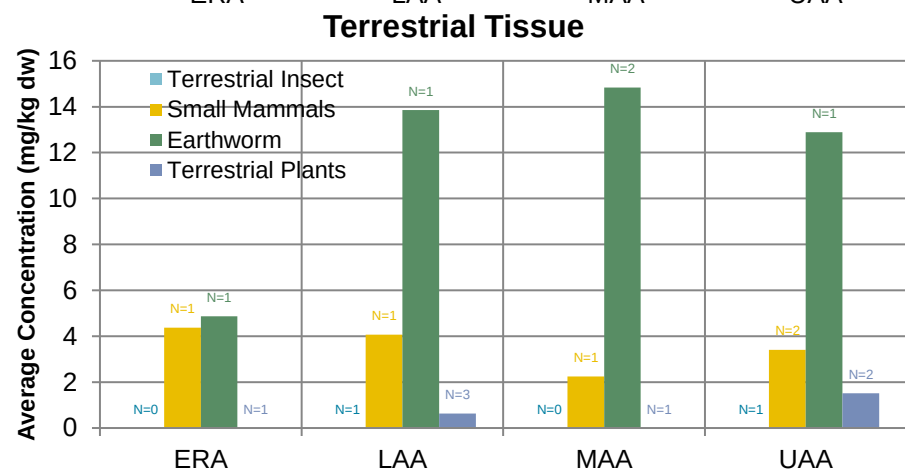
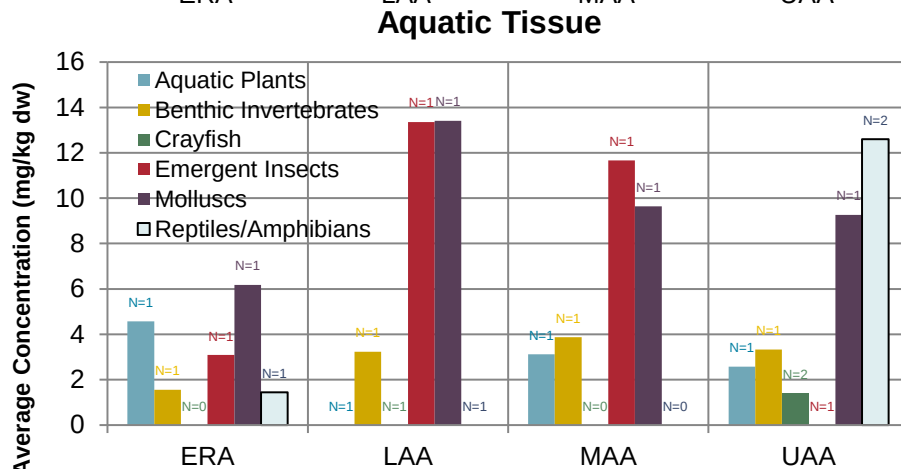
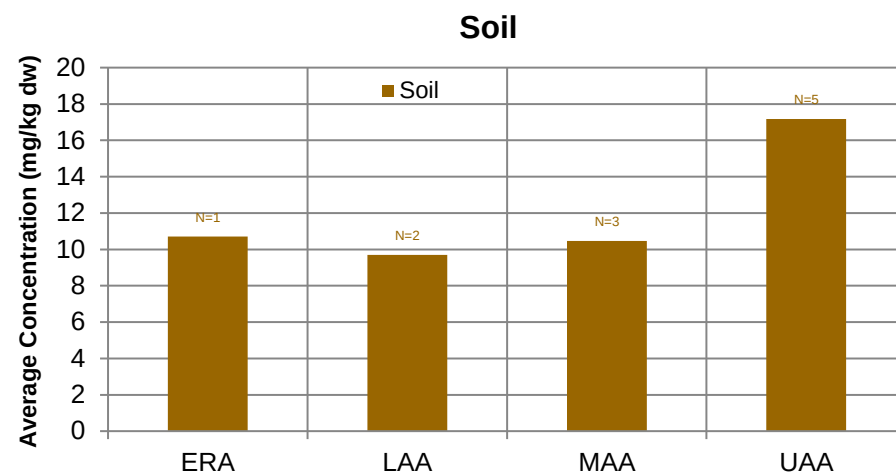
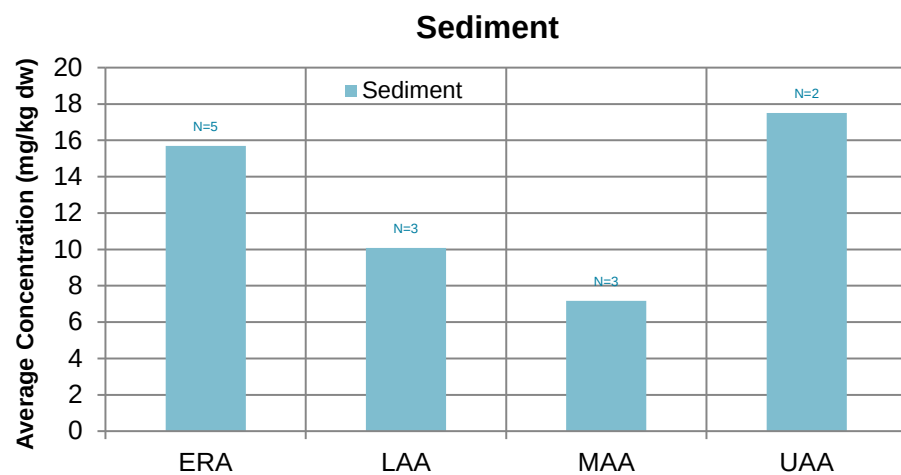
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BERA Figure 6-15, Mean Barium Concentrations for Tissue Data by Ecological Area



FIGURE

AD-10



Notes:

1. Averages are Kaplan-Meier estimates of the mean.
 2. If results are all non-detect in a given media/tissue for a given location, concentration is plotted as zero.
- COPC: constituent of potential concern
 dw: dry weight
 ERA: ecological reference area
 LAA: lower assessment area
 MAA: middle assessment area
 mg/kg: milligrams per kilogram
 N: sample number
 UAA: upper assessment area

Anniston PCB Site
 Anniston, Alabama

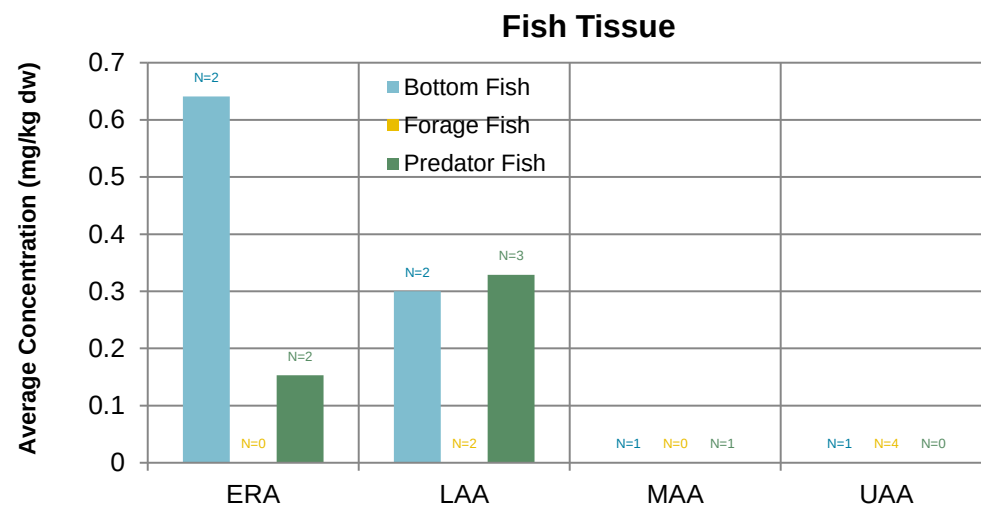
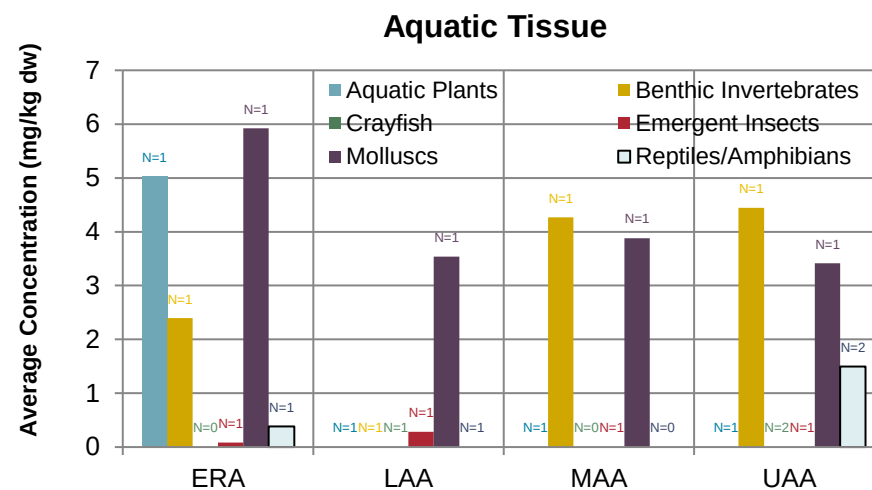
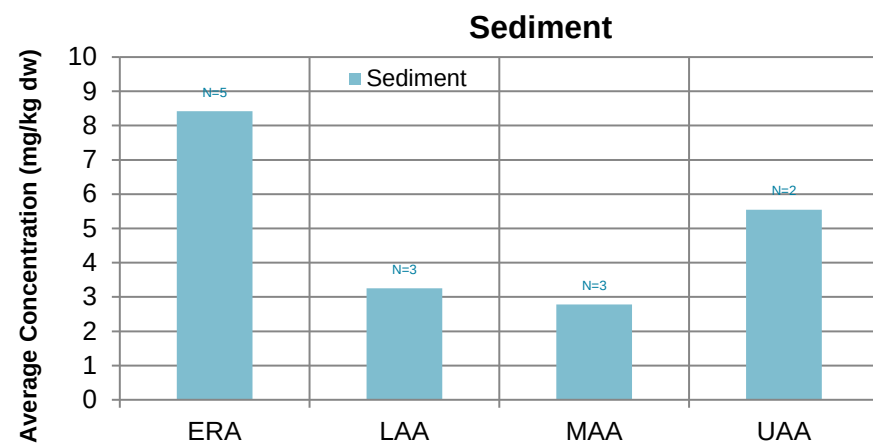
BERA Addendum for OU4

BERA Figure 6-16, Mean Chromium Concentrations for Tissue Data by Ecological Area



FIGURE

AD-11



Notes:

- Averages are Kaplan-Meier estimates of the mean.
 - If results are all non-detect in a given media/tissue for a given location, concentration is plotted as zero.
- COPC: constituent of potential concern
 dw: dry weight
 ERA: ecological reference area
 LAA: lower assessment area
 MAA: middle assessment area
 mg/kg: milligrams per kilogram
 N: sample number
 UAA: upper assessment area

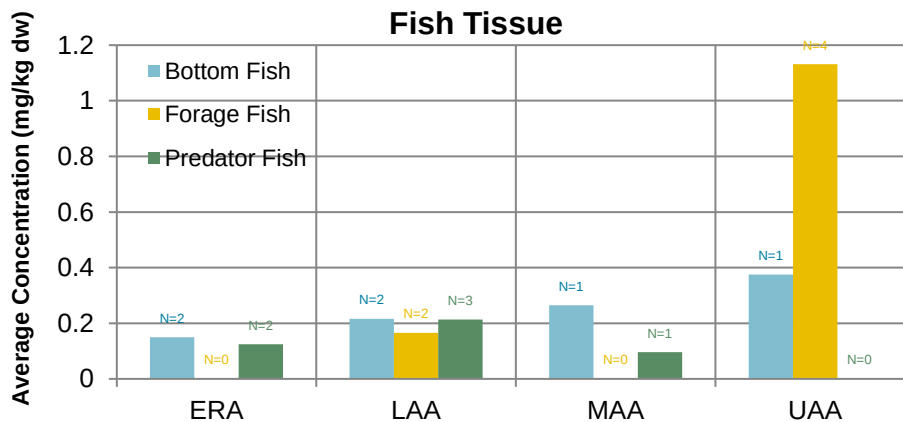
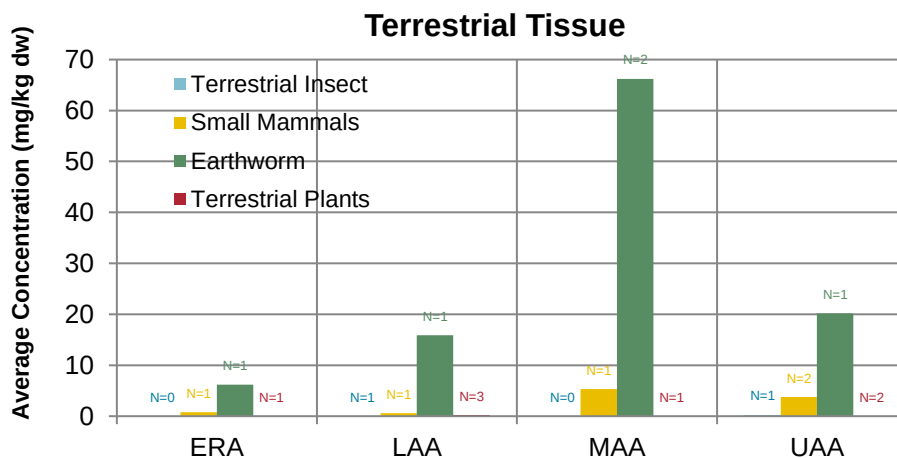
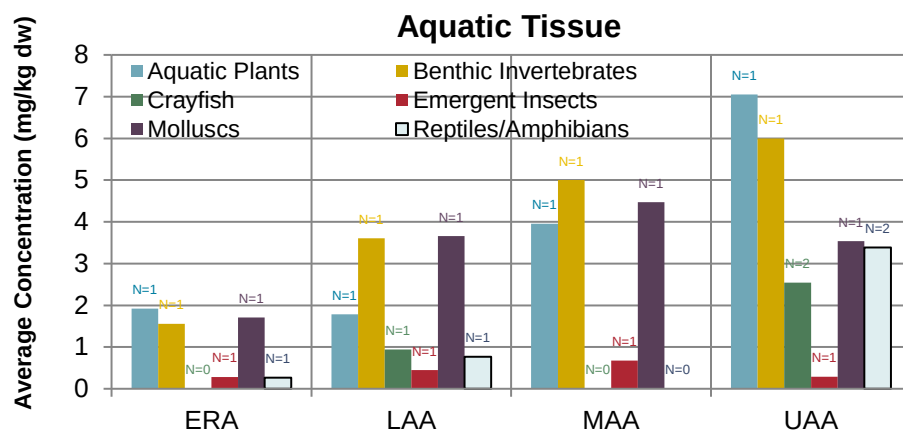
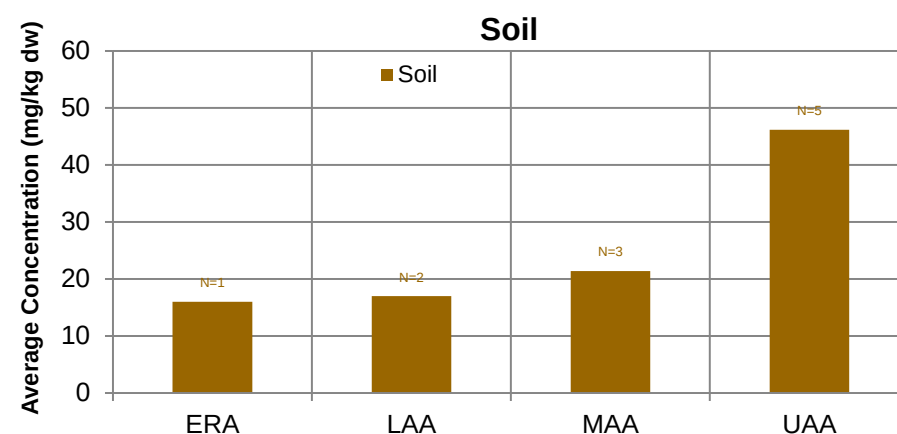
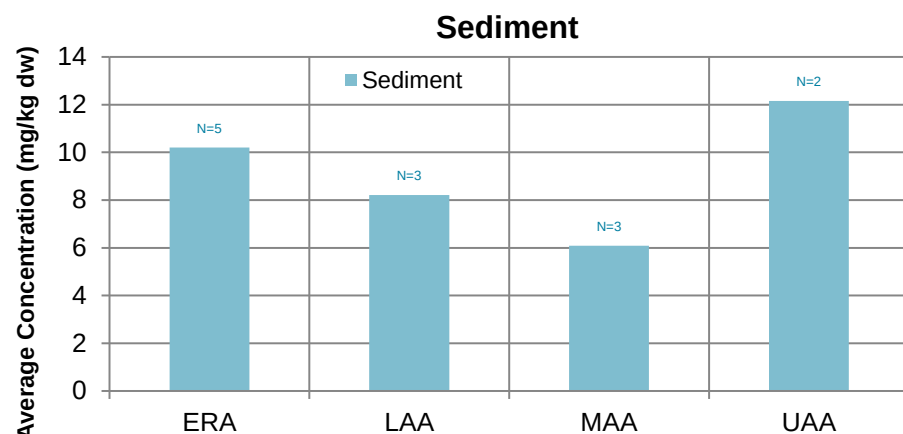
Anniston PCB Site
 Anniston, Alabama

BERA Addendum for OU4

BERA Figure 6-17, Mean Cobalt Concentrations for Tissue Data by Ecological Area



FIGURE
AD-12



Notes:

- Averages are Kaplan-Meier estimates of the mean.
 - If results are all non-detect in a given media/tissue for a given location, concentration is plotted as zero.
- COPC: constituent of potential concern
 dw: dry weight
 ERA: ecological reference area
 LAA: lower assessment area
 MAA: middle assessment area
 mg/kg: milligrams per kilogram
 N: sample number
 UAA: upper assessment area

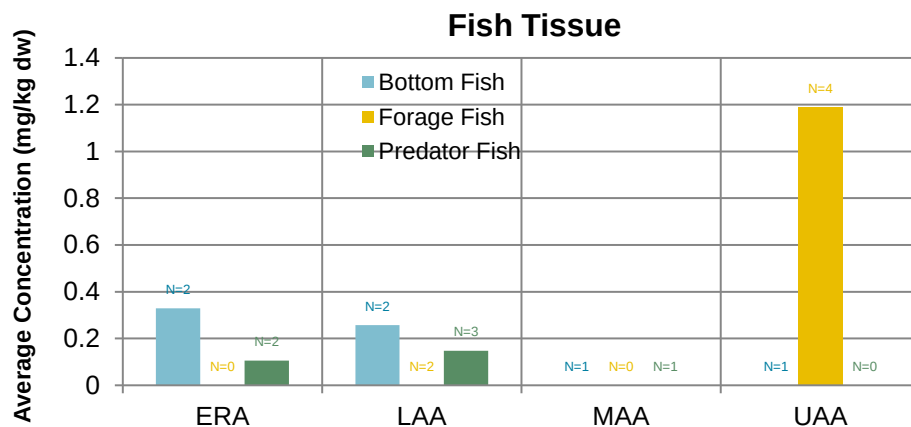
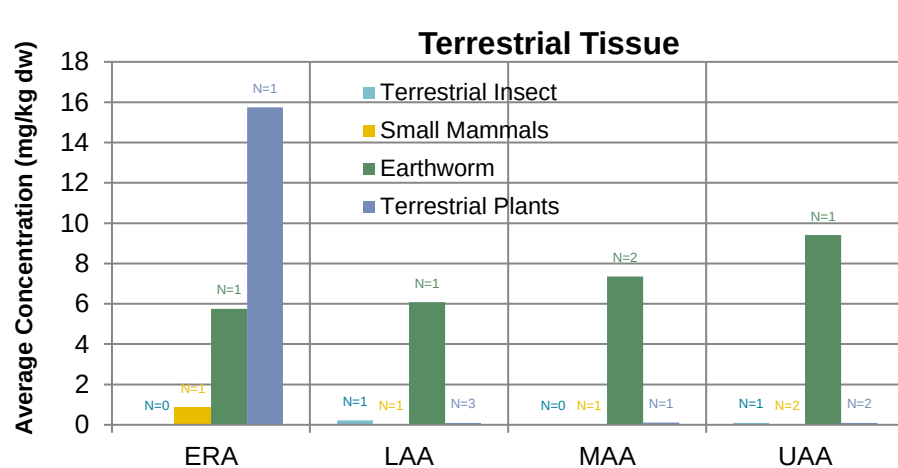
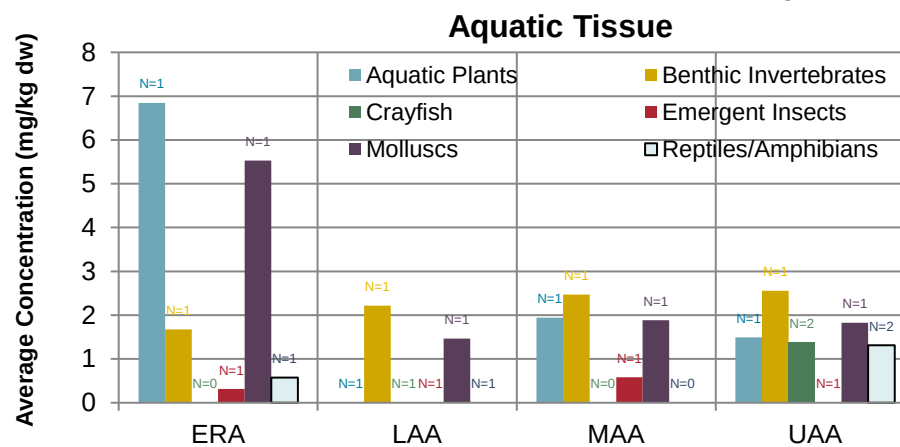
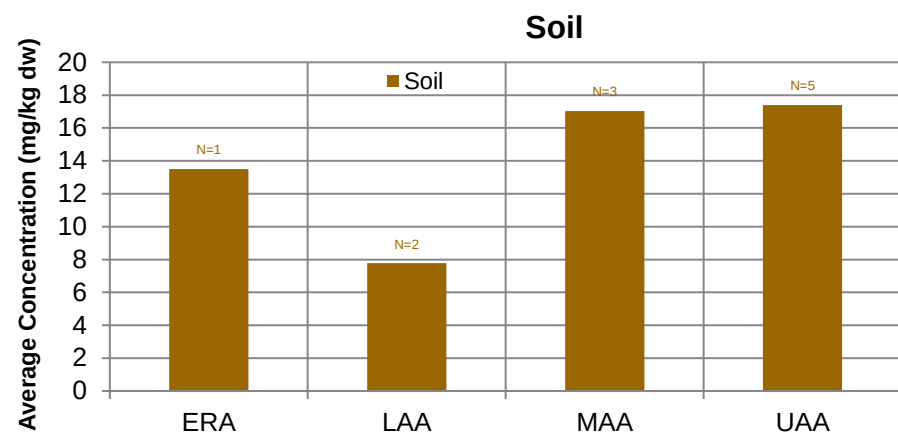
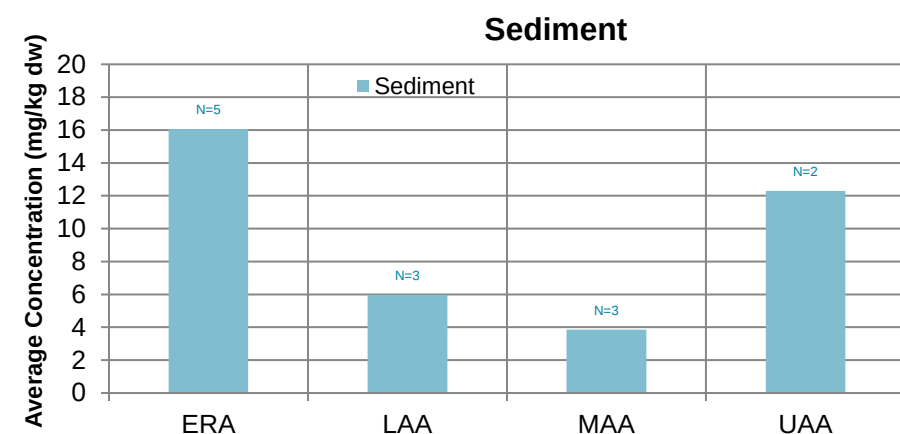
Anniston PCB Site
 Anniston, Alabama

BERA Addendum for OU4

BERA Figure 6-18, Mean Lead Concentrations for Tissue Data by Ecological Area



FIGURE
AD-13



Notes:

1. Averages are Kaplan-Meier estimates of the mean.
 2. If results are all non-detect in a given media/tissue for a given location, concentration is plotted as zero.
- COPC: constituent of potential concern
 dw: dry weight
 ERA: ecological reference area
 LAA: lower assessment area
 MAA: middle assessment area
 mg/kg: milligrams per kilogram
 N: sample number
 UAA: upper assessment area

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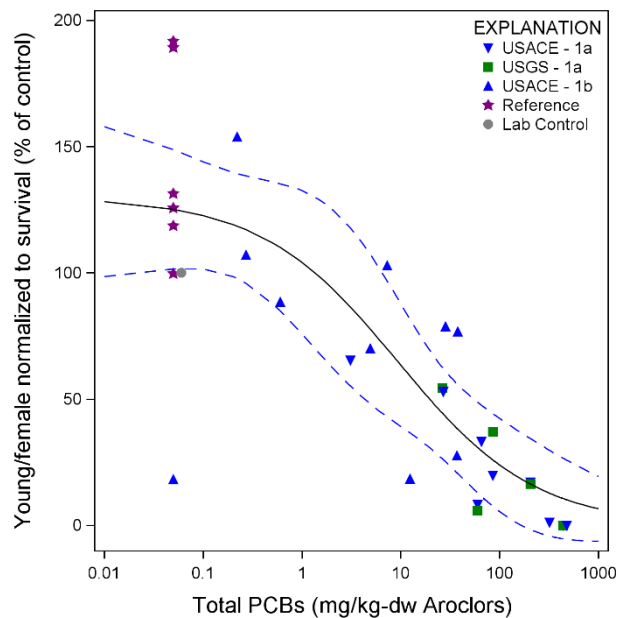
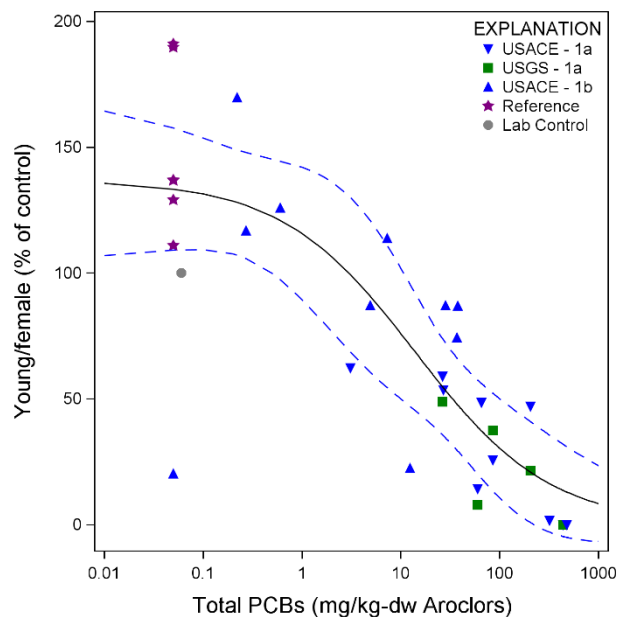
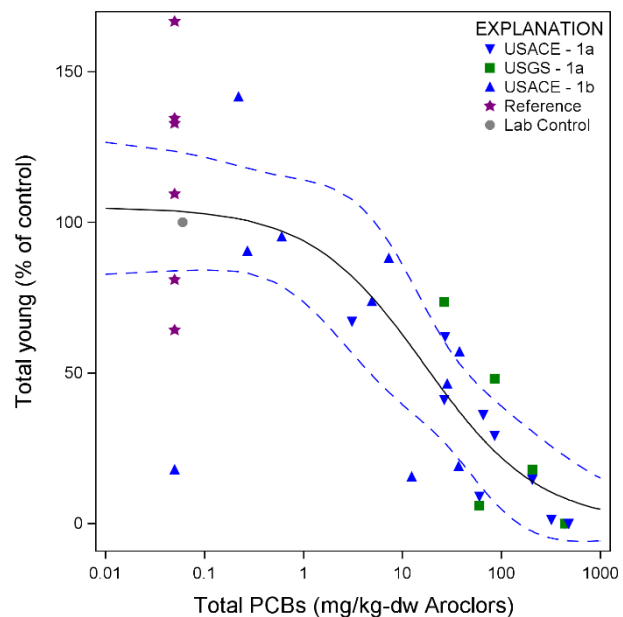
BERA Addendum for OU4

BERA Figure 6-19, Mean Vanadium Concentrations for Tissue Data by Ecological Area



FIGURE

AD-14



Notes:

Black solid line is a fitted 3-parameter non-linear logistic regression model shown when the relationship was statistically significant. Blue dashed lines are 95% confidence limits of the mean response. Response endpoints are expressed as a percent of the laboratory control response in the tested batch.

d: day

mg/kg-dw: milligrams per kilogram dry weight

‰: percent

PCBs: polychlorinated biphenyls

USACE: United States Army Corps of Engineers

USGS: United States Geological Survey

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BERA Addendum for OU-4

Response vs. Dry Weight-Normalized Total PCB Concentration
(Sum of Aroclors) in OU-4 Sediment for *Hyalomma azteca*
Toxicity Tests



FIGURE
AD-15

Figure AD-16a. ECx estimates for 42d young/female (Normalised to survival and as % control).

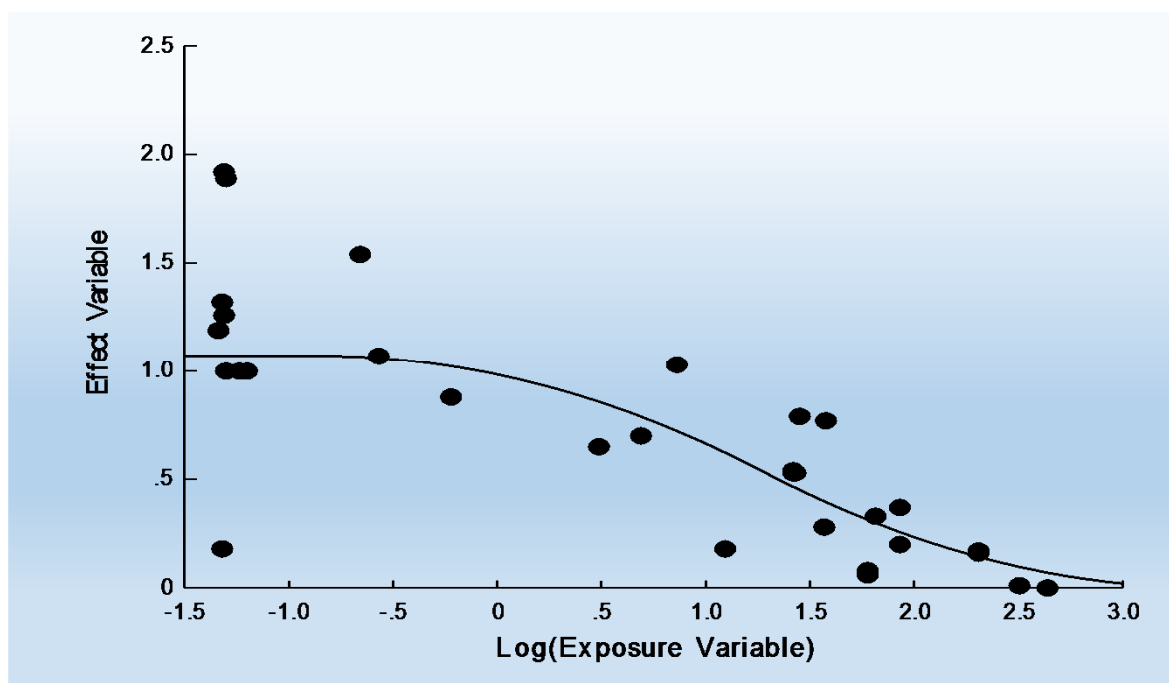


Figure AD-16b. ECx estimates for 42d young/female (normalized to survival and as % control). Non-detect values substituted with $\frac{1}{2}$ method detection limit.

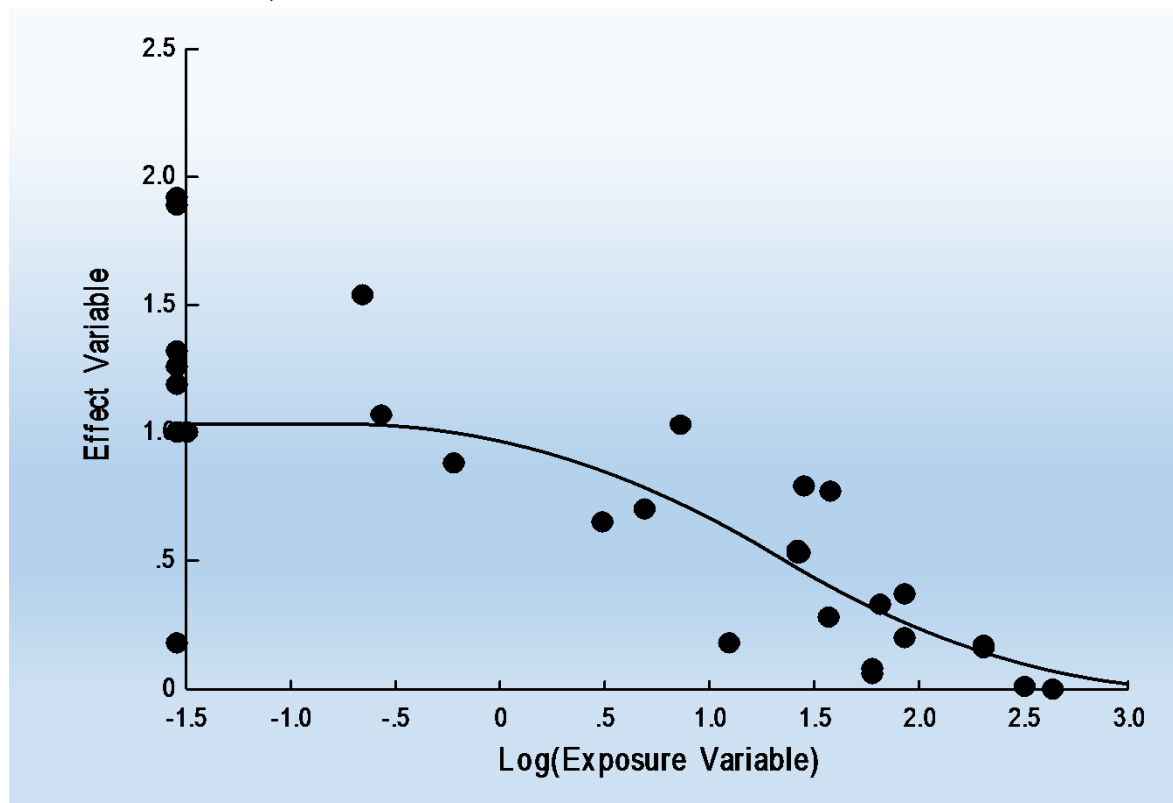


Table AD-17a. ECx estimates for 42d Survival. Non-detect values substituted with method detection limit.

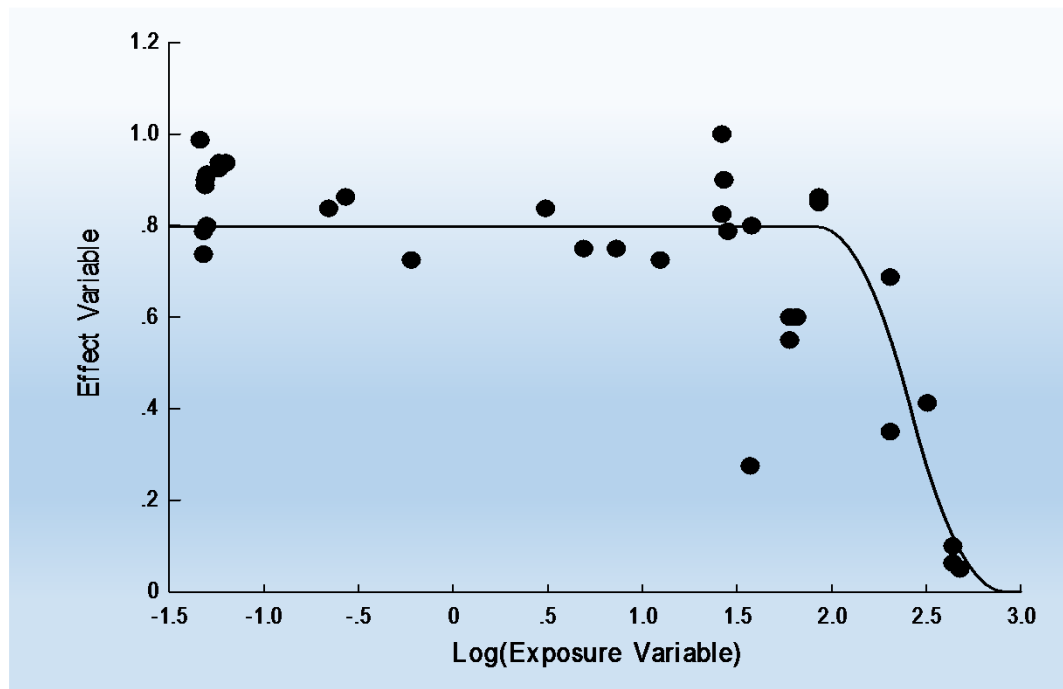


Table AD-17b. ECx estimates for 42d Survival. Non-detect values substituted with 1/2 method detection limit.

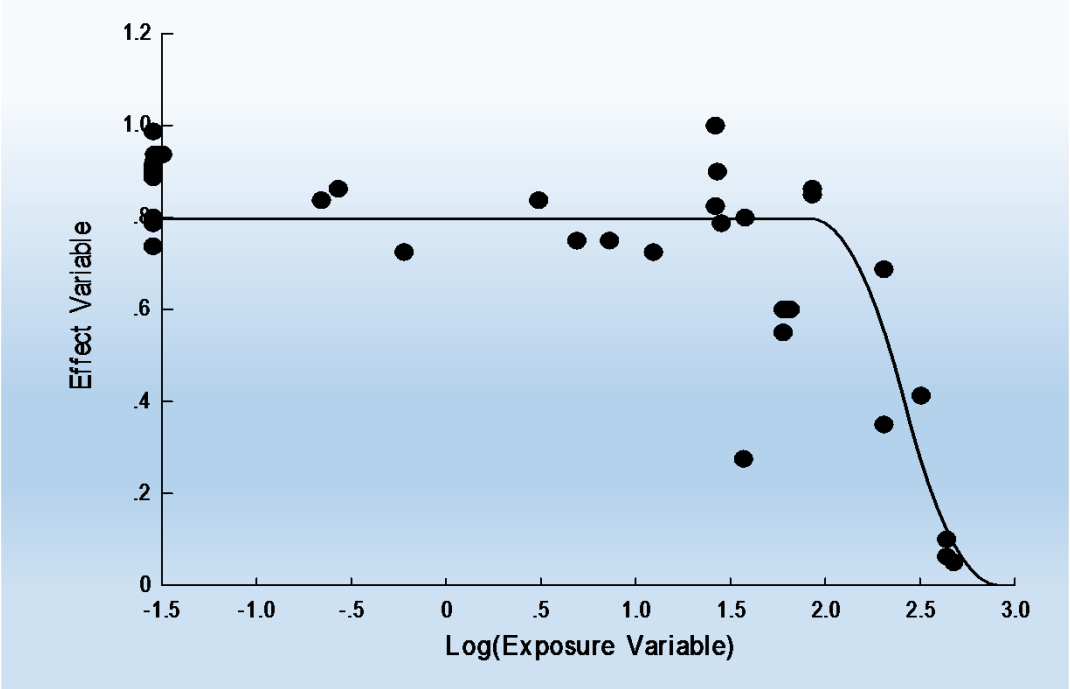


Figure AD-18a. ECx estimates for 42d biomass per replicate chamber. Non-detect values substituted with method detection limit.

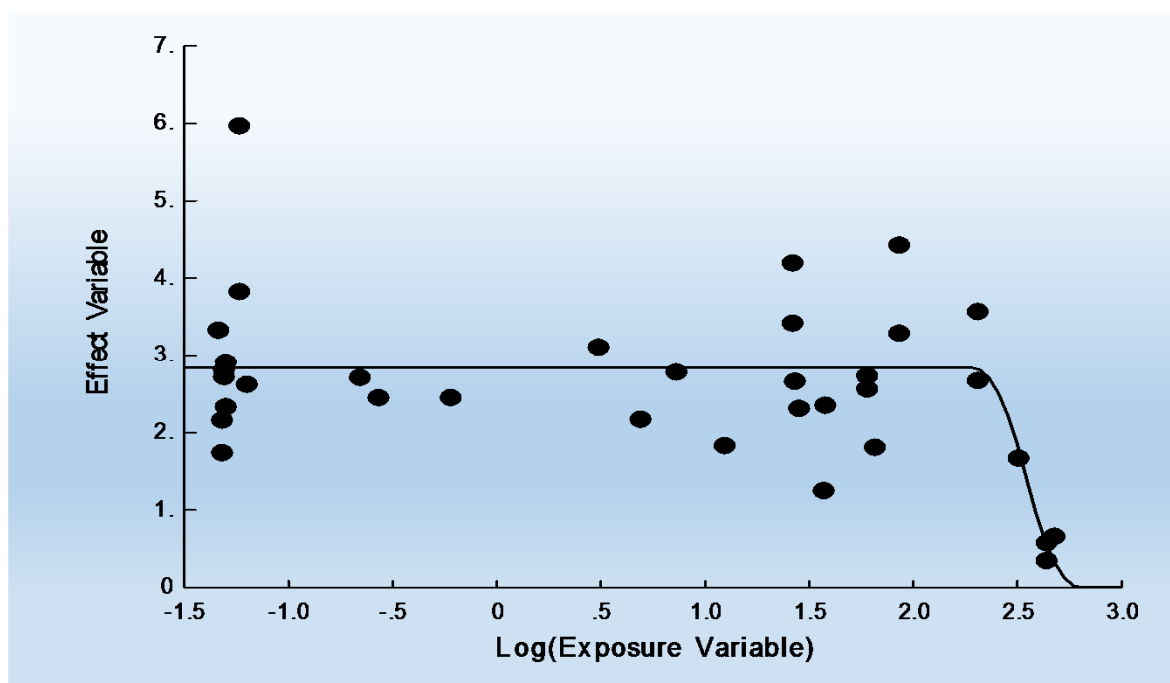
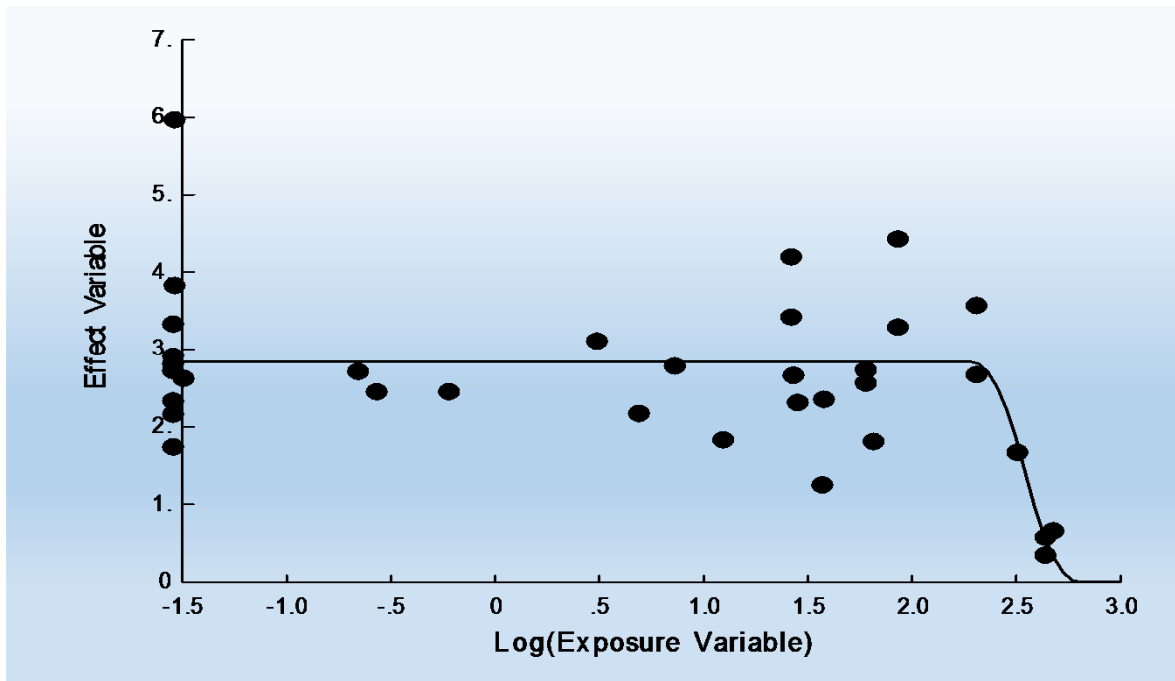


Figure AD-18b. ECx estimates for 42d biomass per replicate chamber. Non-detect values substituted with $\frac{1}{2}$ method detection limit



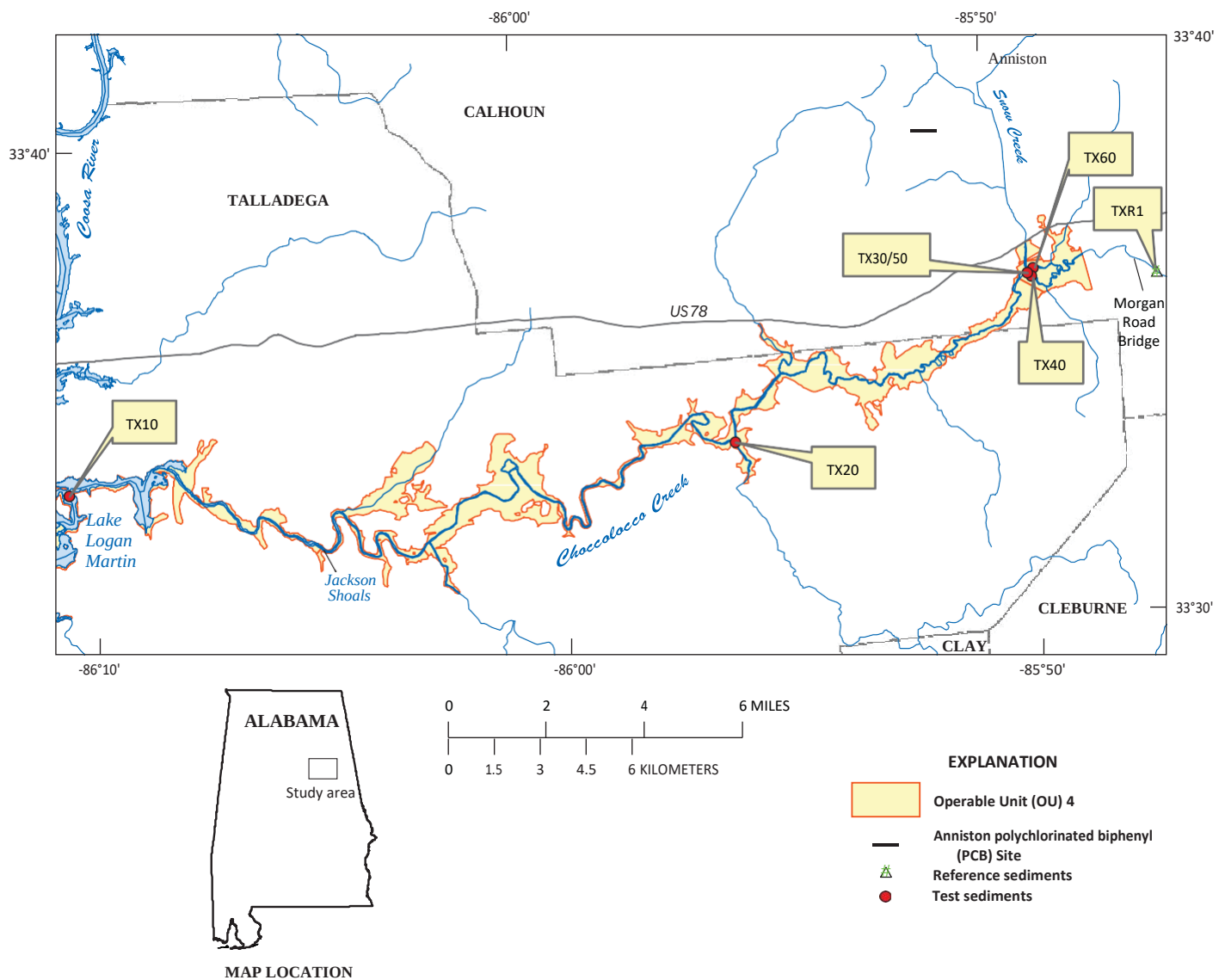


Figure AD-19. Anniston PCB site locations where sediment samples were collected from test sites and from one reference site. (Ingersoll et al. 2014)

Appendix A - Evaluation of October 2016 BERA Revisions

Responses to USEPA Comments on Baseline Ecological Risk Assessment for Operable Unit 4 - August 15, 2015
Anniston PCB Site, Anniston, Alabama

No	part	EPA Category	Comment Response	Comment Addressed?		Was revision as requested	If no, is revision adequate to address comment?
				No	Yes		
1	An explanation of why homolog analysis was done in some tissue types while Aroclors were measured in others (a lower detection limit [DL] can be obtained analyzing homologs) needs to be added to the Baseline Ecological Risk Assessment (BERA).	Aroclors versus Homolog	The following text was added to Section 3.4, 3rd paragraph, 3rd sentence: "As described in the OU-4 Phase 2 FSP (Arcadis 2009), PCBs were analyzed for PCB homolog groups using modified (SIM) USEPA Method 8270C in many cases to achieve adequate detection limits in tissues where PCB concentrations may be low or the tissue mass may have been limited... PCBs in fish, molluscs and crayfish were analyzed as Aroclors and PCBs in the remaining tissue types were analyzed as homologs."		Yes	Yes	
2	Ten percent (%) of the sediment and soil samples collected during the Phase 2 sampling were submitted for homolog analysis. Please add these data to the Appendix E spreadsheet.	Aroclors versus Homolog	Homolog data for the soil sediment and tissue samples are included in the appropriate tabs of the data appendix (E) to the BERA.		Yes partially	Electronic database was submitted. Homolog data was included in revised Appendix E spreadsheets. However, on Tab 1 of Appendix E, "Soils", it appears that the homolog data were added but the Total polychlorinated biphenyl (PCB) Aroclor data were removed.	
3	The total Aroclor PCB concentrations tended to be lower than the total homologue PCB concentrations when the samples were analyzed by both methods. When total PCBs is different by the two methods, there is uncertainty in which value best represents the total PCB concentration for risk assessment purposes. The text of the uncertainty section should be modified so that it does not say that the samples of tissue that measured total PCB homologues overestimated the total PCB concentrations (see the Region 4 PCB Guidance [Wischkaemper et al. 2013]). Discussion of uncertainty regarding analysis of PCBs (weathered PCBs are not always picked up by Aroclor methods) and the uncertainty regarding total PCB Aroclors versus total PCB homologues should be added to Section 6.2.1.1. The table from the Sampling and Analysis Plan (SAP) that explains the analytical methods used for the different types of samples should be included. The methodology should be discussed. If possible, obtain a complete description of how the homolog analysis was conducted from the laboratory and add this to the BERA report.	Aroclors versus Homolog	The way in which total Aroclor concentrations relate to total homolog concentrations is addressed in the uncertainty analysis in Section 6.2.1.1. The following text was added to Section 6.2.1.1. "For PCBs, COPCs were measured as both Aroclors and homologs. Based on the ability of the Aroclor method to accurately characterize the quantity of PCBs, and the large amount of Aroclor data available for multiple media across OU-4 (and the Site), the data collection programs and the BERA generally used total PCBs as the sum of Aroclor results. As discussed in the response to Comment No. 1, PCBs were analyzed as homologs in some cases to achieve adequate detection limits with the available sample volumes. Specifically, surface water, fish tissue, crayfish tissue, and mollusc tissue were analyzed as homologs. Approximately 10% of soil and sediment samples were also analyzed as both homologs and Aroclors. To evaluate the uncertainty associated with the different measurement methods, paired data were evaluated for 106 soil samples, 16 sediment samples, nine surface water samples, and 25 tissue samples (including fish, crayfish and molluscs). A strong correlation was found between the Aroclor and homolog results (Figure 6-21) with r ² values ranging from 0.88 for soil to 0.99 for tissue. A regression was not run on the surface water samples because all Aroclor results were ND. The slopes of the regression line ranged from 0.77 for tissue to 0.83 for both soils and sediment indicating that the Aroclor method slightly overestimates PCB	No.		The 2015 draft BERA (page 6-55) noted that "measured <u>homolog sediment concentrations are generally higher than those measured as Aroclors</u> (e.g., site-specific sediment data indicate that homologs overestimate Aroclor concentrations by a factor of two to four, as shown in Appendix E Table 7) ... tissue homolog data may overestimate tissue Aroclor data. The 2016 revised draft only addresses samples where homolog SIM analysis was conducted. The analysis of total Aroclor PCBs and the homolog SIM analysis might not have picked up on the site-specific composition of PCB congeners in the toxicity test data that showed a relatively high fraction of mono-chlorinated PCBs rather than the PCB congeners associated with Aroclor 1242.	No. The revised document did not provide information on methodology used to analyse PCB homologues by selected ion monitoring (SIM) versus the high resolution method used for the toxicity test samples. Note highlighted text. Additionally, further analysis showed that the concentrations of total PCBs by homolog SIM were underestimated in biota tissue samples. Tables 6-25 & 6-26 on WOE for AEs using food-chain models for birds and mammals need to change the "level of conservatism" entry from high to moderate when the food-chain models relied heavily on homolog SIM data. Estimated exposures to receptors whose diets were predominantly biota tissues measured by

Responses to USEPA Comments on Baseline Ecological Risk Assessment for Operable Unit 4 - August 15, 2015
Anniston PCB Site, Anniston, Alabama

No	part	EPA Category	Comment Response	Comment Addressed?		Was revision as requested	If no, is revision adequate to address comment?
				No	Yes		
			concentrations and that use of the Aroclor data may overestimate risks."				homolog SIM, such as the tree swallow, blue jay, Carolina wren, short-tailed shrew, white-tailed deer, red fox, raccoon 2, and mink 1, might have been underestimated by reliance on homolog measurements in prey.
4	Acid Volatile Sulfide/Simultaneously Extracted Metals (AVS-SEM) data were collected on the sediments used in the toxicity testing. AVS-SEM results should be included in the interpretation of the toxicity testing. Results from these analyses would have aided in the interpretation of sediment chromium and lead concentrations and would have been supportive of the mercury (Hg) results. This comment is referring to Section 5.1.2 on sediment screening for metals and whether metals are contaminants of potential concern (COPCs).	AVS/SEM	The AVS-SEM data are included as Attachment 1 to the revised Appendix C of the BERA and are summarized in Table C-4 of Appendix C of the BERA. The AVS-SEM results are discussed in Section 3.1 of Appendix C, and in Sections 5.1, 6.1.2.1.1, and 6.2.3.3 of the BERA relative to metals bioavailability, toxicity and the COPC analysis. As noted in the Ingersoll et al. (2014) report, "Calculation of values of SEM minus AVS (SEM-AVS, molar basis), and SEM-AVS normalized to the fraction of sediment organic carbon (SEM-AVS/FOC; appendix 1, table 1-7) indicate low bioavailability and low probability of risk from these five metals (USEPA 2005)." The technical conclusion reached in the Ingersoll et al. report regarding the low probability of risk from these five metals is consistent with the evaluation and conclusions presented in the BERA.		yes	Appears to have been. Only some minor edits relating to incorrect table references and units questions	1) Appendix C, Sect 3.1 references Table C-4, should be Table C-5. 2) Main text, page 5-5, 2 nd paragraph: references Table C-2, should be Table C-5. 3) Table C-5: Shouldn't units for SEM be micromoles per gram (μmol/g) and not micrograms per gram (μg/g)? 4) The ARCADIS response to comments should refer to Table C-5 instead of Table C-4

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Anniston PCB Site, Anniston, Alabama

No	part	EPA Category	Comment Response	Comment Addressed?		Was revision as requested	If no, is revision adequate to address comment?								
				No	Yes										
5	The concentrations of PCBs in sediment should be evaluated both on a dry-weight basis and on an organic-carbon normalized basis when comparing with the toxicity test effect concentrations from the Ingersoll et al. (2014) report. Normalizing concentrations to organic carbon will provide a better estimate of the bioavailability of PCBs to benthic invertebrates in finer-grained particles within each of the 10 reach sites, and will refine the exposure scenario and risk determination for benthic invertebrates.	Benthic Macroinvertebrates (BMI), Evaluation of Risk	Both organic carbon normalized and non-normalized PCB effects concentrations were calculated based on the toxicity endpoints and were provided in Appendix C of the draft BERA. They remain in the revised Appendix C (Table C-7) to the BERA. In addition, a point-by-point comparison based on both organic carbon normalized and non-normalized PCB concentrations is provided in the benthic invertebrate risk characterization in the revised BERA (Section 6.1.2; Table 6-4a). The following text was added to the end of the 2nd paragraph on p. 5-7 in Section 5.1.1. "The comparable EC values are also reported on an OC basis. The OC-normalized values introduce more uncertainty into the evaluation, as OC is generally low in most OU-4 sediments (and often not detected) with an average content of 1.1 % in the 268 surface sediment samples and with a standard deviation of 1.0. Given the low bias of the OC data, it is unlikely that OC is significantly influencing the bioavailability of PCBs in the aquatic system. While the OC-normalized results provide a datum, they are not useful for evaluating exposure-based risk due to the low OC concentrations and the high level of uncertainty in the results."		Yes		Editorial: Add the EC0*, EC10, and EC20 values to the mercury columns on Table 6-4a								
6	Risk to benthic invertebrates should be re-evaluated on a point-by-point basis, and the risk conclusions should be based on the number of samples within an Exposure Unit (EU) (Reach or Assessment Area [AA]) that exceed the toxicity threshold for the most sensitive endpoint, not all measured endpoints. Risk categories should be defined (low risk > EC0* and <EC10*, moderate risk > EC10* and < EC20*, and high risk > EC20*) and the number of samples within each EU that fall into these risk categories should be tabulated.	BMI, Evaluation of Risk	The benthic invertebrate risk characterization has been updated to include a point-by-point analysis by reach as requested (Section 6.1.2; Table 6-4a). The low, moderate and high risk categories are consistent with what was provided in the draft BERA and have been carried forward in the revised BERA.		Yes, partially.	Risk was re-evaluated on a Reach basis, but not on an AA basis. Table 6-4a shows the risk categories as > effective concentration (EC)0 *; ≤ EC10. As in comment 135, the EC20 is a concentration where 20% response has been observed. Risk categories should be less than (<) EC0; greater than or equal to (≥) EC0, < EC10; ≥ EC10, < EC20; ≥ EC20. I re-calculated their percentages for Reach C-1 using the above risk categories. Because PCB sediment concentration in 2 samples is 4.4.mg/kg and the EC20 is 4.4 mg/kg, this changes the numbers on Table 6-4a as follows <table><tr><td></td><td>< EC0*</td><td>≥ EC0*, < EC10</td><td>≥ EC10, < EC20</td></tr><tr><td>Current</td><td>31</td><td>25</td><td>25</td></tr></table>		< EC0*	≥ EC0*, < EC10	≥ EC10, < EC20	Current	31	25	25	No. The site-specific toxicity thresholds used for this evaluation were H. Azteca, 42-day young per female (reproductive endpoint) and 13-day C. dilutus survival. The lowest site-specific toxicity threshold was for adult chironomid biomass, which was not used (see comments 141 and 142)
	< EC0*	≥ EC0*, < EC10	≥ EC10, < EC20												
Current	31	25	25												

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Anniston PCB Site, Anniston, Alabama

No	part	EPA Category	Comment Response	Comment Addressed?		Was revision as requested				If no, is revision adequate to address comment?	
				No	Yes	Correct ed	31	25	12.5	31.2	
7	Another line of evidence (LOE) to evaluate potential risk to the benthic invertebrate community is to compare the measured tissue concentrations to tissue residue values reported in the literature. The no observed effect concentration (NOEC) tissue toxicity reference value (TRV) reported for PCBs by van Geest et al. (2011) was 0.59 milligrams per kilogram (mg/kg) wet weight, and the lowest observed effect concentration (LOEC) was 1.4 mg/kg wet weight. Measured concentrations in benthic invertebrates collected in the Upper Assessment Area (UAA), Middle Assessment Area (MAA) and Lower Assessment Area (LAA) and measured concentrations in Lumbriculus used in the site-specific bioaccumulation assays should be compared with the tissue-based TRVs. Concentrations of PCBs measured in mollusks collected on-site should also be compared to the tissue residue-based TRVs.	BMI, Evaluation of Risk	This reported "LOEC" is questionable and was not suggested by the authors. Van Geest et al. observed reduced survival (64% vs. >80%) of Hexagenia spp. (mayfly nymph) in sediment containing 4.8 ppm PCBs and where tissue accumulation was 1.4 mg/kg wet weight. These sediments contained elevated concentrations of other contaminants (PAHs, dioxins) that may have contributed to toxicity. In addition, the authors noted that the nymphs had difficulty burrowing into these particular sediments due to their "course physical structure which likely stressed the organisms". Alternate values based on tissue residue effects data have been employed as CTC values for benthic invertebrates. For benthic invertebrates, NOAEL and LOAEL CTC values of 28.4 and 76 mg/kg wet weight were selected (Borgmann et al. 1990, Nebeker and Puglisi 1974). Receptor-specific CTCs were also developed for oligochaetes, emergent insects, molluscs, and crayfish, as well as for terrestrial invertebrate receptors. Derivation of the CTCs is described in Appendix D. For Lumbriculus, site-specific worm bioaccumulation data were not compared to CTCs because the bioaccumulation tests were conducted with sediments that do not represent surface exposure in OU-4. The laboratory testing of Lumbriculus was conducted using sediments with a range of PCB and OC concentrations to evaluate bioaccumulation rates for aquatic invertebrates. These sediments were mostly mined from subsurface sediments and then were processed to remove all materials that were retained on a 2 millimeter sieve.	No	Yes, for field collected inverts, but did not use requested TRVs. No, did not do Lumbriculus tissue concentration comparison as requested. The Hwang et al. 2001 paper was not added to Table D-12 as requested.	The critical tissue concentration (CTC) value recommended by EPA was not utilized to evaluate this LOE. Alternate tissue TRVs were derived, but a review of the papers used to derive the alternate TRVs noted issues with some of the proposed CTCs (see comments 7a through 7f). <u>One of the most critical issues with the proposed CTCs is related to Appendix D, footnote a to Tables D-11 to D-17, which states “When wet or dry weight (dw) was not specified in study, diet doses [sic] were assumed to be wet weight (ww).” These tissue concentrations were then converted to dw values.</u> If dry or ww is not specified, the conservative assumption that the cited value is dw must be used. Assuming the value is ww and converting it to dw results in a much higher CTC value that may not be protective. NOTE: The Portland Harbor BERA used a LOEC of 1.32 mg/kg ww for the benthic invertebrate CTC for PCBs. This value was calculated as the 10th percentile of the species sensitivity distribution (SSD), and was identified as having low uncertainty, based on 15 acceptable toxicity studies. (Table 6-27 of the BERA)	No. See comments 7 through 7f. Van Geest paper: Confirmed that values are wet weight. Hexagenia survival was > 80% in all but three tested sediments. PCB concentration in sediment was 4.8 mg/kg; the threshold effect concentration (TEC) = 0.0598 milligrams per kilogram (mg/kg), probable effect concentration (PEC) = 0.676 mg/kg. The PCB concentration in the sediment is well above the PEC for PCBs. The polycyclic aromatic hydrocarbon (PAH) conc in sediment was 9.4 mg/kg. TEC = 1.61 mg/kg, PEC = 22.8 mg/kg. Although PAH conc. Exceeds the TEC, it is well below the PEC. The polychlorinated dibenzodioxin/furan (PCDD/F) concentration in the sediment with 64% survival was 0.95 mg/kg, while > 80% survival was observed in a sediment with a PCDD/F concentration of 2.5 mg/kg. Although co-contaminants were present, and grain size issues on burrowing				

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Anniston PCB Site, Anniston, Alabama

No	part	EPA Category	Comment Response	Comment Addressed?		Was revision as requested	If no, is revision adequate to address comment?
				No	Yes		
							were observed, the results from the Van Geest et al. 2011 study have fewer shortcomings than the studies proposed to derive CTCs and described in 7a through 7f. Additionally, as noted in comment 120, some of the toxicity testing samples were collected at the surface. Measured concentrations in <i>Lumbriculus</i> used in the site-specific bioaccumulation assays from the surface samples identified in comment 120 should be compared with the tissue-based TRVs.
7a	Appendix D, CTC sources for BMI. Section 3.4.1, TRV for Aquatic Worms		Proposed NOAEL and LOAEL from Fisher et al. (1999): NOAEL: 92 mg/kg ww, 541 mg/kg dw LOAEL: 112 mg/kg ww, 659 mg/kg dw	No		No. The Fisher paper tested Congeners 1, 15, 47 and 153—none are dioxin-like (DL)-congeners. The LOEC value is for Congener 1, which is not present in Aroclor 1254. The NOEC value is for congener 15; % by weight of this congener in Aroclor 1254 is 0.03%. Hwang et al. 2004 tested congeners 15, 47 and 126. The LOAEL CTC for congener 126 (15.8 mg/kg, wet or dw not stated) is much lower than the LOAEL CTC for congener 15 (333 mg/kg, basis unknown). The use of individual non-DL congener CTCs that are not present in Aroclor 1254 is not sufficiently conservative for this risk assessment. Table D-11 implies that the chemical form tested in Fisher et al. was Aroclor 1254, which it was not.	No.

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Anniston PCB Site, Anniston, Alabama

No	part	EPA Category	Comment Response	Comment Addressed?		Was revision as requested	If no, is revision adequate to address comment?
				No	Yes		
7b	Appendix D, CTC sources for BMI. Section 3.4.2, CTC for aquatic emergent insects		Proposed NOEC value from Sanders and Chandler (1972) 6.5 mg/kg ww, converted to a dry weight value of 21 mg/kg	No		No. Page 259, last paragraph of the Methods section states "Residue concentrations presented in the text and table were computed on whole-body dry-weight basis" The first paragraph on page 261 states that for mosquito larvae "accumulation continued until the seventh day of exposure ... The pupae showed no apparent symptoms of toxicosis after this 7-day exposure. However, many of the pupae were unable to metamorphose into the adult form. Control organisms pupated with success." The value cited for mosquitos should be considered a LOEC and this value is already dry weight.	No. The value cited for mosquitos in paper is 27, not 6 as on Table D-12; also this value is a LOEC. Highest insect NOEC below 27 is 7 ppm for stoneflies). These values are dry weight and do not need to be converted.
7c	Appendix D, CTC sources for BMI. Section 3.4.3. CTC for epibenthic invertebrates		Proposed NOAEL from Borgmann et al. 1990 and LOAEL from Nebeker and Puglisi (1974): NOAEL: 28 mg/kg ww, 158 mg/kg dw LOAEL: 76 mg/kg ww, 422 mg/kg dw	No		No. The tissue concentration reported in Borgmann et al. (1990) was the average from two experiments, on a ww basis. Percent survival at the NOEC exposure concentration was 14 and 30% in the two experiments. Sublethal endpoints (including bioaccumulation) should not be evaluated in samples where significant mortality was observed. Control survival was 15 and 33% for the two experiments, leading to questions whether the test results are acceptable. The Nebeker paper does not indicate whether tissue residues are dry or ww. If this value is used, it should be conservatively assumed that it is dw. Survival of test organisms was 77%, while control survival was only 48%, leading to questions whether the test results are acceptable.	No.

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No	part	EPA Category	Comment Response	Comment Addressed?		Was revision as requested	If no, is revision adequate to address comment?
				No	Yes		
7d	Appendix D, Section 3.4.4 CTC for molluscs		Proposed NOAEL and LOAEL from Lowe et al. 1972 NOAEL: 101 mg/kg ww LOAEL: 150 mg/kg ww	No		No. The paper does not present data in a table or in the text to determine the tissue concentration associated with a 20% decrease in growth—this value has to be estimated from a figure. There is uncertainty associated with this estimate.	No. Basis checks.
7e	Appendix D, CTC sources for BMI. Section 3.4.5. CTC for crayfish		Proposed NOAEL from Sanders and Chandler (1972) and LOAEL from Duke et al. (1970): NOAEL: 6 mg/kg ww, 21.6 mg/kg dw LOAEL: 16 mg/kg ww, 57 mg/kg dw	No		No. The Duke et al. paper does not specify whether the reported tissue concentrations are on a dry or ww basis. If basis is not reported, the conservative assumption that tissue concentration is dw must be made. Lethal tissue concentration = 16 mg/kg dw, use a factor of 3 to adjust to a LOEC = 5.3 mg/kg dw. Use 28% solids to convert to ww = 1.5 mg/kg ww Recommended LOEC: 1.5 mg/kg ww, 5.3 mg/kg dw	No.
7f	Appendix D, CTC sources for EWs. Section 3.4.6. CTC for earthworms		Proposed NOAEL and LOAEL from Rodriguez-Grau et al (1989): NOAEL: 17 mg/kg ww, 78 mg/kg dw LOAEL: 18 mg/kg ww, 83 mg/kg dw	No		No. Rodriguez-Grau et al. report a 5-day LD50 tissue concentration of 1140 µg/g dw. Using an acute to chronic ratio of 0.1, this becomes a LD50 of 114 ppm dw, and using a factor of 3 to convert from an LD50 to a LOEC gives a LOEC concentration of 38 mg/kg dw. Using 29% (cited in section 4.4.6) solids, this is a LOEC of 11 ppm ww. Recommended LOEC: 11 mg/kg ww, 38 mg/kg dw	No.
7g	Appendix D, CTC sources for crickets/grasshoppers. Section 3.4.7.		Proposed NOAEL and LOAEL from Paine et al (1989): NOAEL: 92 mg/kg ww, 307 mg/kg dw LOAEL: 144 mg/kg ww, 480 mg/kg dw		Yes		Numbers and basis check

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No	part	EPA Category	Comment Response	Comment Addressed?		Was revision as requested	If no, is revision adequate to address comment?
				No	Yes		
8	For the benthic community line of evidence, the Hg tissue residues in benthic invertebrates should be compared with the tissue residue benchmarks for Hg from Mendez-Fernandez et al. (2015).	BMI, Evaluation of Risk	The suggested tissue residue benchmarks from Mendez-Fernandez et al. (2015) are not appropriate for mercury because the exposure sediments were from mine sites and contained high concentrations of many other metals that likely contributed to the observed toxicity. Similar to PCBs, receptor-specific CTCs were developed for mercury to assess risk to benthic invertebrates. For benthic invertebrates, NOAEL and LOAEL tissue effects benchmarks (10 and 16 mg/kg ww, respectively) were based on data from Borgmann et al. (1993). CTC values were also developed for emergent insects, molluscs, and crayfish, as described in Appendix D.	No.	Yes, but didn't use requested TRVs	Did not use Mendez-Fernandez et al (2015) or Hook and Fisher (2002) TRV. See response 8a—Some of the CTCs from this study are not from mine sites and do not contain high concentrations of metals; CTCs from those sediments are appropriate and should be used.	No. See comments 8 through 8d.
8a	4.4.1, Hg CTC for Aquatic worms			No CTCs were developed , as tissue effects data for aquatic worms were stated as not available. The test species in the Mendez paper is an oligochaete		Sediments N19 (toxic) and N20 (non-toxic) are not from mine sites. The only metal in sediment that exceeded the TEC value was cadmium (Cd) for both samples, and the Cd concentration was well below the PEC. Tissue concentrations of all metals except Hg are within the range measured in the four reference sediments, all of which were non-toxic. All of the tissue concentrations for other metals except zinc in samples N19 and N20 are below the threshold body burdens in Bervoets et al. 2016. The Hg concentration in N19 can be considered a LOEC (89.6 nanomols per gram (nmol/g) dw; 17.97 mg/kg dw), and in N20 can be considered a NOEC (63.5 nmol/g dw; 12.7 mg/kg dw).	No.
8b	4.4.2, Hg CTC for emergent insects		Proposed NOAEL from Saouter et al (1989): NOAEL: 7.5 mg/kg ww, 24 mg/kg dw		Yes		Numbers and basis check
8c	4.4.2, Hg CTC for epibenthic BMI		Proposed NOAEL and LOAEL from Borgmann et al. 1993: NOAEL: 10.1 mg/kg ww, 56 mg/kg dw LOAEL: 16.2 mg/kg ww; 90 mg/kg dw		Yes		Numbers and basis check

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8d	4.4.4 Hg CTC for molluscs		Proposed NOAEL from Dillon et al 1977 and LOAEL from Thain 1984: NOAEL: 0.6 mg/kg ww; 8 mg/kg dw LOAEL: 12 mg/kg ww, 150 mg/kg dw	No		Prior to conducting acute toxicity tests, clams were pre-exposed to a low concentration of Hg for two weeks, then transferred to clean water (Dillon 1977). 14% mortality was observed during this exposure period. Measured tissue concentrations were 6 mg/kg ww. This should be identified as an effect concentration, not a NOEC. Conversion of this value to a LOEC using an acute to chronic factor of 0.1 gives you a LOEC of 0.6 mg/kg ww (7.5 mg/kg dw).	No.
8e	4.4.6 CTC for earthworm		Proposed NOEC from Burton et al. NOEC = 15 mg/kg dw		Yes		Numbers and units check
9	Section 6.1.2.4, Measurement Endpoint (ME) 2d: Evaluate the benthic community data on an assessment area basis. The hazard quotient (HQ) calculations suggest risk is elevated in the upper reaches and lower in the lower reaches.	Benthic Community Surveys	As requested, the benthic invertebrate community data have been evaluated on an assessment area basis in the revised BERA (section 5.6.2 and Tables 5-8 and 5-9). Both ANOVA and ANCOVA analyses have been provided to evaluate any differences relative to habitat types, seasonality and PCB concentrations in OU-4, relative to the reference areas.		Yes, partially	Text was revised as stated in the Response to Comment (RTC), except the response was included in a different section (not §6.1.2.4.).	No, the last two columns on Table 5-8 must be removed. PCB concentrations were not measured in the sediment samples used for the benthic community analysis. This Table implies that they were, and that community metrics can be statistically tested against sediment PCBs. Editorial: Table 5-8 should indicate sample size
10	The Shannon-Weaver diversity index equation on page 5-28 is incorrect. The logarithm should be replaced with the natural logarithm, and recalculated throughout the Operable Unit (OU)-4 BERA as needed.	Benthic Community Surveys	The equation was corrected in the text in Section 5.6. The calculations were performed correctly using the natural logarithm.		Yes	The equation was corrected in the text. Some calculations were spot-checked and results were confirmed.	
11	Table 5-5 needs to provide variance estimates for each of the mean values reported for each of the five subunits sampled within each of the 10 reach sites. Reach should be included as an additional factor in the analysis of variance (ANOVA).	Benthic Community Surveys	The benthic community data were evaluated on an assessment area basis as suggested in Comment #9 (see Section 5.6.2 and Tables 5-8 and 5-9). Both mean and standard deviation are provided in the revised table (Table 5-8).		.Unclear	It is unclear whether all requested variance analyses were performed as requested. Reach does not appear to have been included as an additional factor in the ANOVA. Many statistics were performed. However, they are meaningless	

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						when performed on metrics other than those in the state protocols. Metrics are not discriminatory.	
12	Section 6.1.2.4: The summary of benthic invertebrate community measures should not combine samples collected in different habitats and different seasons. One of the most significant metrics, abundance, is lower in OU-4 than reference, which suggests effects (mean abundance is 2% lower at OU-4 sample locations if all samples are combined. When adjusted for habitat and year, abundance is 39% lower at OU-4 sample locations than reference locations [footnote 1, Table 5-5]). The benthic invertebrate data are inconclusive. They do not definitively show an effect, but they also do not show the lack of an effect. The study lacks the power to conclude that there was or was not a difference attributable to the contamination – COPCs were not measured in the benthic community survey samples. Revise the text so that it does not state "there appear to be no adverse effects of PCBs or other COPCs on the benthic community." In the October 2008 EPA comments on the Phase 2 Field Sampling Plan (FSP), EPA noted that the samples for the benthic invertebrate community evaluation should be collected from the grab samples submitted for sediment chemistry and toxicity evaluation. The deficiency in the community data relative to the SAP should be acknowledged in the uncertainty section.	Benthic Community Surveys	An error was found in the analysis as presented in the draft BERA. The ANOVA results were misinterpreted and it should have been stated that mean abundance was higher in OU-4 compared to reference. The ANOVA analysis of the benthic community data was revised to include assessment area as a dependent variable as suggested in Comment #9 and to compare each assessment area to reference (Section 5.6, Tables 5-8 and 5-9). Differences related to habitat were appropriately controlled in the analysis as before by having habitat as a fixed effect in the model. The fall and spring data sets were evaluated separately. A power calculation is provided in the revised BERA indicating acceptable power (70%) to detect a 20% change in a benthic measure with 95% confidence. The benthic community sampling was not designed to evaluate associations with PCB concentrations since it was determined that the PCB concentrations did not vary enough or have a large enough range to evaluate such an association. Mean PCB concentrations in the three benthic sampling areas are not statistically significantly different. Therefore, we disagree that the data are deficient. However, in order to evaluate potential relationships between community measures and PCBs, each benthic community sampling location was paired with the mean PCB concentration of surface sediment samples within a half mile range of the location. An ANCOVA analysis was added to the BERA to determine if there is an association with PCB concentration while controlling for habitat and season (Section 5.6). The results of these analyses found no adverse effects of PCBs or other COPCs in OU-4 therefore the statement "there appear to be no adverse effects of PCBs or other COPCs on the benthic invertebrate community" has not been removed from the BERA.	No, in terms of removing statement that there appear to be no adverse effects of PCBs on benthic communities,		Some changes were made to the text per RTC, but the main conclusion of the document relative to the risks to the benthic invertebrate community remained unchanged. The uncertainty section did not mention how the study was not conducted on a gradient of PCB concentrations. In the October 2008 EPA comments on the Phase 2 Field Sampling Plan (FSP), EPA noted that the samples for the benthic invertebrate community evaluation should be collected from the grab samples submitted for sediment chemistry and toxicity evaluation. The deficiency in the community data relative to the FSP was not acknowledged in the uncertainty section.	No. The main conclusion of the document relative to the risks to the benthic invertebrate community remained unchanged. The BERA still concludes that there appear to be no adverse effects of PCBs on benthic communities, however PCBs were not measured in their community samples.

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				No	Yes		
13	Section 6.2.4 needs to include a statement regarding how lack of replication associated with the invertebrate sampling contributes to uncertainty associated with spatial distributions of the community survey data within the five subunits sampled within each of the 10 reach sites.	Benthic Community Surveys	The following text has been added to Section 6.2.4, 5th paragraph: "In contrast, for the benthic invertebrates, sample size is high and adequate with 70% power to detect 20% or larger reductions in means (n = 158). While the sample size was adequate for statistical analysis, the benthic invertebrate sampling locations within each AA were limited in spatial extent which adds uncertainty to the interpretation. However, given that there is little variation in PCB concentrations throughout the AAs, it is unlikely that benthic communities are impacted elsewhere in the AAs outside the sampled areas."	No. The RTC is highly qualified and does not appear to address the comment.		No. The revised document did not mention the fact that the benthic community surveys were not replicated in Section 6.2.4. Particularly in the upper reaches, there are locations with high PCB concentrations. As benthic invertebrates are not mobile, evaluating based on area-wide PCB concentrations is not appropriate. Table 5-8 does not indicate sample size (n) = 4 for each habitat type by season.	No.
14	Section 6.2.4 needs to include a statement regarding how use of different sampling methods in the different habitat types contributes to the uncertainty associated with the benthic community analysis and conclusions. For data to be valid and comparable between areas, they all must be sampled using the same methods and with the same amount of effort.	Benthic Community Surveys	The nature of benthic invertebrate habitats and organisms require different sampling methods be used and the appropriate methods were used in each habitat for this sampling program. The benthic community analysis included habitat as a fixed effect in the model to control for the variability within habitats and due to sampling methods. The following text has been added to the revised BERA in Section 6.2.4 5 th paragraph: "In addition, different sampling methods were used in each benthic habitat type due to the nature of the invertebrates expected to be found within each habitat. The sampling methods were selected to be specific to the habitat types and were consistent between the assessment areas to minimize uncertainties associated with sample collection activities. The potential for these uncertainties were accounted for in the data evaluation process by adding habitat as a dependent variable."	No. The response appears to dismiss the uncertainty associated with habitat type.		The text was revised as written in RTC. However, the sampling did not follow the Alabama Department of Environmental Management (ADEM) protocols, which specify sampling methods used for each habitat type. ADEM protocols include an assessment of the habitat type with ancillary field variables that are used to assess whether impairment to the benthic community is caused by habitat limitations versus impacts due to water quality degradation. Reference stations by roads could have had habitat limitations.	No.
15	Section 6.3.3: Provide additional detail on the mean Ephemeroptera, Plecoptera, Trichoptera (EPT) index between reference and OU-4 (which differed by 18%). Were more sensitive species missing in the upper reaches (where contamination is higher), relative to lower reaches?	Benthic Community Surveys	To provide a more thorough understanding of EPT composition in the benthic sampling areas another benthic metric, percent EPT (of total abundance), was added to the benthic community analysis presented in section 5.6.2 and comparisons were made by AA. The following text has been added to Section 6.3.3 of the revised BERA: "The EPT index and percent EPT were very low in backwater and depositional locations in both OU-4 and reference areas. For other habitats, the EPT index was lower in UAA compared to reference in the fall and spring (riffle only) however the abundance of EPT taxa as a percent of total abundance was equal or greater in all AAs compared to reference. "		Partially Yes	Text was revised as stated in the RTC.	No, the response did not address whether sensitive species were missing in the upper reaches relative to the lower reaches and reference area.

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16	The data used for bioaccumulation factor development were not co-located. Use the data groupings agreed upon by the Bioaccumulation Factor (BAF) Work Group; these are provided in Tables 1 and 2, and illustrated in the set of figures (File name "BERA Ecological Sample Groups PCBs.pdf") to revise the Appendix B tables. Include a new section describing the data groupings and how they were developed. Refer to the data groupings instead of calling the data co-located. All references to co-located soil or sediment samples should be removed from the text.	BAFs - Data to be utilized to calculate BAFs	The groupings shown on the figures are not completely consistent with the groupings presented in the Excel tables provided. As agreed in the workgroup, the 2007 and 2009 data that are proximal to the biological sampling areas are used as the soil or sediment data for the BAF recalculation, as presented in EPA Tables 1 and 2. Two samples (EUT-08-C3N-22 and EUT-08-C3N-23) are located across the creek from the EUT-08 BSA and were not included in the data grouping. Additionally, ELT-02-38 is located nearest to ELT-02 BSA and was included as part of C7 South, not C7 North, as noted by EPA. Text (Section 4.4.1.3) and Tables 4-18 and 4-19 were added to Section 4 and Appendix B to clarify how data were grouped.		Yes	Yes, appears to have been.	
17	The 2007 and 2009 sediment data should be utilized in the BAF calculations. Reference area data should be included in the regressions, but not in the median BAF calculations. It is noted that all reference sediment was non-detect (ND) for Aroclors.	BAFs - Data to be utilized to calculate BAFs	As described in Section 4.4.1.3 and Appendix B, the 2007 and 2009 data are used for the soil and sediment-based BAF calculations (soil, sediment, and biotic tissues). Reference data are included in the regressions when detected (i.e., for mercury but not for PCBs).		Yes	Yes, appears to have been	
18	The <i>Lumbriculus</i> data will only be used as benthic invertebrate tissue data. Mercury was not analyzed in the <i>Lumbriculus</i> samples, only PCBs. Tables 4-1 & 4-2 on exposure parameters should add a row for benthic invertebrate tissue for incorporation into the receptor diets.	BAFs – <i>Lumbriculus</i>	The exposure parameter tables (4-1 a and b and 4-2 a, b and c) were updated as requested and consistent with Tables 4 and 5 provided with the EPA comments.		Yes	Yes	
19	Bioaccumulation factors for Hg bioaccumulation into <i>Lumbriculus</i> should be taken from those reported for the South River in Gilmour et al. (2013). The BAF for mercury bioaccumulation into <i>Lumbriculus</i> in dry weight for the South River was 1 in this study.	BAFs – <i>Lumbriculus</i>	Because there are no site-specific <i>Lumbriculus</i> data for mercury, the requested value of 1 was incorporated into the revised BERA, as presented in Section 4.4.1.4.		Yes	Yes	
20	For the site-specific <i>Lumbriculus</i> PCB data, good regressions can be obtained several ways. The best regression is for wet weight and lipid normalized worm data versus Total Organic Carbon (TOC) normalized total PCBs as homologs in sediment; this regression model should be used to predict benthic invertebrate PCB concentrations. BAFs for <i>Lumbriculus</i> should not be calculated as worm tissue concentration divided by soil concentration (method currently in the BERA),	BAFs – <i>Lumbriculus</i>	All regressions for the laboratory bioaccumulation study were highly significant. The Aroclor sediment data were used rather than the homolog data to be more consistent with the other BAFs employed in the revised BERA. Additionally, the regression based on log-transformed worm wet weight and sediment Aroclors was selected to eliminate the need for an assumption regarding TOC content in sediment, which is highly variable in OU-4. The r^2 value for the log-transformed normalized homolog data was 0.93 and the r^2 value for the selected regression was 0.89. The selected regression was used in the Draft BERA and not a worm tissue divided by soil to as stated in Comment No. 20.		Yes	No	Arcadis calculated the regressions and selected what they decided was the best model. Although not what was requested, the revision is sufficient to address the comment.

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21	In Table 6-19, the laboratory BAFs should be considered to have low conservatism to overestimate risk (not moderate) and high confidence of risk prediction (not moderate). The <i>Lumbriculus</i> bioaccumulation data was analyzed by the high resolution gas chromatograph/mass spectroscopy (GC/MS) method versus the low-resolution GC/MS method that was used for the benthic invertebrate (Odonata) analysis. Additionally, the pairing of sediment to tissue is quite precise. It is of higher quality and was collected to serve as the standard against which all Phase 2 data was to be compared.	BAFs – <i>Lumbriculus</i>	This table is now Table 6-25. The ranking of each HQ line of evidence factors in all components of the HQ calculation (not just the BAF). As such, the level of conservatism for the sandpiper based on the <i>Lumbriculus</i> uptake model and the high sensitivity TRV was kept at high and confidence was changed to moderate because the high sensitivity TRV is likely not a good representation of a toxicity threshold for the sandpiper (or other water birds). The conservatism for the sandpiper based on the mid-sensitivity TRV and <i>Lumbriculus</i> BAF is moderate and the confidence is moderate because the HQ scenario using measured tissue rather than modeled tissue was given higher weight overall.		Yes	Text was revised per RTC.	
22	To develop BAFs, EPA prefers using site-specific regressions over using the median BAF. There are significant regressions for PCBs to earthworms, small mammals and <i>Lumbriculus</i> . The method described in the next comment should be used when a significant regression cannot be developed.	Calculation of BAFs	Consistent with the approach used in the Draft BERA, significant positive regressions were employed. For PCBs, regressions are employed for <i>Lumbriculus</i> , earthworms, and small mammals. For mercury, regressions are employed for odonates (i.e., field benthic inverts), crayfish, snakes, frogs, and earthworms.		Yes	Appears to have been.	
23	When a significant regression cannot be developed, calculate the BAFs as follows:	Calculation of BAFs	The requested approach was generally followed. The specific approach employed is outlined below, as described in Section 4.4.1 and Appendix B. Based on the general nature of Comment #22, it was assumed that this comment applies to both soil- and sediment-based BAFs.		Yes	Appears to have been.	
	· A mean sediment concentration should be calculated for each biological sampling area (BSA). Non-detects should be included in the mean sediment concentration calculations. The mean sediment concentration should be calculated using ProUCL.		Sediment and soil nondetects were included when calculating the mean for BSAs. The Kaplan-Meier mean estimated by ProUCL was used. Nondetects were only excluded for soil and sediment when estimating regressions.		Yes	Yes, appears to have been.	
	· An individual BAF should be calculated for each tissue sample. Non-detected tissue samples should be excluded from the mean. Please include the non-detected tissue samples in the Appendix B tables, clearly marking them as non-detects; <u>but exclude non-detects when calculating the mean.</u>		The calculation of individual tissue ratios precludes the need for calculating a mean for tissue. BAF ratios were calculated for detected tissue concentrations only.		Yes	Yes, appears to have been.	

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	· Calculate a median BAF for each ~~(BSA)~~ .		A median BAF for each BSA and each AA was calculated and each is presented in Table 4-21 and Appendix B Table B-26. However, because each reach (or EU) does not contain a BSA, it is not possible to use a BSA-specific BAF for HQ calculations in all EUs. Specifically, there are measured data for five of the 10 aquatic EUs and in seven of 19 terrestrial EUs. In addition, the number of tissue values for each BSA was three at most (except for fish), and when nondetect values are excluded for BAF calculation, this sample size is smaller in most cases. Thus, for consistency in approach for modeled and measured tissue estimates (as requested in comments 39 and 48), AA-specific BAF estimates are employed. For the modeled exposures, the soil or sediment EPCs are EU-specific and are used in the food web calculations with the AA-specific BAFs. For the AA-specific BAFs, the median of the individual BAF ratios for all BSAs within an AA was selected. HQs are also presented on an overall AA basis.		Yes	Yes, appears to have been.	
	· Calculate a median BAF for each assessment area (AA).				Yes	Yes, appears to have been.	
	· Calculate summary statistics representing the variation around the mean.		Because median BAFs were requested, it is not clear what mean is being referred to here. To address this comment, variation around the median was estimated as presented in Table B-26.	No		No variation information is presented on Table B-26. However, all of the other revisions requested were done. Confidence limits around the mean were developed (Comment 34).	Although Arcadis did not do exactly what was requested, the revision that was done is sufficient.
	EPA is recommending this approach for the following reasons: · 1) Knowing the variation in your BAF term allows you to evaluate the uncertainty associated with your BAF estimate. 2) Knowing the variation in tissue term will also support an evaluation of whether you are seeing a broad or narrow accumulation range at a particular sediment concentration. 3) Knowing the variability in the calculated BAFs will help understand the uncertainty associated with tissue concentration estimates in the areas that lack measured tissue concentrations.		Comment noted. Uncertainty in the BAF term is also addressed by comparing the measured tissue-based HQs to those calculated using modeled tissue concentrations.		Yes		
24	To account for bioaccumulation in low-concentration areas, the percentage of NDs can be qualitatively evaluated. It can be noted that bioavailability cannot be numerically described accurately due to NDs, but that bioavailability is low.	Calculation of BAFs	These circumstances (i.e., for grasshoppers) are discussed in the uncertainty analysis in Section 6.2.2.1 2 nd to last paragraph. The following text was added regarding grasshoppers. "For terrestrial insects (i.e., grasshoppers), PCBs were never detected in grasshopper tissue; therefore, a BAF of 0.17 derived from non-worm terrestrial insects along the Kalamazoo River (Blankenship et al. 2005) was selected for use in the modeled dietary HQ calculations. This literature-based BAF likely overestimates uptake to terrestrial insects such as		Yes.	Yes.	

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			grasshoppers and crickets, in which PCBs were not detected in OU-4 samples."				
25	For PCBs the tissue data should be lipid-normalized and the sediments or soils should be TOC normalized. Mercury and other metals data should not be normalized. Please check the Lipid-normalized concentrations in Table B-27.	Calculation of BAFs	A detailed regression analysis was conducted using dry weight, wet weight, and lipid-normalized tissue as well as OC-normalized soil or sediment (Appendix B Tables B-9 through B-12 for sediment and Tables B-18 through B-21 for soil). In most cases, the lipid- and OC-normalized data resulted in a similar or worse regression fit than for non-normalized data (except for forage and predator fish for which a negative uptake relationship was found). Thus, the non-normalized data were used in BAF estimation to eliminate the need for a static assumption regarding TOC in sediment across an entire EU, which is quite variable. Section 4.4.1 summarizes the rationale for the selection of each model and BAF employed in the BERA. More detail is provided in Appendix B.	No			Although this comment was not addressed, what was done in the BERA is only used for the food chain models; for this purpose, what was done is sufficient. If the data was being used to describe uptake mechanisms, then lipid and TOC are essential.
26	For terrestrial biota, BSA-based BAFs should be calculated. If there are fewer than five BSAs with detects in tissues, and/or there is no spatial pattern to the detections, then the 95% upper confidence limit (UCL) for OU-4 overall should be calculated.	Calculation of BAFs	Rather than exclude BAFs based on these uncertainties, all receptor dietary doses are estimated based on modeled prey tissue estimates (i.e., using BAFs or regressions) as well as measured tissue concentrations (see also response to Comment 114). In a few cases, USEPA recommended a literature BAF due to low detections or lack of site-specific data (see responses to Comments #19, 32, and 33). For consistency with the HQs based on measured tissue (using AA-specific EPCs) and the aquatic modeled tissue HQs (using AA BAFs; see response to Comment No. 23), AA BAFs for the terrestrial prey tissues were used for PCBs and mercury, as described in Section 4.4.1.3	No			Revisions that were made based on the request to evaluate exposure based on both modelled and measured concentrations addresses the underlying issue. Therefore, performing the analysis with area-wide BAFs is not really needed.
27	To calculate a BAF for toxic equivalents (TEQs), a BAF will be calculated for each congener, and a toxic equivalency factor (TEF) will be applied to the estimated concentration for that congener. Exposure estimated with the TEF-concentrations should then be summed to obtain the PCB TEQ and 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) TEQ based exposure estimates.	Calculation of BAFs	The BAF calculation approach selected for other COPCs was used to calculate site-wide median BAFs for each congener, as data allowed. In the absence of sufficient data, site wide average ratio BAFs were calculated. If congeners were never detected in tissue, no BAF was selected. PCDD/PCDF and DL-PCB BAFs are presented in Appendix F Attachment 1. See also responses to Comments #23 and 165.		Yes	Yes, However, the highlighted additional text in this response is wrong. In order to evaluate risks on a total TEQ basis, it is essential to evaluate the specific congener BAFs. Total exposure is the sum of all of the congeners. Without a way to get the exposure/concentration for each congener, there is no way to get the TEQ value	Need to edit the highlighted text.

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			The revised BERA includes the requested approach recognizing that while it's interesting to evaluate how each individual congener moves through the environment, congener-specific BAFs are not needed for risk assessment purposes and complicate an already complicated exposure model. Risks and hazards are not evaluated on an individual congener basis but rather on a TEQ basis. The important factor isn't how a particular congener moves from sediment to fish but how much dioxin equivalency is in the sediment and moves up the food web.				
28	Separate BAFs will be calculated for reptiles and for amphibians. Arcadis will go back to the dietary composition percentages in U.S. EPA (1993), and select the proportion of reptiles and amphibians for each receptor (this information is available for most of the receptor species).	Calculation of BAFs	BAFs for snakes and frogs are estimated individually based on the site-specific measured sediment and tissue, as described in Section 4.4.1.4 and Appendix B. The portion of each receptor diet comprising reptiles and amphibians are considered individually in the exposure models, as shown on Tables 4-1a through 4-2b. The diet composition is taken from Direct Comment Tables 4 and 5 provided by USEPA.		Yes	Yes	
29	For emergent insects, a sediment concentration will be used to calculate the BAF for crane flies. A BAF for emergent insects will be calculated on an assessment area basis. The BAF will not be weighted by the percent of crane fly-only samples versus the total number of emergent insect samples collected.	Calculation of BAFs	The AA-specific BAFs (as outlined in response to Comment No. 23), result in crane-fly-specific BAFs for a portion of the UAA (two of the three sampling areas contained crane flies exclusively). These two samples resulted in tissue concentrations more than one order of magnitude greater than other emergent samples. Using the median BAF for the UAA results in a BAF value that is based on the crane fly tissue and sediment. The crane fly BAF is not consistent with other tissue/BAFs for emergent insects seen within OU-4 or at other sites. However, no crane fly-specific BAFs were located for direct comparison. The uncertainty associated with these two elevated tissue samples is discussed in Section 6.2.2.1.		Yes	High BAFs for emergent insects have been observed at other sites. High concentrations of PCBs have been observed in emergent insects in other field studies. Froese et al. (1998) collected emergent insects from Saginaw Bay and reported a lipid normalized BSAF of 11 for PCBs. A lipid-normalized BSAF for total PCBs in male chironomids of 12.19 was reported by Maul et al. (2006). A BAF of 26.4 can be calculated using the sediment and tissue data presented in the paper. (lipid-normalized BSAF and BAF for females was 0.95 and 3.1, respectively).	
30	Because terrestrial insects collected on-site did not include spiders or detritivorous insects, the OU-4 earthworm PCB and Hg data should be used as representative of all terrestrial invertebrate prey. Analyses provided to Arcadis on the BAF Work Group conference calls support the use of this approach.	Calculation of BAFs	The earthworm BAF regression was used for spiders (or other detritivores), as described in Section 4.4.1.5 and Appendix B. For the portion of the receptor diet that is specifically crickets or grasshoppers, site-specific data were employed. Using earthworms as a surrogate for grasshoppers is not warranted when OU-4 grasshopper data exist.		Yes.	Since the site-specific value is ND, use of a literature value is conservative. Comment 24, Section 4.4.1.5, and Appendix B indicate a literature-based BAF was used for crickets and grasshoppers (0.17, Blankenship et al.2005). The RTC	Although this revision was not as requested (use the earthworm BAF for all terrestrial invertebrates), what was done is sufficient.

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						stating site-specific data were used for crickets and grasshoppers is incorrect.	
31	Small mammal PCB concentrations should be predicted using the site-specific regression model. A comparison of OU-4 small mammal uptake with literature-reported uptake values should be provided. The degree of uncertainty in the mammal regression equation should not be deemed low just because a positive correlation was observed. Revise the text to remove characterization of the uncertainty in the BAF for small mammals as low.	Calculation of BAFs	The small mammal regression was used in the BERA to predict small mammal tissue concentrations in the food chain model. The following text and analysis was added to Section 6.2.2.1. "For small mammals, there is some uncertainty regarding the range of PCB concentrations included in the dataset. To evaluate this uncertainty, the OU-4 model was compared to a model based on data from the Kalamazoo River. While a regression could not be developed for the Kalamazoo River dataset (Blankenship et al., 2005), the static BAF based on average soil concentration and average tissue concentrations was estimated for small mammals. The static BAF ratio based on the same assumptions used in the OU-4 BERA (i.e., combined shrews and small mammals using an assumption of 32% solids) is 0.314. This BAF predicts mammal tissue concentrations approximately 2 to 4 times lower than those predicted by the OU-4 regression. As such, the mammal regression employed is considered adequately protective and to have relatively lower uncertainty compared to the ratio BAFs for which no relationship was found."		Partially Yes	Although the site-specific regression equation was used to estimate small mammal tissue concentrations for the food chain models, the degree of accumulation in small mammals at this Site is lower than expected and has high uncertainty associated with it. The literature comparison was requested based on this uncertainty.	Although the Blankenship et al. 2005 paper provides a single data point for comparison, the BAFs presented in Ficko et al. (2013) should be included, as this paper presents several values for comparison and may provide more reliable BAF estimates.
32	The OU-4 plant PCB data is too limited to develop a regression. All of the OU-4 plant data fall within the 95% prediction interval for the Ficko et al. (2013) plant data. The Ficko et al. (2013) model should be used to estimate plant PCB concentrations.	Calculation of BAFs	This BAF is used as requested for terrestrial plants in addition to the use of the measured data. Literature values were also requested for mercury for <i>Lumbriculus</i> (response to Comment 19) and plants (response to Comment #33). A description of selected BAFs for PCBs and mercury is provided in Section 4.4.1.4 and 4.4.1.5.		Yes	Yes	
33	Mercury accumulation in terrestrial plants should be predicted using the BAF of 0.05 after Pant et al. (2011).	Calculation of BAFs	See response to Comment #32.		Yes	Yes	

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34	To address EPA's concern regarding quantifying the variation in the BAF term with respect to the uncertainty in the BAF, add a confidence interval around the BAF. Formulas from Snedecor and Cochran (1980) were provided for the ratio of means BAF and a paper by Clarke and van Gorder (2013) was provided for the confidence intervals on the geometric mean regression BAF. The confidence intervals described above are for BAFs having significant regressions. The regression BAFs are developed from x, y pairs of ProUCL-derived means by location group. They differ from the average BAFs developed for situations where the regression is non-significant in that the latter uses itemized tissue data.	Calculation of BAFs	Confidence intervals around the regressions (when significant regressions were found) are provided in Appendix B using standard methods for ordinary least square regression (and not geometric mean regression). For ratio BAFs, confidence intervals around the selected median values are also provided.		Yes	Although the revision was not exactly what was requested, confidence limits were developed for the BAFs and what was done was sufficient to address the comment.	
35	The dietary exposure models currently use exposure point concentrations (EPCs) for abiotic media calculated using all available data. Run the risk characterizations on the 2007 and 2009 data separately from all the data to highlight recent conditions.	Dietary Exposure Model Calculations	See response to Comment #113.		Yes, Partly	This comment was partly addressed by plotting data from various field events with different symbols on Figure 6-22. The calculations were not rerun but the data collected at different times were visually compared.	
36	For non-Hg metals, measured 95UCL tissue concentration forward risk calculations should be done, using a site-wide 95UCL tissue concentration estimate.	Dietary Exposure Model Calculations	Tissue EPCs for non-mercury metals are estimated based on the lower of the Site-wide 95% UCL and the Site-wide maximum, as described in Section 4.2.4 and presented in Tables 4-15 and 4-16.		Yes	Yes	
37	For mercury, risk characterization should take into account the proportions of methylmercury in the prey. This can be done one of two ways: 1) evaluate estimated exposures using both methylmercury (MeHg) and inorganic Hg TRVs either based on the assumption that each comprises 100 % of the mercury present in a sample. Literature data for % MeHg and inorganic Hg in different prey species can be used to discuss implications of using this approach in the uncertainty section, or 2) by estimating % of each form present within a matrix using information provided by EPA (Table 3).	Dietary Exposure Model Calculations	This evaluation is not included in the main component of the BERA risk calculations. Section 6.2.3.9 describes the uncertainty associated with the assumption of 100% methyl mercury used in the BERA and provides an example calculation for the Carolina Wren to demonstrate the impact of this uncertainty. Tables 6-22 and 6-23 provide the inputs for the calculations.		Yes	Although the revision is not what was requested, assuming that 100% of mercury present is methylmercury (MeHg) is a conservative approach and is sufficient to address the comment.	
38	For the forward risk calculations using measured tissue data, NDs should be included when calculating 95UCL tissue concentrations using ProUCL.	Dietary Exposure Model Calculations	NDs are included in all UCL calculations.		Yes	Yes	

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39	For aquatic biota, because there are issues with both the BAF models (models tend to under-predict measured tissue concentrations) and with the available tissue data (several reaches lack measured tissue samples), the dietary exposure models will be calculated two ways:	Dietary Exposure Model Calculations	The calculation of modeled exposure (using BAFs) and measured exposure (using 95UCL tissue estimates) is included, as described in Section 4.4.1.		Yes	Yes	
	1) Measured 95UCL tissue concentrations (calculated on an assessment area basis) forward risk calculations will be done for each reach using Reach-specific 95UCL abiotic EPCs.		Tissue UCLs are calculated on an AA basis and employed in conjunction with soil or sediment EPCs that are estimated on a reach-specific (i.e., aquatic EU) basis.		Yes	Yes, except they are using the 95UCL of the SWAC, not the 95UCL of the abiotic media concentration.	
	2) Assessment area-specific BAFs will be used to estimate prey tissue concentrations for Reaches where biota were not collected.		AA-specific BAFs are estimated for PCBs and mercury for all tissue types. As described in response to Comment #23, HQs are calculated two ways in the BERA: 1) based on modeled exposure (using BAFs) and 2) based on measured prey tissue. Both the BAFs and the tissue EPCs are estimated on an AA-specific basis.		Yes	Yes	
	3) When tissue concentrations are estimated for reaches that lack site-specific tissue data, the BAF should be applied to the 95%UCL of the abiotic media concentration in that reach.		As discussed in response to Comment #154, an SWAC-based UCL is employed as the sediment EPC, as described in Section 4.2.1.	No		No, they are using the 95UCL of SWAC, not the 95UCL of measured concentration in abiotic media as requested.	The impact of this issue is unknown. We need to know how different the standard 95%UCL is from the SWAC 95%UCL. Presentation of both parameters was requested in comments 52, 123, 154.
	4) When presenting final conclusions in Section 8, distinguish the reaches with modeled predictions from the reaches with measured data.		As described above and in response to Comment #23, HQs are estimated based on both modeled and measured prey tissue estimates in the revised BERA.		Yes	Yes	
40	Revise Table 4-13 so that it is clearer. Although there is no riparian area in Reaches 1 and 10, the risk calculations should be done on an assessment area basis. There is no need to adjust dietary percentages for riparian-feeding receptors in the UAA and the LAA. Scenario 1 should be added for sandpiper and mink.	Dietary Exposure Model Calculations	Risk estimated for Sandpiper 1 and mink 1 HQs were added (Tables 6-7a and 6-7b). The following text was added to the end of Section 4.3. "Note that for reaches C1 and C10, riparian habitat is not present. Risk to wildlife receptors exposed to riparian media in the food web models was evaluated using the UAA-wide riparian soil EPC for reach C1, and using the LAA-wide riparian soil EPC for reach C10. Additionally, metals were not analyzed in floodplain soil in reach C1. UAA-wide soil EPCs were used for metals to estimate risk associated with metals in reach C1. Uncertainties related to these assumptions are discussed in Section 6.2.1.1." Table 4-13 was updated (now Table 4-17) to improve clarity.		Partially yes	For data-poor Reach C1, the maximum detected concentration in Reach C1 floodplain soil should have been used as the EPC instead of the 95% UCL concentration for all riparian soils from UAA reaches combined.	

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41	The equation for deriving concentrations in eggs needs to be provided. From Office of Environmental Health Hazard Assessment (OEHHA) (2015) page 5-12, Equation 5.3.4.2: $C_{fa} = (Inhalation + Water\ ingestion + Feed\ ingestion + Pasture/Grazing\ ingestion + Soil\ ingestion) * T_{co}$. 1) C_{fa} = Average concentration in farm animals and their products (micrograms per kilogram [µg/kg]) ; 2) Inhalation, water ingestion, etc. = Dose through inhalation, water ingestion, etc. (micrograms per day [µg/d]) ; 3) T_{co} = Chemical-specific transfer coefficient of contaminant from diet to animal product (d/kg)	Bird Eggs	Equations were added to the document in Section 6 of Appendix B.		Yes	The correct equation has been included in Section 6, Appendix B.	After review of the equation, it should be adjusted by the bird's body weight to make it applicable to ecological risk assessment for smaller bird species.
42	OEHHA (2015) also has TCos for polychlorinated dibenzo-p-dioxin/polychlorinated dibenzofurans (PCDDs/PCDFs) and 9 inorganics, including Hg and lead (Pb). Estimated egg concentrations of these COPCs should be evaluated.	Bird Eggs	Egg concentrations were estimated mercury and HQs based on egg residues were included in the Draft BERA using the OEHHA TCos. However, use of these TCos requires a dose estimate. The estimated dose is then multiplied by the TCo to estimate bird egg concentrations, in effect applying a second BAF (and associated uncertainty) to calculate the bird egg HQ. For PCDD/PCDFs, the congener-specific BAFs have a high degree of uncertainty due to the limited OU-4 PCDD/PCDF dataset. Due to this uncertainty in the BAFs and use of an additional uptake factor (i.e., TCo), the egg-based HQs have greater uncertainty than dietary HQs estimated using only the soil-to-biota BAFs. Egg-based HQs were not calculated in the TEQ assessment because they do not provide value in evaluating the potential TEQ risk to birds in OU-4. Thus, only the dietary analysis is included in the BERA for PCDD/PCDF. A lead TRV based on egg residues is not readily available in the literature; therefore, egg-based HQs for lead were not included in the revisions because this analysis would only serve to increase uncertainty compared to the LOEs already evaluated.		Only partially	No, egg concentrations were only estimated for Hg.	No. There is probably no reliable egg CTC for lead and not including lead is acceptable, A sentence should be added to App. B Sect. 6 stating this was not done due to the general absence of egg-based TRVs for lead and other inorganics that can be used to evaluate this exposure route. There are CTC values available for PCDD/PCDF. Several potential sources for a CTC are cited in Harris and Elliott (2011). Cohen-Barnhouse et al. (2011) also provides CTCs for dioxin/furans in bird eggs for several species. Although there will be large uncertainty associated with the TCDD egg concentration estimate, this is no different than the uncertainty issues that they have for estimating PCB and Hg concentrations in eggs. Some bounding analyses

Commented [KK1]: I removed this: However, the formula in Section 6.1 on Page 6-4 is different from the formula in Appendix B.

The formula on pages 6-3, 6-4 is not for calculating egg tissue concentration, and it refers you back to Section 4.4, which refers you to Appendix B

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							could be included (lowest and highest PCDD/PCDF exposure dose estimated from the food web models along with the TCo to quantify how variable the results are.
43	Section 6.1.5.1, ME 5a and 5c: This should be 3 separate lines of evidence: 1) Estimated dietary exposure vs TRVs; 2) Estimated egg concentrations vs TRVs; 3) Estimated OU4 egg concentrations vs reference. Lines 2 and 3 are not discussed in the aquatic bird summaries pages 6-21 to 6-24, and are not shown on Table 6-12.	Bird Eggs	HQs for bird eggs are presented in Tables 6-9 and 6-10. In text summary tables referred to in this comment have been removed from the document. Results of the egg-based analysis are included in the text in Section 6.1.5.1 and egg-based analysis is included in the WOE summary table (Table 6-25). Egg concentrations vs reference for PCBs cannot be estimated because PCBs are ND in reference soil and sediment.		In general, yes.	The revision generally captures what was requested in the comment. Eggs have been included. Comparison to reference is not really discussed, but text has been included that explains why (lack of reference data, etc.). A more specific description would clarify the discussion, but is probably not necessary	
44	The quality and utility of the community survey data is highly dependent upon how they were collected. Unless field observations contain metrics that can be definitively associated with contaminant exposure, they should only have low weight in the weight of evidence; none of the community surveys included information on COPC concentrations at the survey sample locations. There is insufficient information presented in this BERA report regarding experimental design and statistical analysis methods used (e.g., type of experimental design, defining the experimental unit, randomness, sample unit independence, adequate spatial and/or temporal replication, power analysis) to evaluate whether conclusions based on the community surveys can be supported. The uncertainties associated with the statistical approach taken to evaluate the data, particularly in situations where the OU-4 site was considered as a single exposure unit, relative to reference, merit further discussion. Interpretation of differences (or lack of differences) between site and reference field survey data requires extensive evaluation and documentation of a wide range of potentially confounding factors that may affect the data (e.g., different site histories, underlying geology and soil types, land management practices, presence and potential influence of other	Community Surveys	The uncertainty text in Section 6.2.4 address the following key uncertainties. "Key sources of uncertainty include (1) adequacy of sample size per habitat type which affects statistical power to detect differences, (2) similarity of reference locations to OU-4 locations, (3) seasonal or annual variability, and (4) detectability." Uncertainties associated with each of these are discussed in detail. The WOE confidence ranking for all community metrics except for benthic invertebrates has been changed to low. Benthic invertebrates are considered moderate and this is discussed in more detail in response to Comment #12 through 15.		Yes, mostly	They have revised the text to indicate the community data is a secondary LOE except for benthic macroinvertebrate community data;more weight is given to the benthic community survey data.	The benthic community survey data cannot be used to down weight risk conclusions based on measured chemistry data in the WOE evaluation. The uncertainty associated with detected PCBs in sediment at the upstream Choccolocco Creek reference location (mono-, di-, and tri-chlorinated PCBs were detected in sample TXR1-02-P at low µg/kg concentrations) and in surface water and plants at reference location 2 should be discussed, especially if reference location 2 was included in the community survey reference sampling. PCB homologs were detected in surface water at REF-2 in ERT-02-43 sample at a total homolog concentration of 0.114

Commented [KK2]: Brad – please check this carefully and confirm my edits did not change the intent of you comment

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	stressors or other factors that may act to improve/impair quality of ecological measurements, etc.). Field data are highly variable spatially and temporally. For these data to be useful, they must be collected over an adequately large area, with sufficient replication, and over a sufficient time frame. The description of the field data presented in Section 2.1 suggests that all of the field data are of a rather short duration - a couple of seasons over at most a couple of years - and have limited replication and sample sizes. As a consequence, these data are not definitive measures of possible effects but rather supportive at best. Comparison of biological community metrics between OU-4 and the reference habitats should not be considered a primary and robust line of evidence for any assessment endpoint, or be identified as the line of evidence with the highest degree of confidence.						µg/L relative to the state standard of 0.014 µg/L. The highest concentrations of PCBs measured in plants were detected in aquatic plants from REF-2. Figures 2-1a through k and 2-2a and b do not appear to show the reference locations used for any of the RI/FS community surveys. It is uncertain whether the reference stations are not impacted by the site. Community evaluations that rely on comparison to reference locations are uncertain and this should be discussed.
45	The BERA needs to specifically identify which community surveys were not evaluated relative to reference areas (plants, aquatic birds and mammals), and note that this is a significant limitation for these receptors.	Community Surveys	A new table (5-3) was added to Section 5 to clarify which analyses were conducted for each community data type.		Yes, in part.	No. Although Table 5-3 addresses the 1 st part of the comment, they do not appear to have included text that identifies the lack of a reference as a significant limitation	The revision is adequate to address the comment.
46	All of the measurement endpoints related to COPC body burdens (ME1b, ME2b, ME3b, ME4b, ME6b) should state “comparison of measured concentrations of COPCs in organisms collected on-site with literature-derived tissue-based toxicity values”, not comparison of estimated tissue concentrations with concentrations in organisms from the reference area. Use of the site-specific bioaccumulation factor BAF to estimate tissue concentrations underestimates risk, increases the uncertainty associated with the risk estimate, and decreases the level of confidence in the risk conclusions; HQs should have been calculated using the actual measured tissue concentrations. When comparing the measured concentrations in biota to tissue-residue TRV, use the 95% UCL on the tissue concentrations as the EPC. Alternatively, tissue concentrations can be compared on a point-by-point basis and reported as frequency of exceedance.	Critical Tissue Concentrations (CTCs)	Although previous versions of the MEs (i.e., in the BPF) included comparisons to critical tissue residues (CTRs [referred to in USEPA comments as critical tissue concentrations or CTCs]), the initial BERA MEs did not include comparison to CTRs for most receptors. This revision was based on discussions with USEPA and a desire to limit CTCs to those COPCs and tissues for which a consensus value was available from multiple studies in the literature. For most tissues, these toxicity data are lacking; therefore, the CTC ME text was removed. As requested in this comment, the revised BERA includes comparisons of measured tissue 95 UCLs to CTCs for PCBs and mercury (when values are available) and the ME text has been reinstated (Table 2-16). CTC comparisons are not included for non-mercury metals, except for lead and vanadium in fish, for which ample data were available. The AE and ME table (2-16) and text were updated to reflect this change. As described in response to Comment #23 and #39, dietary HQs are presented based on both modeled and measured prey tissue estimates.	No		No. The recommended CTCs were not used in this evaluation. Comments on the selected CTCs are above, comments 7a-7g and 8a – 8f	No. Questions regarding the basis (dw or ww) and the acceptability (use of tissue concentrations based on sublethal effects measured in samples that were acutely toxic or where control survival was poor) of the selected CTC add high uncertainty to the risk conclusions.

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47	Measurement endpoints ME1b, ME2b, ME3b, ME4b, and ME6b should be evaluated quantitatively. Figures 6-1 to 6-9 show the OU-4 data compared with the reference data (based on average concentrations). Present a statistical analysis (literature-based CTC versus LAA, MAA, UAA and reference).	CTCs	ME Xb was revised to include both a comparison to reference and a comparison to CTCs. Tissue-based HQs were calculated for all tissue for which sufficient toxicity data were identified. CTC comparisons are evaluated statistically by comparing the 95 UCL tissue EPC for an AA to the selected CTC value (this is the equivalent of a one-sample T-test). Results are presented in Table 6-11 and are discussed in the risk characterization. Figures 6-4 through 6-9 present box plots of reference and site data (by AA) for soil, sediment and biotic tissue for PCBs and mercury. Box plots for non-mercury metals in soil and sediment are provided in Figures 6-10 through 6-14. Statistical comparison is provided where adequate sample size was available (Tables 6-13 through 6-15). For non-mercury metals in tissue and PCDD/PCDFs in all media, sample size precluded statistical comparisons. Mean site and reference concentrations are compared qualitatively and show on Figures 6-15 through 6-20.		Yes	Text/Tables were revised per RTC.	
48	The dietary exposure models should be re-run using measured tissue concentrations from reaches where data is available. For aquatic exposures, the risk calculations should be done on an assessment area basis.	Dietary Exposure Models	See responses to Comments #23 and #39. Both modeled and measured exposure estimates are provided on an EU and AA basis (using AA-specific tissue EPCs and BAFs in conjunction with EU-specific soil or sediment EPCs for each EU).		Yes	Yes	
49	Results of dietary exposure models run with measured tissue concentrations should be compared with the models run using the estimated tissue concentrations; this will provide a measure of the uncertainty associated with the estimated tissue concentrations.	Dietary Exposure Models	See response to Comment #48.		Yes	Yes	
50	Dietary exposure models for receptors that include <i>Lumbriculus</i> as a portion of the diet need to be clearly discussed in the text and presented on the appropriate Tables.	Dietary Exposure Models	The receptors that include <i>Lumbriculus</i> (i.e., benthic invertebrates) in diet are the sandpiper and raccoon. Table 4-17 and corresponding text in Section 4.5.2 were updated accordingly. In addition, the classification in Tables 4-1a, 4-1b, 4-2a, and 4-2b to distinguish between different types of invertebrates in receptor diet (see responses to Comments #108 and #110) provides clarity on this point.		Yes, partially	Partially	An expanded discussion of the source of the dietary proportion assumptions for the raccoon, and whether assuming 3% diet comprised of benthic invertebrates adequately addresses the reason this exposure scenario was requested should be added to the text.

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51	Section 3.0: There needs to be a comprehensive data inventory for all site-related data. This should include a table (or series of tables) that clearly summarizes the number of samples from each reach for each medium (abiotic media and biota) and the analytes that were measured. In addition, there needs to be a table or tables that summarize the number and types of field community surveys that were conducted, and where and when they were performed.	Editorial Comments – Must be addressed	New tables 3-1 through 3-3 have been added to summarize the data available for each EU and AA for each COPC. The specific data employed in BAF calculation (which is different from the site-wide dataset) is presented in Appendix B. The available community data are summarized in Section 2 and the collection locations are presented on the Figure 2-1 series. Text was added to Section 5.6 to clarify which community data were used in the quantitative evaluation of this LOE. Table 5-3 was also added to summarize this information.		Yes	Yes	
52	Tables 3-1 to 3-9, F-1: Summary statistics should be calculated by analyte, biota type, and area so that variation in concentrations among areas and biota can be readily evaluated. Graphical presentation as boxplots would also be helpful. Please revise.	Editorial Comments – Must be addressed	Summary statistics for each media type and COPC are provided in Tables 4-4 through 4-16. Box plots of PCB and mercury concentrations by AA and including reference are provided in Figures 6-4 through 6-9. Additional details for summary statistics for all media, COPCs, and exposure areas (site wide, AA, and EU) are provided in Appendix E. See also response to comment No. 47.		Yes, partially	No	To fully address this comment, regular sediment 95UCLs need to be provided on Tables 4-4 and 4-5 in addition to the SWAC UCLs. The 95UCLs based on all PCB and Hg concentrations measured in surface sediment by Reach and by AA need to be added.
53	Table 4-14: Need to include the regression for sediment to <i>Lumbriculus</i> .	Editorial Comments – Must be addressed	This table is now 4-20 and the selected regression was added.		Yes	Yes	
54	Table 5-2b: Tissue TRVs are presented in dry weight but the fish tissue data in Tables 3-1 to 3-3 are in wet weight, so they are not comparable. Present the tissue TRVs on a wet weight basis.	Editorial Comments – Must be addressed	While most of the tissue CTCs are based on wet weight data reported in the literature, the dietary models are based on dry weight tissue EPCs and TRVs. As requested, both wet weight and dry weight tissue CTCs are presented in Table 5-2b.		Yes	Yes. However, tissue concentrations were assumed to be wet weight (ww) if basis was not stated in the article.	No. If dry or ww is not specified, the conservative assumption that the cited value is dry weight (dw) must be used. Assuming the value is ww and converting it to dw results in a much higher CTC value that may not be protective.
55	Figures 5-2 and 5-3 should be presented as bar charts as opposed to line diagrams. Lines imply an association between measures - site and reference habitats are independent measurements.	Editorial Comments – Must be addressed	Figures 5-2 and 5-3 have been converted to a bar chart format.		Yes	Yes	
56	Table 6-12: Add rows to show the egg TRV comparison results where LOEC HQs are > 1.	Editorial Comments – Must be addressed	Table 6-12 and similar in-text HQ summary tables for wildlife were replaced in the revised BERA to incorporate HQs for both modeled and measured tissues. Egg-based HQs are also included in the revised tables (Tables 6-9 and 6-10a for birds)		Yes	Yes	

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				No	Yes		
57	Table 6-12: There should be two rows for the spotted sandpiper, Sandpiper - 2 and Sandpiper (alternate BAF).	Editorial Comments – Must be addressed	Based on the requested revisions to receptor exposure scenarios provided in USEPA Directed Comment Tables 4 and 5, the alt BAF scenario is no longer included. Rather, sandpiper-1 includes a diet of 50% terrestrial worms and 50% aquatic invertebrates (estimated based on the field collected odonate tissue) and sandpiper-2 includes a diet of 50% aquatic invertebrates (based on odonate tissue) and 50% <i>Lumbriculus</i> (based on lab data). These dietary compositions are described in Tables 4-1a,b and in Section 4.5.2.1		Yes	Yes	
58	Table 6-18: Add a row with the site-specific sediment toxicity thresholds for survival, growth, and reproduction; these should all be classified as exhibiting a low level of conservatism to overestimate population risk and a high confidence in risk prediction.	Editorial Comments – Must be addressed	This table is now 6-24. Consistent with the analysis conducted in the BERA, the table contains rows for survival endpoints and reproduction endpoints. The EC values for the most conservative result in each category provide the basis of the conclusions. The survival endpoint is ranked as low conservatism and the reproduction endpoint is ranked as moderate conservatism because of the variability in the control response (i.e., the actual effect threshold could be much higher). Both LOE are given an overall confidence of moderate/high. Reproductive endpoints were ranked as higher conservatism than survival due to less certainty in population-level effects and high variability in the test results. No changes were made for reproduction ranks. Growth endpoints were removed.		Yes	Comment was mostly addressed. The confidence in this LOE was identified as moderate/high as opposed to high (as requested).	
59	Table 6-18: Add ME2b to this table (comparison of measured COCs in tissues to literature-based TRVs).	Editorial Comments – Must be addressed	See response to Comment #46.		Yes, partially	The recommended CTCs were not used.	See comments 7 to 7f, 8 to 8d.
60	Table 6-18: Based on the uncertainties associated with the community data, Table 6-18 should be revised to state that the community evaluation exhibits a high “level of conservatism to overestimate population risk” and low “confidence in risk prediction”.	Editorial Comments – Must be addressed	This table is now 6-24. For the benthic community, no rank of conservatism is applied because assumptions were not made. The WOE ranking is thus, based on the underlying uncertainty associated with the evaluation. For the benthic community, based on the 158 observations, this uncertainty is considered moderate and the overall confidence in the WOE conclusions is considered moderate.	No		No.	The confidence in risk prediction based on this LOE should be changed from moderate to low. EPA’s scoring of the benthic community data indicated poor conditions in the upper EDR relative to fair conditions in the other EDRs and reference. The conclusion still states results indicate no adverse effects of PCBs on the benthic community, but there is no data on the PCB concentration in the community sediment samples.

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				No	Yes		
61	Figures 6-1 through 6-9: These data would be much more interpretable if error bars and sample sizes were noted for each bar. Ideally, these data would be presented as a series of side-by-side boxplots so that the full distributions, including outliers, is displayed.	Editorial Comments – Must be addressed	For PCBs and mercury, these figures were revised and data are presented as box plots, now numbered 6-4 through 6-9. Box plots for non-mercury metals in soil and sediment are provided in Figures 6-10 through 6-14. For non-mercury metals in tissue and PCDD/PCDFs in all media, mean site and reference concentrations are compared qualitatively and show on Figures 6-15 through 6-20. Sample sizes are shown on all figures.		Yes	Yes	
62	Tables B-44 through B-46 should show all small mammal data and show the non-detected results in red ink.	Editorial Comments – Must be addressed	The complete summary of the data with NDs in red is provided in Tables B-15 and B-16 for PCBs and mercury, respectively. These are consistent with the tables provided for all other tissue types. Based on the requested changes to the BAF approaches, all of the BAF tables included in Appendix B were revised.		Yes	Yes	
63	Tables B-36, B-37: It appears that B-flagged data was typically included in the tables as detected values. Confirm all B-flagged data are correctly indicated. Please discuss the uncertainty related to B-flagged values and how these were treated in the BAF calculations.	Editorial Comments – Must be addressed	B-flagged data are considered detected concentrations. All B-flagged data are for inorganic COPCs. The B flag in this case indicates an estimated value between the instrument detection limit and the reporting limit (RL). These values were included in the BAF calculations. Appendix E provides a sample qualifier key. Values indicated as ND in the referenced tables were re-verified.		Yes	Yes However, changes made to address the comment raised a broader issue of how the data was validated. Additional revisions may be required if the metals data were not validated.	The B flags appear to be the laboratory data flags that are often changed to J flags when the data are validated. The QAPP indicated that 5% of the data would receive Stage 4 validation. Solutia was contacted for information on the data validated conducted on the BERA validation. No response has been received yet. Figure 6-19 and the text in Section 6.1.1.2 my need to change once the metals data have been validated.
64	Tables B-36, B 37: Some J-flagged small mammal data are shown in red ink. These results need to be checked to confirm they are the result, not reporting limit (RL)/2.	Editorial Comments – Must be addressed	Tables were updated appropriately to show ND values in red at the full RL.		Yes	Yes	
65	On Table B-5, for the UAA, the sediment concentrations shown are for the LAA, while the fish tissue concentrations appear to be for the UAA. This comment applies to Table B-6 as well.	Editorial Comments – Must be addressed	This table was corrected. This issue did not affect the BAF calculations.		Yes	Yes	
66	Table F-1: Present the dioxin-like (DL)-PCB TEQ along with the total and PCDD/PCDF TEQs.	Editorial Comments – Must be addressed	The DL-PCB TEQ was added.		Yes	Yes	

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				No	Yes		
67	An additional Table with summary data (mean, range, sample size, number of detects) for all PCDD PCDF and DL-PCBs needs to be provided. The number of samples cited on page F-20 do not match the number of samples in Appendix E. Also, the mean TEQ values reported in Table F-1 cannot be replicated using either the surface sediment or soil data, or the surface data from samples near the BSAs.	Editorial Comments – Must be addressed	Summary statistics for all constituents (including PCDD/DF and DL-PCB data) were added to Appendix F.		Yes	Yes	
68	The site-specific toxicity thresholds are reported to several significant digits in Table C-1, but are reported to no decimal places elsewhere (e.g., page 5-7, Table 5-2a). Toxicity thresholds need to be reported to the appropriate significant figures (e.g., 1 vs. 1.38 mg PCB/kg for the EC0* for <i>H. azteca</i> survival-normalized reproduction, 7 vs. 6.8 mg PCB/kg for the EC10* for <i>C. dilutus</i> emergence). Toxicity thresholds and HQs should be reported to two decimal places.	Editorial Comments – Must be addressed	Toxicity thresholds are shown to one decimal place when less than 10 and greater than 0.1. Values less than 0.1 are shown at one significant figure and values 10 or greater are shown as whole numbers. Results are presented as number of exceedances of individual samples rather than HQs.	No		No	The toxicity thresholds need to be reported to the appropriate significant figures They also need to fix their conditional formatting and the greater than or equal to placement: LOAEL HQs greater than or equal to 1 should fall in the moderate risk category. They use the range low risk is greater than the NOAEL but less than or equal to a LOAEL HQ of 1. Because they have whole numbers, this means all HQs less than 1.5 fall in the low risk category. If they only want to show one figure, conditional formatting should be based on ≥ 1 not > 1.5. If needed, we can provide Pam a table showing the one decimal place using the spreadsheets we have prepared to check the risk calculations.
69	Section 6.2: The uncertainty section goes to great lengths to state that the whole assessment is conservative and that almost all of the uncertainties serve to overestimate potential risks . The actual data and available information do not support this assertion. Text should be modified to more accurately reflect that the assessment is not necessarily conservative.	Editorial Comments – Must be addressed	While it is true that in many cases, uncertainties were mitigated by making conservative assumptions that would likely result in overestimation of exposure or risk, the uncertainty analysis was modified to clarify when the uncertainty could result in either over or underestimation of exposure or risk.		Yes, partially	Parts of Section 6.2 were revised to say BAF uncertainty could over or under estimate the risk but the summary section still says the uncertainty overestimates risk.	Changes should be carried through to all sections.

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				No	Yes		
70	Page ES-7: States "Only one wild species with high sensitivity to PCBs, European starling (<i>Sturnis vulgaris</i>), is known to be present within OU-4." There are three high sensitivity species present within OU-4, the starling, ruby-throated hummingbird (Table 2-4 and 2-11), and the gray catbird (Table 2-11) (Farmahin et al. 2013).	Editorial	The text in the executive summary has been modified as follows: "Three wild species with high sensitivity to PCBs, European starling (<i>Sturnis vulgaris</i>), ruby-throated hummingbird (<i>Archilochus colubris</i>), and the gray catbird (<i>Dumetella carolinensis</i>), have been observed within OU-4."		Yes	Yes	
71	Global: Capitalize the "l" in <i>Lumbriculus</i> .	Editorial	The requested change was made.		Yes	Yes	
72	Section 2.3: For the dietary exposure models, HQs represent a modeled exposure estimate compared to a literature-based toxicity value. For all other HQ calculations, the HQ is a comparison of measured COPC concentrations to literature-derived benchmarks.	Editorial	Based on the modifications to the BERA that include dietary HQs for both measured and modeled tissues, the comment is no longer relevant and no changes to the BERA were necessary.		Yes	Yes	
73	Table 2-3: Expand this table to provide details on fish species and tolerance.	Editorial	A column characterizing species as (I) intolerant, (M) moderately tolerant, or (T) tolerant was added to Table 2-3.		Yes	Yes	
74	Table 2-5: The text describes bobcat tracks observed at the reference location. No bobcat on Table 2-5.	Editorial	Bobcat were observed in Reference Area 2 (Cheaha Creek) in spring 2007. Table 2-5 reports observations during the aquatic habitat surveys. The bobcat is noted on Table 2-12 which reports the terrestrial habitat surveys and as a result, no changes were necessary.		Yes	Yes	
75	Table 2-16: What is footnote 1 for?	Editorial	This footnote was removed.		Yes	Yes	
76	Section 3.0: States "Data inputs needed in this OU-4 BERA to evaluate the assessment endpoints (AEs) and MEs identified in Section 2 include abiotic (i.e., surface sediment, water, and soil) and biotic (i.e., prey tissue) media COPC concentrations." Revise as: Data inputs needed in this OU-4 BERA to evaluate the AEs and MEs identified in Section 2 include abiotic (i.e., surface sediment, water, and soil), biotic (i.e., prey tissue) media COPC concentrations, and site-specific toxicity data. Secondary lines of evidence include community and population metrics data.	Editorial	Section 3 text was revised as follows: "Data inputs needed in this OU-4 BERA to evaluate the AEs and MEs identified in Section 2 include abiotic (i.e., surface sediment, water, and soil) and biotic (i.e., prey tissue) media COPC concentrations, and site-specific toxicity tests and community analysis. Secondary lines of evidence include community and population metrics data. "	No		No. The first part of the paragraph in the RTC was added to Page 3-1 as requested. However, the last sentence of the paragraph was not added. The essence of the comment was not addressed. The sentence about the community and population metrics serving as secondary lines of evidence was not included.	No.
77	Page 3-11: Indicate the plant tissues that were collected.	Editorial	There were 24 species collected in total across OU-4 and the reference areas. It is not feasible to list all 24 in text. Specific plants collected in each sample can be seen in Table 4 in Appendix E.	No		We requested tissues (e.g., root, leaf, seed), not species	No.
78	Section 4: Explain the methodology used to generate the OU-4 floodplain boundary and the rationale for not utilizing the Federal Emergency Management Agency's (FEMA's) 100-year floodplain, particularly because PCBs have been measured at elevated concentrations outside the boundaries of the study area used in the OU-4 BERA.	Editorial	The following text was added to Section 3.2 "The FEMA 100-year floodplain was not used exclusively for the project as it does not incorporate a significant amount of relevant data that have been collected for the Site. The hydraulic flow model that was used by FEMA to establish the 100-year floodplain was used as an initial starting point and was supplemented with site-specific data for		Yes	Yes	

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				No	Yes		
			Choccolocco Creek and the associated floodplain. These data included surveyed elevations for more than 100 creek-channel transects located along Choccolocco Creek and USGS Digital Elevation models for the floodplain. Other improvements to the FEMA model included a review of the aerial imagery to adjust roughness coefficients, and site photographs were used to improve information at the bridge cross sections. The development of the 100-year floodplain using the FEMA model is described in Appendix D of the Off-Site RCRA Facility Investigation (RFI) Report (BBL 2000). Subsequent to this effort, the floodplain was adjusted in 2010 using updated Digital Elevation models from the USGS and the surface water elevations from the HEC-RAS surface water flow model developed during the Off-Site RFI program. The overall process to update the floodplain footprint and the resulting minor adjustments are described in Attachment A of the Phase 3 Field Sampling Plan for Operable Unit 4 (Arcadis 2010b). The process of updating the 100-year floodplain in 2010 resulted in the minor expansion of several areas."				
79	Section 4-4, Equation 2: The equation does not match the parameters in Tables 4-1 and 4-2. Soil ingestion in the tables is reported as a percent of diet whereas in the equation it is a normalized kg/kg/d rate (normalized ingestion rate _{soil} [NIRs]). Need to explain the conversion and make the terms consistent. Either drop the dietary fraction _{soil} (DFs) term because NIR _s already addresses soil ingestion, or NIR _s should be NIR _f to accurately represent scaling of food ingestion for the percent of soil ingested. It should be noted that food ingestion in this model is not a function of which food type but rather of all food. Scaling of food ingestion occurs as a function of both the COPC _k and FR _k terms. NIR should not really have a 'k' subscript, but rather an 'f' subscript to represent food. Define NIR _w .	Editorial	The equation presented in Section 4.4 was updated to be consistent with the exposure parameters tables (Table 4-1a,b and 4-2a,b).		Yes, mostly	NIR _w was not defined	
80	Please apply the comments on exposure parameters presented in Tables 4-1a, 4-1b, 4-2a, and 4-2b to the exposure parameters presented in these Appendix F Tables 2a, 2b, 3a and 3b.	Editorial	The exposure parameters evaluated in the BERA are consistent for all COPCs, including PCDD/PCDFs in Appendix F. Appendix F exposure parameter tables (F-4a through F-5b) are consistent with Section 4 exposure parameters tables (4-1a through 4-2b).		Yes	Yes	
81	Section 4.5.2, Page 4-25: Drinking water ingestion rates (IRs) were actually calculated using Calder and Braun (1983).	Editorial	Section 4.5.2 discusses dietary composition. The drinking water ingestion methodology is discussed		Yes	Yes	

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				No	Yes		
			in Section 4.5.3 with the appropriate reference and thus no updates to the BERA were necessary.				
82	Tables 4-1a and 4-1b: All cited home ranges should be converted to the same unit (acres).	Editorial	The home ranges are presented differently at the request of USEPA to account for those receptors that have linear home ranges.	No		No. For example, Table 4-1a, for tree swallow: lower bound is 0.1 km, central tendency is 225 m, upper bound is 0.3 ha	This was an editorial comment intended to clarify the text, not a critical comment.
83	Tables 4-7, 4-8: Please add acreage of each subgroup be added to this table.	Editorial	The acreage was added to the text in Section 4.1.1 in the bullets that describe the reaches and EUs.		Yes	Yes	
84	Figures 4-2a through 4-2k show the PCBs measured in soil and sediment in the 10 reaches. A similar set of figures for mercury measured in soil and sediment should be included for visualizing the distribution of mercury.	Editorial	Figures showing mercury concentrations were added to Section 4 (a new Figure 4-3 series presented in the same format as the Figure 4-2 series for PCBs).		Yes	Yes	
85	Section 5.5.5: Cites “Environmental Contaminants in Wildlife: Interpreting Tissue Concentrations (Thompson 1996)”. This citation should be updated to the more recent version of this book (Shore et al. [2011] in Beyer and Meador 2011).	Editorial	This citation was updated.	No		No-the text in Section 5.5.1.2 still references Thompson 1996	
86	Table 5-2b: Why were Eco-SSLs for lead not used?	Editorial	The Efroymsen values were selected because they are more protective. The screening tables were revised to use the EcoSSL values for terrestrial plants and invertebrates as requested.		Yes	Yes	
87	Page 6-9: States “For these metals, concentrations in the OU-4 Areas are generally similar to or lower than in the ERAs, suggesting that metals detected in plant tissue along Choccolocco Creek are not different from reference areas.” For chromium, mean OU4 levels are four to almost seven times greater than reference. Vanadium is also greater in OU4 than in reference. The text should be revised.	Editorial	Sections 6.1.1.2, 6.1.2.2.2, 6.1.3.2.2, 6.1.4.2.2, 6.1.5.1.2 and 6.1.6.1.2 include a detailed description of how OU-4 and reference conditions compare for each COPC. While based on small datasets, these text sections discuss when OU-4 concentrations appear to be higher than reference conditions.		Yes,for the most part.	Yes, The reference comparison was included as requested. However, due to limited data, high RLs for ND samples, and undocumented data quality for metals the strength of evidence for the conclusions is low. This may affect whether inorganics can be eliminated as COPCs and may also affect the constituents monitored in surface water during remedy construction and in post remedial monitoring.	In addition to revisions that were made, the concentrations of PCBs in aquatic plants at OU4 should be compared to the reference areas, noting that the concentration of total PCBs in aquatic plants at the REF-2 location were substantially higher than observed in OU4 in Section 6.1.1.2 on Page 6-7. The revised BERA did not include a CTC for evaluating the tissue residues of total PCBs in aquatic plants. There is no suitable CTC value for the revised BERA to use. The highest concentration of total homolog PCBs in either aquatic or terrestrial plants was 6 mg/kg in dry weight at REF-2. The maximum concentration

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				No	Yes		
							of total PCBs in aquatic vegetation from Cheaha Creek produced a LOAEL hazard quotient above 1 for the muskrat (using exposure parameters from the OU1 ERA).
88	Pages 5-11, 6-82: The Hansen, Schimmel and Foster conference proceedings study of the sheepshead minnow should be Hansen et al. 1973 instead of 1974. Please correct the reference.	Editorial	This citation was updated.	No		Text still says 1974	
89	Page 6-43: States, "Overall, the [herptile] tissue PCB data collected from the OU-4 Areas indicate concentrations that are relatively higher than the ERAs. ...This result is also similar to the relative PCB concentrations in small mammal tissue, and might be expected based on the relatively high mobility of these receptors." Tissue concentrations in small mammal tissue in the OU-4 areas were twice the tissue concentration in reference small mammals. Tissue concentrations in herptiles were 25 to 40 times higher in the OU-4 area than the reference area. The text should be amended accordingly.	Editorial	The text has been modified as requested to indicate the magnitude of the difference between site tissues and reference tissues. Section 6.1.6.1.2 reads "There are no statistically significant differences between mean small mammal tissue concentrations within the MAA and LAA (Table 6-15), but mean tissue PCB concentrations in the ERA were about one-half the tissue concentrations in the OU-4 AAs." Section 6.1.7.2 reads "Mean reptile and amphibian tissue concentrations in the ERA are significantly lower (30 to 170 times) than in the OU-4 AAs."		Yes	Yes	
90	Page 6-47: Exposure of terrestrial wildlife receptors to mercury and other metals in Reach C-1 was not evaluated, as metals were not analyzed in soil samples from this reach. Tissue samples were not collected in Reach C-1, either (Table 4-3, BERA report). The uncertainty associated with the lack of site-specific data, and risk calculations for this area, should be highlighted.	Editorial	The following additional uncertainty text has been added to Section 6.2.1.1 to address this issue: "Data for mercury and other metals in soil are not available for the Snow Creek reach (C1). In this BERA, exposure to metals in this area is uncertain. For non-mercury metal COPCs in OU-4, concentrations are generally similar to reference areas and/or, there is no upstream to downstream trend, and the metals are not associated with historical Site use. Therefore, Site-related risk due to non-mercury metals is not anticipated in Snow Creek. The lack of non-mercury metals data in Snow Creek is not considered to significantly affect risk conclusions for this OU-4 BERA. For mercury, the lack of soil data in reach C1 represents an uncertainty. In sediment however, sediment mercury concentrations in C1 are similar to those for the Choccolocco Creek AAs (Figure 6-7), and therefore it is reasonable to assume that soil mercury concentrations in the UAA (and associated ecological exposures and risk) would also be similar to those in reach C1."	No		See RTC 87	No.

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91	Page 6-75, Equation 9: All input values used in Equation 9 need to be specified and supported.	Editorial	Definitions were added or clarified for all parameters in Equation 9 and the associated text of the BERA (Section 6.2.3.7) has been clarified.		Yes	Yes but this is actually equation 8 now.	
92	Page 6-95: Remove the italicized part of the conclusion: "Results of the ecological community assessments indicate that, in general, OU-4 conditions are similar to reference, <i>and therefore, there appear to be no adverse effects of PCBs or other COPCs within OU-4</i> ". There are no associated media chemistry data to support any statements regarding effects of COPCs on community structure.	Editorial	This statement was revised as follows: "Based on this analysis, although there is variability in the benthic community for the two years evaluated, overall results suggest no adverse effect of PCBs or other COPCs on the benthic invertebrate community and overall health within OU-4 can be considered comparable to reference areas. While sediment chemistry is not specifically co-located with the community assessment locations, the fact that the sediment PCB concentrations are higher in OU-4 than in reference locations suggests that PCBs are not impacting the community. There is moderate level of confidence in this line of evidence because although it was based on 158 site-specific observations, the survey was spatially and temporally limited in scope."	No		No.	No sediment samples for COPC analysis were collected at the time and location of community samples. The text should be revised to say "low level of confidence."
93	Page 6-106, first bullet: Although high risk was predicted for carnivorous birds in Reach C1, the confidence in the prediction was moderate because cooper's hawks and barred owls were observed at the site. Text should be revised to remove statements linking moderate risks to observations of birds, because there is limited power in the observational data to detect whether there was potential impact to the bird community.	Editorial	All WOE discussions have been updated based on revisions to the overall approach in the BERA. The specific WOE for the carnivorous bird has been revised as follows in the 2nd bullet under the Carnivorous Birds sub-heading in Section 6.3.6.2. "Dietary HQs based on mid-sensitivity avian TRVs indicated that risk is negligible in all EUs within the LAA as well as C5 North. Predicted risk is low in C3 and C5 South, and moderate in all remaining EUs except C1 West where predicted risk is high. This evaluation is considered to be moderately conservative because the mid-sensitivity PCB TRVs are based on mourning dove studies, which are ecologically relevant and adequately representative of birds present onsite. Because the HQ results are based on doses estimated using predictive models for prey tissue across the full range of PCBs measured in OU-4 soils, receptor specific parameters, and appropriate TRVs, and also because the red-tailed hawk and other carnivorous birds have been observed onsite, confidence in the risk prediction for terrestrial carnivorous birds based on this LOE is moderate to high."		Yes	Yes	
94	Section 6.1.2.2, ME2b: This ME should be revised to state: "Body burdens of COPCs in OU-4 benthic invertebrate tissue as compared to tissue residue-based toxicity values and to concentrations measured in tissues collected in the reference area(s).	Editorial	This and other ME related to CTCs were updated in Table 2-16 in all cases where acceptable CTCs were identified. See also response to Comment Nos. 7, 46, 47, and 176.		Yes, partially.	Table 2-16 was updated to include the comparison of body burdens to CTCs as AEs whereas the initial draft only compared body burdens to reference body burdens, not to	Although the comparison was done, questionable CTCs were utilized in the comparison (see comments 7a-7f, 8a-8f)

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						literature-based CTCs as the ME in the Problem Formulation stated.	
95	Section 6.2.1.1: States “Changes in sediment deposition over time, such as increased sedimentation or erosion losses, may have occurred such that the surface soil/sediment dataset used in this OU-4 BERA is no longer representative of current conditions. Deposition of clean sediments or soils over historically contaminated materials may reduce exposure, or sediment removal in eroding areas may expose historically elevated concentrations of some COPCs.” Are there data to quantify this? If there are, this information should be included so that the implications of this can be quantified and used to improve the uncertainty analysis. What proportion of the site is depositional and what portion is erosional? How do these areas relate to risk estimates?	Editorial	The following information was added to the uncertainty analysis under a new sub-heading for exposure point concentrations (6.2.1.2) "For sediment EPCs, specifically, the EPC is weighted based on the estimated spatial extent of the three texture classes (i.e., fine, coarse, gravel) identified in OU-4 sediments. An evaluation of the visual classification of sediment cores (using the Unified Soil Classification System) collected from more than 180 transect locations in OU-4 indicated that much of Choccolocco Creek is composed of coarse-grained materials consistent with a high-energy non-depositional environment. For the 413 acres of creek between Snow Creek and the Highway 77 bridge, 174 acres can be characterized as consisting of gravel and having no recoverable material (42%) and 183 acres were classified as coarse grained (44%). This leaves only 56 acres (14%) defined as fine grained and likely depositional. Because the sampling for OU-4 was disproportionally focused on depositional areas, an approach to estimating EPCs based on the spatial area of each texture class was used. Thus, uncertainty associated with the class assignments may affect the estimated sediment EPCs." In addition, regarding potential changes in deposition or erosion over time, Table R-1 (attached) shows that PCB concentrations in surface sediment are higher than subsurface concentrations in areas of Choccolocco Creek downstream of the backwater area, making the current exposure estimates protective. The PCB concentrations are higher in the Backwater area subsurface sediment than in the surface sediment, but sediments in this area are stable making the exposure of ecological receptors to deeper sediments unlikely. See response to Comment #137 regarding sediment stability and 155 regarding the proportion of the site that is depositional.		Partially.	No. The text added to address the comment did not address sediment stability relative to Principals of Contaminated Sediment Management, Principal #4–Develop and Refine a Conceptual Site Model that Considers Sediment Stability.	The missing information could be addressed in the FS, but it will be needed prior to the proposed plan.

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				No	Yes		
96	Section 6.2.1.1: States “Additionally for metals, only total metals were analyzed. The toxicity of many metals, notably including mercury, depends strongly on the oxidation state, presence of methylation, and other site-specific factors (such as presence of iron sulfide, or co-occurring metals) that influence uptake and effects. Thus, measurement of total metal concentration likely overestimates actual risk from most metals, because the specific form and toxicity of these metals in OU-4 is not accounted for.” For mercury, there is sufficient literature supporting the assumption that the majority of mercury present in fish tissue is MeHg, the most toxic form. As requested in Comment #37 (for the percentage of methylmercury in prey items to be factored into the risk equations) and in Comment #4 (consideration of the SEM-AVS data), which consider the form present, the text will need to be revised to remove statements that measurement of total metals likely overestimates the risk.	Editorial	The text regarding this uncertainty in the last paragraph in Section 6.2.1.1 under the Analytical Methods sub-heading is revised as follows: "Thus, measurement of total metal concentration may overestimate risks from some metals to specific receptors, because the form and toxicity of these metals in OU-4 is not accounted for. Additional information regarding the speciation of mercury and effects on risk estimates is presented in Section 6.2.3.9."	No		No, the text still states that risks are overestimated for some metals. However, Hg is evaluated using the conservative assumption that all Hg present is MeHg.	
97	Section 6.2.1.5: States “All selected exposure parameters are likely to overestimate potential exposure to actual wildlife present in OU-4.” Statements like this need to be quantitatively supported. It is not unusual to need to approximate diets based on available tissue data. This is a real uncertainty, but it may result in either over- or under-estimation of risks.	Editorial	This statement in Section 6.2.1.5 (now 6.2.1.6) was revised to state: "The selected exposure parameters are likely to accurately represent or overestimate, but not underestimate potential exposure to actual wildlife present in OU-4, as the exposure parameters were selected to be more protective (i.e., high ingestion rates, low body weights, 100% site use/exposure to the upper bound of concentrations). For several of the selected representative receptors, significant uncertainty in the availability of preferred prey items in OU-4 was identified. Therefore, alternative diets were also considered. "	No		No, they do not acknowledge that risks may be underestimated.	No.
98	Section 6.2.2.1: States “It was also necessary to convert the estimated tissue to a dry weight value to be consistent with the dry weight IR used in the dose model. The average percent solids of 19% (84% moisture) was used for this purpose.” If the dose model is using a dry weight ingestion rate, why not perform the regression using dry weight concentrations? Doing this post-regression wet-dry conversion using an average moisture content adds uncertainty to the estimated results. Sample-specific moisture values should have been used to reduce the uncertainty.	Editorial	The regression shown in Figure 6-23 was performed on a dry weight basis and the fit was not significant. The only fit that was significant was on a wet weight basis. The static assumption was necessary to compare possible results based on this regression to the results in the Draft BERA. No change was needed.		Yes	Although the comment was not addressed as requested, the response was sufficient to address the comment.	

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				No	Yes		
99	Section 6.2.2.1: States “To further evaluate the predicted sediment median BAFs based on the OU-4 data, BAFs available for two other PCB sites were considered.” When comparing the BAFs developed for Anniston with those developed for other sites, please note the uncertainty in the OU4 BAFs on account of the limitations in the degree of co-location of tissue and sediment samples; comparisons to PCB BAFs from other sites should be caveated.	Editorial	The following text has been added to Section 6.2.2.1 to address this issue: "Differences in the OU-4 BAFs/BSAFs relative to those estimated for the Kalamazoo River and Housatonic River may be due to a variety of factors, including differences in the composition of PCBs at the sites, site-specific factors affecting bioavailability, and the degree to which abiotic and biotic samples were co-located (for OU-4, data were not precisely co-located)."		Yes	Yes	
100	Table D-2: The acute and chronic values appear to be reversed.	Editorial	The acute and chronic values were corrected in Table D-2 and Table 5-2b.		Yes	Yes	
101	Table D-4, 5, 8, 9 and 10: More information should be included in this table - test species, test duration, number of doses, PCB form used, etc. Body weights and ingestions rates used to estimate doses should be as reported in the studies (i.e., Lillie et al. 1975 report different food ingestion rates for each dose and Aroclor tested). If values are not reported, food ingestion should be derived based on the chicken strain and test animal age using information from U.S. EPA (1988).	Editorial	Clarifying information, such as the number of doses, species tested, test duration, and PCB form was added to the tables in Appendix D. Note that these tables have been renumbered. Body weights and ingestion rates from the studies were used when available. If these parameters were not reported in the study, generic assumptions from USEPA (1993) and Nagy (2001) were used, consistent with the BERA.		Yes	Yes	
102	Inconsistent terminology is used throughout the BERA to describe the site-specific toxicity thresholds (e.g., also referenced as benchmarks or criteria).	Editorial	Terminology has been made consistent throughout the BERA. Site-specific sediment toxicity thresholds are called out as such. Other literature derived soil or sediment-based values are referred to as benchmarks. Toxicity values for birds and mammals based on dietary dose are referred to as toxicity reference values (TRVs). Toxicity values for invertebrates, fish, bird eggs, and small mammals based on tissue residues are referred to as critical tissue concentrations (CTCs).		Yes	Yes	
103	Terms including “similar to reference”, “impairment in some LOE” and “impairment in many LOE” are not clearly defined throughout the OU-4 BERA.	Editorial	The term impairment has been removed from the BERA. The term similar to reference is explained with each use. As an example, text in Section 5.6.7 for the mammal community metrics describes the term as follows: "Mean abundance and species richness were higher, although not significantly so, in OU-4 compared to reference. Diversity and dominance do not significantly differ between OU-4 and reference locations. Based on these results, the condition of the large mammal community within OU-4 appears to be similar to reference areas." In some cases, in order to improve readability of the text, these terms are used and supporting tables or figures are referenced that provide specific information clarifying the statements.		Partially Addressed	No. Text was changed but the original language remains in Table 6-24 of conclusions. Table 6-24 still uses terminology, “no impact indicated.” The revision was intended to change the text to, “similar to reference.”	EPA may have to come up with its own version of Table 6-24 to include in the proposed plan or ROD.

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104	Page 3-10, Appendix B: The description of the emergent insects should discuss how they were collected and whether adult or larval forms were collected. The Phase 2 FSP (Arcadis 2010a) indicated that benthic invertebrate sampling would include EPT species for larval and emergent life stages. There should be a discussion of what was collected relative to what was included in the FSP. Include a discussion of the number of samples collected versus the number of samples planned.	Emergent Insects	Additional text was added to Section 3.4 for each type of species collected that describes what was targeted and what was collected. In addition, two tables have been added that summarize this information. (Tables 3-13 and 3-14 for aquatic and terrestrial species respectively).		Yes in general	No, they did not discuss the number of samples collected versus the number of samples planned.	Although what was done was not what was requested, the revision made was sufficient.
105	Section 3.4.1: Hymenoptera are not aquatic insects, but were included in the emergent insect samples. Halictid sweat bees are wholly terrestrial, nesting in the ground and foraging on plants. Why are sweat bees not mentioned in Appendix B?	Emergent Insects	The following footnote was added to the species list for emergent insects in Section 3.4" While Hymenoptera and Halictidae are not aquatic species, they were collected in the general area proximal to the creek where other emergent insects were collected in order to obtain adequate sample volumes for analysis."	No	.	No. Although this was added as a footnote in Section 3.4 the Presence of halictids in emergent insect samples was not discussed in Appendix B.	No. The fact that this taxa is included in the emergent insect category adds uncertainty and reduces the relevance of the emergent insect uptake models. Terrestrial insects are not related to the exposure system they are being assigned to (aquatic). This should be addressed in the uncertainty section. It is critical to know how much of the sample biomass was non-aquatic species in order to interpret the utility of the aquatic tissue values. EPA may need to incorporate literature studies or rely more heavily on Lumbriculus data. May need to revise Table 6-24 for this AE to reflect lower level of conservatism and moderate confidence in risk prediction.
106	The Biota-sediment accumulation factors (BSAFs) calculated for dragonflies and damselflies are significantly lower than those reported for bioaccumulation of PCBs into emergent insects at other sites, which ranged from 0.1 to 1.1 for total PCBs in the EPA BSAF database. To address uncertainty in the bioaccumulation factors for benthic invertebrates, literature values for bioaccumulation into emergent insects, or the crane fly data, should be used to predict PCB	Emergent Insects	As described in responses to Comment Nos. 23 and 39, both modeled and measured tissue concentrations were evaluated in the revised BERA. In addition, the full range of BAFs based on crane fly and non-crane fly data were incorporated. The following text was added to the last subheading "Use of crane fly data for emergent insects" in Section 6.2.2.1 in the uncertainty analysis. "Literature values specific to crane flies were not available for comparison. However, as discussed below, data for emergent insects from the		Yes	The revision was not exactly what was requested, however, based on evaluation of the Kay et al. (2005) paper relative to the OU4 results, additional info is not needed.	The numbers in the text in Section 6.2.2.1 need to be fixed.

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	concentrations in infaunal emergent insects. Text on Page 6-57 should be revised to address the species collected as well as issues related to unknown degrees of exposure to contaminant concentrations in sediments including the sediment data pairing and sampling data concordance.		Kalamazoo river would suggest that the crane fly-based BAFs are likely to be overestimating uptake. While there is uncertainty associated with these elevated concentrations, they are based on validated data and are used in the BERA. The two crane fly samples affect exposure estimates for aquatic insectivorous birds and mammals within the UAA (including reaches C1 through C4) and may over predict exposure. The emergent insect BAFs employed for the MAA and UAA were based on samples primarily containing damselflies and dragonflies (odonate species). These BAFs were compared to BAFs estimated using an available dataset from the Kalamazoo River (Kay et al., 2005). For all aquatic insects, a BAF of 0.54 was calculated based on the mean tissue (0.74 mg/kg ww converted to 2.39 mg/kg dw assuming the average of OU-4 emergent insect samples of 31 % solids) compared to the mean sediment concentration of 4.46 mg/kg dw. This BAF is very similar to the 0.56 and 0.53 BAFs calculated for OU-4 for the MAA and LAA respectively. A BAF value for odonates only (the species collected for the MAA and LAA), is estimated to be approximately 0.15. Thus, the selected BAF for the two downstream areas is considered adequately conservative."				
107	The evaluation of exposure of higher trophic levels to emergent aquatic insects was based on a mean PCB concentration calculated across all emergent aquatic insect taxa sampled within each of the 10 reach sites (page 4-20). BAFs for emergent insects should be calculated on BSA and an assessment area basis. Crane flies should be evaluated separate from the other types of emergent insects. The dragonflies, damselflies and misc. winged insects can be combined and evaluated with separate grouping for BSAs and EDRs.	Emergent Insects	See responses to Comment Nos. 29 and 106.		Yes	Yes, it appears to have been addressed.	They are using 31% aquatic spiders, detritivores for the Carolina wren. What tissue data are they using for aquatic spiders, detritivores?
108	Table 4-1a, 4-1b, 4-2a and 4-2b indicate that no receptors eat terrestrial invertebrates (worms). Worms should be included as a dietary component for the appropriate receptors.	Exposure Parameters	Tables 4-1a,b and 4-2a,b were updated as requested in USEPA Comment Table 4 (exposure parameters for birds) and Table 5 (exposure parameters for mammals).		Yes	Yes	
109	Terrestrial invertebrates should have also included spiders/detritivores in addition to the herbivorous insects that were collected (Phase 2 FSP, Revision 2, page 50: Measured concentrations of COPCs in prey [e.g., edible plants, invertebrates [including spiders]]). Instead of using a literature-based BAF for	Exposure Parameters	The portion of the receptor diet comprised of detritivores and spiders is estimated using the worm regression equation (or measured worm tissue). The portion that is comprised of crickets or grasshoppers is comprised of tissue estimates based on site-specific mercury data or estimated using literature PCB BAFs for terrestrial insects		Yes	Yes, the earthworm data are site-specific and based on analyses we conducted during review of the 1 st draft they are adequately protective/representative of spiders.	

Commented [E3]: I checked the BAFs for emergent craneflies and dragonflies from Kay et al. 2005. I get a BAF of 1.03/4.09 =0.252 for nematocera (craneflies) and 0.32/4.09=0.078 for odonates.

So, overall the OU4 results are higher than what is seen in the Kalamzoo

Commented [E4]: This is an error – Based on Table 1 in Kay et al. 2005, 4.46 is %TOC in sediment. Total PCBs are 4.09 mg/kg dw. Using this corrected PCB value, the BAF is 0.58.

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	spiders, the terrestrial worm data should be used as representative of all terrestrial invertebrate tissue concentrations.		from Blankenship et al. (2005). These approaches are summarized in Sections 4.4.1.1 and 4.4.1.5 and described fully in Appendix B (Sections 4.4 and 4.5). See also response to Comment No. 30.				
110	Table 4-1-a, 4-1b: Several receptors are indicated as feeding on aerial invertebrates that should be consuming terrestrial invertebrates (Carolina wren, spotted sandpiper, blue jay). See Tables 4 and 5 for recommended diet composition percentages.	Exposure Parameters	Tables indicate that all terrestrial invertebrates and insects should be modeled using the earthworm data in spite of the fact that portions of receptor diets are identified as crickets and grasshoppers. The earthworm model was used for detritivores and worms and the grasshopper data were used for that portion of the receptor diets.		Yes	Yes	
111	Because they represent very different exposure pathways, reptiles and amphibians should not be combined as a dietary component. The exposure parameters need to be better refined so that the appropriate measured tissue concentrations/BAFs may be used independently. See Tables 4 and 5 for recommended diet composition percentages; the revised percentages of reptiles and amphibians were taken from U.S. EPA 1993.	Exposure Parameters	Reptile and amphibian portions of receptor diets were separated as outlined in USEPA Tables 4 and 5. See response to Comment No. 28.		Yes	Yes	
112	Hazard quotients are presented for terrestrial receptors in Tables 6-4 & 6-5 that include receptors having a diet consisting of a mixture of terrestrial and aquatic prey items, including reptiles and amphibians for terrestrial receptors and small mammals for carnivorous wading birds. Clarify how the bioaccumulation factors for reptiles and amphibians exposed to sediment or small mammals exposed to soil were used and how this information was incorporated into dietary exposure calculations for these receptors.	Exposure Parameters	The BAFs for reptiles and amphibians are based on sediment and those for mammals are based on soil. The uncertainty associated with applying these values to another media to estimate tissue concentrations is discussed. In addition, the exposure estimates based on measured tissue also address this uncertainty.		Yes.	Yes. This was addressed in Tables 6-4 and 6-5 that now include the medium to which the dietary items in the food chain were assumed to be exposed. The food-chain models have been clarified.	
113	Use the abiotic data agreed upon by the BAF Workgroup for estimating the EPCs reflective of more recent conditions, i.e., 2007 – 2010 data. Risk calculations should also be run using the pre-2007 data for historical context and greater spatial coverage. Alternatively, risk calculations could be run using the most recent (2007-2009) data. The more recent data could be statistically compared with the older data; these relationships can be used to make conclusions concerning how risks may have changed.	Exposure Point Concentrations (EPCs) – Data used to calculate	BAFs and tissue EPCs were calculated using tissue and soil/sediment from Phase 1 and Phase 2 data only (i.e., 2007-2010). EPCs are not calculated using multiple iterations of the dataset. This would add an unwarranted level of complexity to the BERA (i.e., two complete sets of risk calculations). Moreover, the comparability of the datasets would be highly uncertain due to the differences in spatial areas sampled. Figures 6-4 and 6-7 provide box plots of the soil and sediment data for PCBs and mercury respectively based on the Phase 2 data only (synoptically collected with the biotic tissue) and the entire BERA dataset.		Yes, in part.	They appear to have used the 2007-2010 data for the BAF calculations as requested. Based on reading Sections 3.1 and 3.2 it appears that abiotic data from as early as 1999 was included in the EPC calculations. This is not made clear in the comment response if this is in fact so. It does not appear that any comparison of older data with the newer data was done as requested; trends in data over time are not discussed in the text. Figure 6-4 shows a stronger gradient in PCB	A discussion of how conditions within the system are changing over time and why they are changing should be added to the uncertainty section. We do not need this information to support the risk assessment. It might play into fate and transport for the FS.

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						concentration from upstream to downstream in the complete dataset than in the Phase II data. Hg did not change over time.	
114	If the COPC was detected in environmental media or tissue in fewer than five location groups and there is no spatial pattern to the detections, use the measured OU4 site-wide 95% UCL (or maximum detection) as the EPC for all ecological exposure units.	EPCs – 95% UCLs versus Modeled EPCs	Terrestrial plants are the only tissue type with detections in fewer than five location groups. The measured site-wide UCL is used as the tissue EPC for terrestrial plants.		Yes	Yes	
115	If the COPC was detected in greater than or equal to five location groups and displays a spatial pattern of concentrations, then use the measured 95% UCL by ecological EU or by AA depending on the amount of data available, for the ecological exposure units that have available data. Use predicted 95% UCL EPCs for ecological EUs lacking data using BAFs. For PCB and mercury bioaccumulation into terrestrial plants, literature based BAFs can be used.	EPCs – 95% UCLs versus Modeled EPCs	See responses to Comments Nos. 26, 23, and 39.		Yes	Yes	
116	Use ProUCL to calculate the 95% UCLs and utilize the program's method of treating non-detects.	EPCs – 95% UCLs versus Modeled EPCs	See responses to Comments Nos. 132 and 154.		Yes, partially	Partially.	The RTC to Comment 132 is adequate but 154 is not.
117	Compare measured fish tissue concentrations (forage, bottom fish and predator fish) with fish tissue TRVs. Use the 95UCL of measured fish tissue concentrations as the EPC.	Fish	As described in responses to Comments Nos. 23 and 39, both modeled and measured tissue concentrations were evaluated in the revised BERA.		Yes	Yes	
118	The conclusions in the BERA relate to fish in general and do not identify the higher degree of risk in predatory fish. Text should be revised to discuss risks to predatory fishes, including a discussion of the higher degree of bioaccumulation observed through trophic transfer, and the measured concentrations of PCBs and mercury in predator fish relative to tissue residue based TRVs. Tables 6-1 & 6-2 should include hazard quotients for predator fish.	Fish	Section 6.1.4.2 presents risks for each type of fish (i.e., forage, bottom and predator) based on tissue residues, with tissue HQs presented in Table 6-11 for the various fish tissue types.		Yes	Yes	
119	Page F-18: The measured moisture content in fish from OU4 should be used to convert tissue concentrations to dry weight instead of using an assumed value.	Fish	The sample-specific moisture for fish was used to convert the wet weight tissue concentrations to dry weight.		Yes	Yes	
120	Section 6.3.1: The Weight of Evidence (WOE) Approach boils all of the LOEs into two categories: HQ results and community survey results. This under-represents the lines of evidence that are available. There are 3 general types of LOE:	Lines of Evidence, Risk Conclusions	The recommendation in a and c are included. Bullet a is specifically expanded to include a range of values. However, the site-specific bioassays could not be incorporated because the studies were not designed to support evaluation of OU-4 spatially. Only three locations contained sediments that had a	No		No. The toxicity tests are still not being evaluated as an independent LOE. Section 3.5 states that 26 sediment samples were collected at 6 locations for performing bioassays.	No. Section 3.5 of the revised BERA indicated that three of the five locations for the toxicity testing collected samples from the top 1 foot of the

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	a) Literature-based TRVs vs EPCs (either media concentrations or dietary exposure estimates) b) Site-specific bioassays, and c) Site-specific field surveys.		surface start depth. Of those, two included sediments mixed within the top 2 feet. Thus, these sediments cannot be used directly to evaluate conditions in surface sediments within OU-4. The results of the sediment toxicity testing are included in the context of site-specific sediment toxicity thresholds. This is consistent with the study design.			Whereas samples from 3 of these 6 locations were at the surface, at the other 3, depths ranged from 1-4 ft. Although it can be assumed that the subsurface samples may not represent surface, the 3 locations where samples were from the surface should have been used as lines of evidence for these locations. In addition, maps should be provided that indicate which locations have surface data and which do not. Evaluation of the toxicity associated with the surface samples may provide insight on mixture toxicity, which the other LOEs do not.	sediment cores. The three locations were the reference location, TX-10, and TX-20. It also appears from the field notes that TX-50 was also collected from 0- to 1 foot below the sediment surface. TX-30-01 and TX-50-01 were collected from the same location. TX-30-01 was the 1- to 2-foot section of the cores. TX-50-01 was the 0- to 1-foot section of the cores. TX-30-02 and TX-50-02 were collected from the same core. The cores were only 2 to 2.5-feet long. One sample was taken from the top of the core and one was taken from the bottom of the approx. 2-foot core. It is not clear from the field notes which one was the surface sample, but between TX-50 & TX-30 at least one had to be a surface sample. Both TX-50 & TX-30 had high concentrations of total Aroclor PCBs and were toxic. These cores were taken from the backwater area, where similarly high concentrations of total PCBs were detected in sediments in the Phase I sampling event. TX-10 and TX-20 were collected from further downstream in the downstream and midstream reaches, respectively. The downstream samples TX-10 and TX-20 were not toxic.

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121	Each of these can be split further depending upon what data are available. Each LOE must be as independent as possible; different effect thresholds, different ways that exposure is evaluated. These are all then weighted to get at the WOE. Boiling everything down to two categories loses much useful information.	Lines of Evidence, Risk Conclusions	See response to Comment No. 120.		Yes in general	Yes, except for the site-specific bioassay line of evidence	Table 6-24 should be revised to refer to the section of the text that discusses the finer points, where the degree of confidence in the assessment can depend on the COPC.
122	Literature-derived toxicity benchmarks and site-specific toxicity thresholds should be evaluated as separate LOEs as they are independent.	Lines of Evidence, Risk Conclusions	HQs based on literature benchmarks and site-specific bioassays were evaluated separately as noted in response to Comment No. 120 and in Section 6.3.3.	No		no	See comment 120
123	Section 4.2.1: "Due to limitations with the dataset in a few of the reaches, in some cases reaches were grouped as shown below and surface weighted average concentrations (SWACs) (Table 4-5) for mercury were calculated for: • C1 - Oxford Lake Park; • C2 - Backwater Area; • C3 and C4 – Friendship Road to Coldwater Creek; and • C5 through C8 – Coldwater Creek to Jackson Shoals Dam". Pooling data among reaches decreases resolution, will increase uncertainty, and limit the ability to draw risk conclusions by reach. Table 4-5 should be revised to present summary statistics for mercury (minimum, maximum, mean, number of detects, 95%UCL, EPC and EPC basis) on an assessment area basis.	Mercury	Tables showing the summary statistics for mercury are included in Section 4. See response to Comment No 154 for specific changes to the sediment EPC approach. For mercury, data were pooled to estimate reach-specific EPCs due to small sample sizes. EPCs are also calculated on an AA basis.		Yes	No	EPA requested a standard 95% UCL table to compare with the SWAC EPCs. (see comment 154). The standard 95% UCL for all of the measured sediment data (by Reach and by AA) is needed for comparison purposes.
124	The OU-4 BERA data set does not contain all of the available data compiled on the site to date. Although it is not explicitly stated in the Phase 2 FSP, the table on page 59 notes that the environmental media and prey tissue COPC concentrations used in the BERA will be the data collected during the Phase 2 sampling. Arcadis can respond to this in response to comments memo. Older tissue data available includes a lot of fillet data, with only limited site-specific data on whole body to fillet ratios (two locations, bass and catfish, section 4.3.1.2.3.2, Phase 2 FSP). Some fish locations do not have corresponding sediment data. The fish collection efforts for the human health risk assessment (HHRA) targeted different sized fish than the fish collected for the BERA. The current ecological fish data are of sufficient quantity and quality to support the risk analysis.	Missing Data	The tissue dataset for the BERA includes the data collected during the Phase 2 FSP. These data are considered to be the most accurate representation of current conditions in biotic tissues. It is noted that additional fish tissue data from historical collection efforts and ongoing monitoring are available. Historical data were not included because they do not represent current conditions and the 2007 dataset is sufficient for the BERA evaluations. Other data are primarily fillet data. An extrapolation would need to be employed to use these data in the BERA. The uncertainty associated with extrapolation was considered unwarranted given the sufficiency of the 2007 dataset.		Yes	Yes	

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125	Soil and sediment data sets Arcadis did not have access to do not need to be included in the BERA.	Missing Data	Comment noted.				
126	Section 2: The measurement endpoints selected for evaluating the status of the selected assessment endpoints (specifically survival, growth and reproduction of benthic invertebrates) should add the survival and growth of freshwater mussels in laboratory toxicity tests. Although this report was not available when the BERA was done, the data are available now (Evaluation of the Toxicity of Sediments from the Anniston PCB Site to the Mussel <i>Lampsilis siliquoidea</i> [September 2015]; available at: http://www.fws.gov/daphne/Contaminants/index-AnnistonNRDA.html). Arcadis can include the mussel study results if they want to, but it is not required. EPA will consider data from the mussel toxicity study in the risk management decision.	Mussel Toxicity Tests	Perspectives on the USFWS (2015) mussel toxicity findings are provided in Sections 5.1.1 and 6.1.2.1.1 in terms of the relative sensitivity of these organisms compared to the midge and amphipod test species from which the invertebrate toxicity thresholds were derived. An evaluation of the mussel toxicity study results shows that they are less sensitive to OU-4 sediments than either the midge or amphipod. The effects concentrations provided in the BERA are, thus, protective for bivalves in the OU-4. Based on this finding, a formal concentration-response modeling exercise was not conducted, as it would not have produced effects concentrations that would replace those calculated for the infaunal test organisms. It is agreed that the mussel data are an important consideration for risk management in OU-4.		Yes	Yes	
127	Estimates of PCB concentrations in pore water based on solid-phase microextraction (SPME) need to be discussed in the OU-4 BERA. Site-specific sediment toxicity thresholds based on concentrations of PCBs estimated for pore water need to be presented as a supporting line of evidence.	Pore Water	The SPME pore water PCB estimates are provided and discussed in the revised Appendix C to the BERA (Table C-5 and Attachment 1), including the raw data and a summary of the total PCBs by sample. The concentration-response relationships developed by Ingersoll et al. (2014) using these data showed an almost identical relationship and statistical significance for effects relative to those in sediments. As such, the sediment data are the most appropriate means for computing effects concentrations, as sediment is what risk management decisions will be based on. See also response to Comment No 146.	No		No. EPA comments on the "Annotated Outline: Assessment Endpoints, Measures of effect, and Proposed Representative Ecological Receptors" recommended that pore water be considered an exposure pathway and that it be evaluated as part of ME2a (6.1.2.1)	No. Although pore water data are included in Appendix C and Attachment 1 in Appendix C, there is almost no discussion. Bioassays are not included as a separate LOE (but should be at least for the 3 sites with surface sediment). The same should probably apply for porewater. Pore water data were not evaluated against toxicity. Looking at the toxicity test data, toxicity is associated with high concentrations of PCBs in pore water. It is important to find out whether the high concentrations of low-molecular weight PCBs are driving toxicity in the pore water versus the low concentrations of highly toxic high-molecular weight PCBs in the pore water. This information will affect the conceptual

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				No	Yes		
							site model and will identify locations of OU4 that are experiencing greater risk.
128	EPA reviewed the approved 2006 Baseline Problem Formulation (BPF) for OU-4 to determine whether all agreed-to receptor groups, exposure pathways, AEs and MEs were evaluated in the BERA. For Table 2-16, the risk questions and measurement endpoints should be copied out of the approved Problem Formulation. Some of the agreed-to receptor groups were not evaluated as stated in Section 3.1.6 of the Problem Formulation (threatened and endangered [T&E] species), and some of the measurement endpoints presented in the BERA were not consistent with the measurement endpoints identified in the approved problem formulation (e.g., comparison of OU-4 tissue concentrations with reference tissue concentrations instead of critical tissue concentrations, comparison of estimated rather than measured tissue concentrations). The Problem Formulation document should be cited in the BERA.	Problem Formulation	Components are discussed in the responses to Comment Nos. 46 and 157. The Baseline Problem Formulation document is referenced in the problem formulation of the revised BERA as requested.		Yes	Yes, mostly. The AEs and MEs identified in the BPF report were compared to those in the BERA. They are generally consistent. However, plants, fish, birds and mammals have health and community metrics as AEs in the BERA that are not in the BPF report.	
129	Section 2: The conceptual site model is incompletely described and does not include diagrams that establish the linkages between the various elements of the problem formulation.	Problem Formulation	A food web figure has been added (Figure 2.3) to clarify the linkages between Site media and the different trophic levels of the food web. The CSM text has been updated to more clearly describe fate and transport, trophic transfer and complete exposure pathways between the potential sources and the ecological resources at the Site.		Yes	Yes	
130	Section 2.1: This Section should provide a description of: a general summary of the types of habitat and ecosystems present; the sources and releases of COPCs; COPC fate and transport; and potential receptors in OU-4. All discussion related to the community surveys except for the habitat description should be moved to Section 5.7, Effects on Ecological Communities, and discussed as an LOE.	Problem Formulation	Section 2.1 was updated as follows: 1) The CSM discussion has amended to include sections specific to sources, fate and transport, receptors. The summary information in Section 2.1 regarding community surveys has been revised to provide information on habitat and species present. Discussion of the results of these studies has been moved to Section 5.7.		Yes,	Yes, this was discussed in Section 5.6.	

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131	Section 2.5: There are some gaps in data developed for the BERA. Although methods are available to perform site-specific bioassays for a number of assessment endpoint groups, they were only performed for benthic invertebrates. Some discussion should be included to indicate that site-specific data could have been developed for plants, soil invertebrates, and amphibians, but were not. In EPA comments on the "Annotated Outline: Assessment Endpoints, Measures of Effect and Proposed Representative Ecological Receptors, Page 3" it states: "The identified MEs do not include laboratory toxicity tests with soil invertebrates. This should be considered in the BPF and a discussion should be provided as to why they were or were not included.	Problem Formulation	A footnote is added in Section 2.5 acknowledging that other bioassays could have been conducted. Footnote 4 includes the following: "Site-specific bioassays were conducted for benthic invertebrates only. While it is recognized that bioassays could have been conducted for other species such as terrestrial invertebrates, the evaluation of the range of other receptors included in the BERA were considered sufficient for characterizing and managing possible risks."		Yes	Yes. The footnote was included on Page 2-20.	
132	Use the most recent version of ProUCL, Version 5.0, which was released in 2013, for all EPC calculations.	ProUCL	All summary statistics were run using ProUCL 5.1.		Yes	Yes	
133	If there are any data available to demonstrate that abiotic conditions associated with habitats in the reference sites were similar to abiotic conditions associated with habitats the 10 reach sites (e.g., temperature, depth, flow, grain size, total organic carbon, turbidity, lighting, physical-chemical properties), these data should be presented in the BERA.	Reference Locations	Available data regarding abiotic conditions was added to Section 5 in Tables 5-6 and 5-7. The following text was added to the end of the first paragraph in Section 5.6.2. "In general the ranges of abiotic conditions were similar at OU-4 and reference locations for each habitat type. Tables 5-6 summarizes water quality parameters during the 2006 and 2007 sampling events. Table 5-7 summarizes the composition of substrate at OU-4 and reference locations."		Yes, partially	No	No, the degree of lighting, size of catchment, and how the reference locations were selected were not discussed. This should be discussed as an uncertainty in the benthic community assessment associated with the habitat quality variables at the reference stations. This supports our broader comment that the confidence in the risk prediction for the benthic community in Table 6-24 should be changed to "low." Additionally, PCB homologs were detected in surface water at concentrations above AWQC in Reference location 2. The maximum detection of PCB homologs in aquatic plants was also at this location (Cheaha Creek). This location may not be a suitable reference station.

Commented [E5]: This footnote on Page 2-20 is not exactly correct. The 1st sentence says that sediment toxicity tests were not performed with surface sediments. However, Section 3.5 says that surface sediment for bioassays were collected from 3 of 6 onsite locations.

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							Upstream Choccolocco Creek Station TXR1-02-P had low level detections of total monoCB, total diCB and total TriCB in sediment. Community observations and other LOEs that rely on comparison of site metrics to reference conditions should incorporate these issues in the risk conclusions.
134	Global comment for all HQ tables (Tables 6-1 to 6-11) - the lowest threshold should be set at 1, not 1.5. Section 6, the risk summary section, would be easier to review if all HQs greater than 1 (not greater than 1.5) were shaded yellow.	Risk Characterization	The HQs are reliant on multiple variables with varying levels of precision and are comprised of values and calculations that in most cases over-estimate risk. An example of precision includes the BAF ratio that can be calculated to multiple decimal places but given what we know about the representativeness of the relationship, the precision in that estimate is low. Other inputs, such as food ingestion rates and toxicity reference values (TRVs), have similar levels of variability and hence uncertainty. The TRV and exposure concentrations are also examples where risks are overestimated in an effort to be protective. Given these uncertainties, reporting HQs to anything more than a whole number implies a precision that is not supported in the inputs to the calculation. HQs were reported throughout the BERA to one significant digit (i.e. HQ = 1, not HQ = 1.0).	No		No	No. Reporting HQs as whole numbers significantly affects the interpretation of the risk calculated results. Additionally, a LOAEL is an exposure concentration at which an adverse effect has been observed; any exposure concentration equal to or greater than this value (LOAEL-based HQ ≥ 1) indicates calculated risk. The BERA interprets LOAEL-based HQs = 1 as low risk. The impacts of these two issues is critical and one of the most significant issues in the report in that the interpretation of risk is underestimated when calculated LOAEL-based HQs fall between equal to 1.0 and 1.5.
135	The risk summaries for each receptor need to be carefully reviewed and revised. The following risk categories should be used consistently throughout the summary: no observed adverse effect level (NOAEL) HQ < 1, risk is negligible or <i>de minimus</i> ; NOAEL HQ > 1 and lowest observed adverse effect level (LOAEL) HQ ≤ 1, risk is low. LOAEL HQs > 1 should be evaluated based on the magnitude and the ecological significance of the response in the selected critical study. Most of the mistakes in the text are for HQs >1 and < 1.5.	Risk Characterization	The general categories outlined in this comment were employed. As described in response to Comment #134, an HQ of < 1.5 rounds to a whole number of 1 and is considered to be equal to 1 in the BERA.	No		They have changed their footnotes to state that “all HQs are rounded to the nearest whole number”. This means that all HQs > 1 and < 1.5 round to one, meaning their shading and risk conclusions don’t change at all.	No – this is a big deal – one of the more significant in the report in that risks are underestimated when they fall between ≥ 1 and 1.5

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136	Table 6-12, 6-13, 6-14, 6-15, 6-16, 6-17 under-represent risks. They only include COPCs with LOAEL HQs > 1.5. All HQs >= 1 should be included.	Risk Characterization	See responses to Comments Nos. 134 and 135.	no		No	No – this is a big deal – one of the more significant in the report in that risks are underestimated when they fall between > 1 and 1.5
137	The sediment biologically active zone of exposure evaluated was typically to a sediment depth of 5 centimeters (cm) (2 inches; Table 4-4, page 3-2, page 4-10). No data are provided illustrating the stability of sediments across the 10 reach sites (e.g., what is the potential for redistribution of sediments to a depth of more than 5 cm?). No conclusions can be made on the risks associated with exposure to deeper sediments (e.g., 5 to 15 cm) or on the risks associated with redistribution of contaminated sediments. The uncertainty associated with how the biologically active zone was defined and potential risk associated with exposure to deeper sediments should be discussed. Arcadis can respond to this comment in a response to comments memo. Reference the sediment stability study. The term “biologically active zone” was not used in the FSPs, although it was used in the BERA.	Sediment Sampling Depth	See response to Comment No. 138 regarding the depth profile sampled in sediment. The possibility of deeper sediment being exposed over time was evaluated to evaluate whether changes in deposition or erosion over time would result in changes to the surface concentrations such that the current risk assessment is underestimating exposure. As shown on Table R-1 (attached), in current surface sediment downstream of the backwater area, PCB concentrations are higher than subsurface concentrations, making the current exposure estimates protective. The PCB concentrations are higher in the Backwater area subsurface sediment, but sediments in this area are stable making the exposure of ecological receptors to deeper sediments unlikely. See also response to Comment No. 138.		Yes	Yes	
138	Add a quantitative analysis that demonstrates that the 0-2" results are equivalent to 0-6" results to the BERA. Include the figure cited at the 2-17 meeting showing PCB concentrations by sample event. Cite U.S. EPA 2015, "Determination of the Biologically Relevant Sampling Depth for Terrestrial and Aquatic ERAs".	Sediment Sampling Depth	The following text was added as the last paragraph in Section 6.2.1.1. " <u>Depth Profile</u> For soil and sediment sampling, different depth profiles were sampled during different sampling events. The soil was generally sampled from 0 to 1 foot, which is considered a reasonable estimate of the potential exposure zone for ecological receptors. The sediment was sampled at both 0 to 2 inches bgs and 0 to 6 inches bgs. While the most likely ecological exposures are likely in the most surficial sediments, the 0- to 6-inch interval is considered more comprehensive of the potential exposure depth and is what is recommended in the USEPA document entitled "Determination of the Biologically Relevant Sampling Depth for Terrestrial and Aquatic ERAs" (USEPA 2015). Thus, there is uncertainty associated with the use of the data from the 0- to 2-inch depth. To evaluate the comparability of data collected from the 0- to 2-inch interval versus the 0- to 6-inch interval, sediment cores collected during the RFI phase of the project and segmented into the 0- to 2-inch and 2- to 6-inch intervals were evaluated to identify any differences or bias that may be introduced by using data from the 0- to 2-inch interval as representative of the 0-		Yes	Yes	

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			to 6-inch intervals. A statistically significant (P-value <0.001) regression line for the 0 to 5 mg/kg dataset (which excludes one value greater than 5 mg/kg) has a slope of 0.962 indicating an almost 1:1 relationship for data from the two intervals. This correlation and slope indicate that the 0- to 2-inch interval are a suitable representative for the 0- to 6-inch interval. Surface sediment data (0-6 inches bgs) are shown by program on Figure 6-22." The correlation between the 0 to 2-inch and 0 to 6-inch horizons presented above in the text of the revised BERA are consistent with the mathematical construct that was previously discussed with the USEPA. In the mathematical construct, the 0 to 2-inch interval would be representative of the biologically active zone (BAZ) even if the sediment in the 0 to 6-inch interval was the true BAZ. This is in contrast to the result of an approach that sampled the 0 to 6-inch interval when the true BAZ was less than 6 inches thick. The quantitative comparison results presented above and in the revised BERA confirm that results for the 0 to 2-inch and the 0 to 6-inch horizons are both representative of the BAZ, and are consistent with the mathematical construct that had been previously used so support using the results from both sample collections horizons.				
139	The sediment toxicity tests, which are a site-specific measure of effect, should be considered a primary LOE for assessing risk to the benthic macroinvertebrate community	Sediment Toxicity Tests	The sediment toxicity tests are the primary line of evidence for the BERA. They form the basis for the calculation of all the site-specific toxicity thresholds used to conduct the point-by-point effects analysis by reach. Individual sediment samples used for toxicity testing were collected from various depths to capture a range of PCB concentrations and therefore are not representative of the exposure of a benthic organism in the biologically active zone (0-6"). Therefore, toxicity results from the testing program could not be used to evaluate risk at the sampling locations.	No		No. The sediment toxicity tests were not evaluated as a separate LOE.	No. One of the risk questions in the BPF was "Is the survival, growth or reproduction of aquatic invertebrates exposed to whole sediments from OU-4 significantly lower than those exposed to reference sediments?" At a minimum, the tested surface sediment samples (Section 3-5) need to be evaluated as an LOE.

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140	An explanation of the differences in the Arcadis interpretation and the Ingersoll interpretation of the toxicity test study results should be added to the BERA report. A table should be developed which compares the various sediment quality benchmarks developed by Arcadis to those developed by Ingersoll, with any associated equations or a worked example provided so that the analysis is transparent. These comparisons should be done for multiple endpoints. This recommendation will provide context and added support for the values being used in the BERA. If Arcadis has issues with the toxicity thresholds derived or the analysis done in the Ingersoll et al. (2014) report, those issues should be clearly articulated in the BERA; an explanation of why the Ingersoll values were not used must be provided. EPA noted that including tables with both study interpretations, scatterplots, and overlays of the dose response curves produced by Arcadis and Ingersoll will support the discussion of the differences in the study interpretations.	Sediment Toxicity Tests	An explanation and comparison of the difference in the interpretation of the sediment toxicity test program results between Ingersoll et al. (2014) and the BERA is provided in the revised Appendix C (section 3.2 Table C-11) to the BERA. A table comparing the differences in the effects concentrations for some of the sensitive endpoints is included as part of this assessment (Table C-11). The USGS and USACE were contracted to conduct the field and laboratory studies and to provide the results of these benchtop studies for use in preparing the BERA. Ingersoll et al. (2014) conducted a separate evaluation of these benchtop data for NRDA purposes, and in some cases used inappropriate models and assumptions for their analysis. These are discussed in Appendix C (Section 3.2). The benthic invertebrate risk analysis in this BERA was conducted using the USGS/USACE benchtop testing data and technically appropriate data evaluation techniques.		Yes but review of this section raised additional questions	Yes, This comparison was included as Appendix C, Section 3.2, Table C-11	Footnote b of Table 5-2a states that “EC0 was set at a concentration of 0.05 (the mean reference sediment concentration)”. However, total PCB Aroclors were not detected (ND) in any of the reference sediment samples; 0.05 mg/kg is actually the maximum reporting limit (RL). Looking at Figure C-3c, the curve drops rapidly for the Young/female normalized to survival (% of control) endpoint. If you use a value of ½ the RL as the EC0, what is the effect on the calculated EC0* and EC10* values? Please provide a sensitivity analysis evaluating the effect on the site-specific toxicity thresholds calculated using a value of ½ RL versus using the RL as the EC0. Additionally, PCB homologs were detected in some of the reference samples at low concentrations. The average homolog PCB concentration at the reference stations is low. It is unclear that these low concentrations represent acceptable risk. The types of PCBs that were detected were lower-chlorination range PCBs that are associated with the site and are labile compounds not associated with legacy

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							contamination from general use of PCBs by industry before PCBs were banned. Since acceptability of risk is being defined as comparison to the bottom of the reference envelope, there is uncertainty in whether the EC0 or EC0* can be described as a threshold for adverse effects, when the shape of the dose-response curve (Figure C-3c) does not suggest a threshold. There does not appear to be an actual threshold where risks begin at the site. The EC0 and EC0* cannot be considered a NOEC; all references to these values as being a NOEC should be removed from the BERA. It should not be stated there is acceptable risk at sediment PCB concentrations below the EC0*; a WOE evaluation is needed to conclude whether risk is acceptable or unacceptable
.14 1	The sub lethal endpoints from the Ingersoll toxicity tests were not used to develop site-specific toxicity thresholds. The statements regarding growth and reproduction as less certain measures of effects should be removed from the BERA. Additionally, the conclusion in the OU-4 BERA that “chironomid data provide a more appropriate test of potential toxicity because these receptors are known to be present at OU-4” is not correct and should be deleted. Chironomids are typically less sensitive, and <i>Hyalella</i> can be used as a surrogate for more sensitive species that may be present in the ecosystem. Test results from both surrogate species are equally relevant to	Sediment Toxicity Tests	All endpoints (except chironomid adult biomass - see response to Comment No. 142) were considered and evaluated in the Draft BERA. Revisions to the benthic community assessment in the BERA focus on the most sensitive reproductive and survival endpoints for the two species tested (<i>Table 6-4a</i>) Text regarding the relative applicability of chironomids was removed.		Yes	Yes	

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	evaluate impacts on benthic macroinvertebrates. Toxicity reference values generated for sensitive species and the most sensitive endpoints should be used preferentially to evaluate the potential for population level effects on benthic invertebrates and to develop risk conclusions for the BERA.						
142	The site-specific toxicity threshold for midges based on the most sensitive endpoint of adult biomass was not used in the OU-4 BERA to evaluate risks (page C-7, page 5-7). The larvae on Day 13 of the exposure would be at a stage where there is reduced feeding rate before pupation, so any density-dependent effects on weight of larvae, pupae, and resultant adults would be minimal. A strong correlation was observed between adult biomass and Day 13 average weight of midges (Figure A3-15L in Ingersoll et al. 2014), indicating that emergence of adults was not likely biased due to the possibility of a density-dependent influence of larvae surviving to the 4th instar subsequently dying before emerging as adult. Midge biomass should not be excluded as an endpoint.	Sediment Toxicity Tests	As described in the BERA, this endpoint is not included in the site-specific toxicity thresholds evaluated in the BERA because of the high level of uncertainty in the estimation method employed and based on a far-reaching and unsupportable assumption regarding linear growth in midges from day 13 through the end of the test. The reason for the strong correlation cited between adult biomass and Day 13 average weight is that the adult biomass was calculated by Ingersoll et al. (2014) based on the 13-day average weight. As a result, this correlation is meaningless. There are no data to support the assertions or to estimate adult biomass credibly from this testing program. The specifics of the uncertainty associated with this endpoint are discussed in Appendix C and Section 5.1.1.	No.		No	No, the most sensitive endpoint measured in the toxicity tests, Chironomid adult biomass, is still not included.
143	The bottom of the reference envelope was defined as the lowest reference response, whereas it is typically defined as the 5 th or 10 th percentile of reference responses (MacDonald and Landrum 2008; Hunt et al. 2001). This is the least conservative definition of the reference envelope. The BERA should calculate the 5th percentile of the reference envelope and present results both ways: compared to the lowest response percentage (currently in the BERA) and compared to the 5th percentile percentage.	Sediment Toxicity Tests	In most cases, the 5th percentile of reference response, when derived parametrically, is lower than the minimum observed reference response. Therefore, for most endpoints, and for all of the most sensitive endpoints, an EC0* based on the 5th percentile is higher than one based on the minimum. To illustrate this, a total PCB threshold value was also calculated for each endpoint at the 5th percentile of reference and presented in Table C-1 of Appendix C. These values were greater than EC0* for most endpoints and for all of the most sensitive endpoints.	No		No	Table A4-2 of the Ingersoll et al. (2014) report shows the 5 th percentile of the reference response; that value is always higher than the minimum observed reference response. Are the 5 th percentile EC0* calculations affected by the fact the PCBs were ND in all of the reference samples (see comment 140)
144	Calculated lower prediction limits (LPLs) are not typically used in a risk assessment. The reference envelope is a defined lower limit; if survival, growth, or reproduction responses fall outside of the normal range of reference responses, a sample should be considered toxic. Lower limit statistics have to truncate at this level. It is also not clear how the LPL was calculated. The ProUCL user guide (U.S. EPA 2013, .pdf page 156) states: "In many environmental applications ... one needs to compute lower limits including LPLs, lower tolerance limits (LTLs), or lower simultaneous	Sediment Toxicity Tests	The ProUCL technical guide and statistical output provide the equations and statistics needed to calculate the lower limit statistics using simple arithmetic operations. In the Draft BERA, HQs were presented and discussed based on 90%LPLs in addition to EC*0, EC10*, and EC20*. However, because the EPA has requested this change, the LPL was removed from the BERA.		Yes	Yes	

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	limits (LSLs). At present, ProUCL does not directly compute a LPL, LTL or a LSL." Please remove the Lower Limit calculations from the BERA.						
145	Because of the high reliability of the Pb, Hg, and polycyclic aromatic hydrocarbon (PAH) thresholds from Ingersoll in correctly predicting toxicity, the EC0*, EC10*,EC20* and EC50* should be calculated for these analytes. The BERA currently only compares concentrations of metals and PAHs to the "consensus-based" probable effect concentrations (PECs) published by MacDonald et al. (2000) and concludes that metals and PAHs are not likely to have contributed significantly (relative to PCBs) to toxicity in OU-4 sediments. Reliability analysis in the Ingersoll report indicates that the Pb, Hg, and PAH thresholds correctly classify samples as toxic or nontoxic 74-96% of the time. Because these values are site-specific, these values should be included and compared with measured sediment Pb, Hg and PAH concentrations. Metals toxicity might be a factor in some of the tests based on AVS-SEM data. Some of the sediments with higher concentrations of PCBs also contained mercury concentrations within a range that was found to be toxic in other studies. Chibunda (2009) reported an effects concentration for 28-day emergence in <i>C. riparius</i> of 3.84 mg/kg of mercury in sediment and an effects concentration for 14-day growth of 2.42 mg/kg.	Sediment Toxicity Tests	Appendix C of the BERA has been revised to include an expanded discussion of the non-PCB data. Because the contaminant concentrations in tested sediments are correlated, it follows that concentration response models can be developed for lead, mercury, and PAHs (not a COPC for OU-4), and that the threshold values generated from these models (i.e., comparable to EC0* and EC10*) would show apparent predictability of toxicity. Ingersoll et al. (2014) recognized that this correlation may lead to false conclusions about causation among contaminants, and that the threshold values required further evaluation. Ingersoll et al. (2014) found the thresholds calculated for these compounds to be lower than either consensus-based SQGs (i.e. PECs) or LC50s generated in spiked toxicity tests, and therefore concluded that they are "likely not the main contributors to the observed toxicity." Lead toxicity thresholds ranged from 9 to 14 ppm, lower than both the TEC (35.8 ppm) and the PEC (128 ppm). This suggested to Ingersoll et al. that lead was not the driver of toxicity. The AVS-SEM data also supported that lead was not a primary contributor (see response to Comment No. 4). Mercury toxicity thresholds from Ingersoll et al. (2014) ranged from 0.3 to 1.3 ppm. These values are in fact within the range of the TEC (0.18 ppm) and the PEC (1.06 ppm). Site-specific values for mercury were calculated in a manner consistent with the PCB approach and are included in the revised BERA (Appendix C, Table C-6).				
146	A discussion of the SPME pore water COC concentrations and the toxicity test results should be added to the BERA as a supporting line of evidence.	Sediment Toxicity Tests	The SPME pore water PCB estimates are provided and discussed in the revised Appendix C to the BERA. See response to Comment No. 127.	No		No, the dose-response figures are not included in the revised BERA.	See response to comment 127
147	Table 5-2a: The most sensitive EC0*, EC10* and EC20* values listed in Table 5-2a should be identified as the site-specific PCB toxicity values for benthic invertebrates. Presenting toxicity thresholds for all endpoints rather than just the most sensitive endpoints makes the benthic analysis difficult to follow.	Sediment Toxicity Tests	The new point-by-point effects assessment for the benthic invertebrate toxicity thresholds provides a more concise and easy to follow assessment, clearly focusing on the most sensitive endpoints (Table 6-4a).While risk estimates were based on these most sensitive endpoints, the survival endpoints have not been removed from the effects assessment as they provide important perspective on the risk characterization, particularly given the high degree of uncertainty associated with the most sensitive reproductive endpoints for amphipods.		Yes, mostly	Yes	

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148	Page 5-7, Tables C-1, 5-2a, Table E-1: The site-specific toxicity thresholds are reported to several significant digits in Table C-1, but are reported to no decimal places elsewhere (e.g., page 5-7, Table 5-2a). Toxicity thresholds need to be reported to the appropriate significant figures (e.g., 1 vs. 1.38 mg PCB/kg for the ECO* for H. azteca survival-normalized reproduction, 7 vs. 6.8 mg PCB/kg for the EC10* for C. dilutus emergence). Toxicity thresholds and HQs should be reported to two decimal places.	Sediment Toxicity Tests	See responses to Comment Nos. 68, 134, and 135.	No.		No.	See responses to Comment Nos. 68, 134 and 135.
149	Evaluate PCBs in surface water on an assessment area basis, not on an OU-4 overall basis.	Surface Water	For PCBs and metals, surface water was evaluated on an AA-basis (Table 6-12).		Partly	No, there is a mistake on Table 6-12 and the WOE evaluation is incorrect. Page 6-15 states that SW concentrations are compared to ADEM WQS, NAWQC, and Tier II thresholds. The Tier II SCV is 0.14 ug/L, and the lowest chronic value for fish is 0.2. We asked them to use the Tier II values. A value of 0.4 was used for fish; this is not the Tier II or the receptor-specific value.	The surface water screening benchmarks include the Alabama Department of Environmental Management (ADEM) chronic surface water quality standard (SWQS) for PCBs, which was exceeded in surface water on-site. A second LOE, comparison of water concentrations with receptor-specific water quality benchmarks, concludes negligible risk as the receptor-specific benchmarks were not exceeded. The ADEM SWQS is an applicable or relevant appropriate requirement (ARAR). Unacceptable risk must be concluded due to exceedance of this ARAR.
150	The first row in Table 8-1 indicates that the potential risk to aquatic invertebrates is low throughout OU4. Table 6-18 indicates that the potential risk to aquatic life was moderate due to the comparison of the surface water concentration to the Alabama Department of Environmental Management water quality standards (ADEM WQS); the chronic surface water standard for PCBs was exceeded at the site. Please correct Table 8-1 to show the potential risk to aquatic invertebrates as moderate.	Surface Water	Based on other revisions requested in the methods for evaluating surface water (see responses to Comment Nos. 149 and 153), this table was updated to reflect that ADEM WQS do not apply to benthic invertebrates. The WOE findings for the benthic invertebrate community are described in detail in Section 6.3.2 and summarized in Table 6-24.		No	No	Table 6-24, Page 2 of 4, lists WOE for aquatic community as "low" when we wanted it changed to "moderate." Not in Table 8-1 anymore.

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				No	Yes		
151	The use of water quality guidelines or the ADEM WQS to assess benthic species should be further supported. The data sets used to derive these guidelines likely do not contain data for benthic species. If the ADEM WQS values are considered relevant for benthic species, how is a 7-fold exceedance of the chronic guideline for PCBs considered to represent a low risk, as most benthic species are immobile and would experience chronic exposures?	Surface Water	The text in Section 6.1.2.1.2 was revised to clarify that WQS were compared to surface water concentrations to evaluate all aquatic life, recognizing that the WQS may not be directly applicable to benthic species.		Yes.	Yes. Text revision is okay. However, it does not negate the need to change the WOE in Table 6-24 with regard to aquatic invertebrates (see comments 149 and 150).	
152	National Ambient Water Quality Criteria (AWQC) should have been used as an additional source of surface water benchmarks. Describe the magnitude and frequency of exceedance of the AWQC and the ADEM WQS in the OU-4 BERA.	Surface Water	Values that are different between the two sources are evaluated in Table 6-12 and Section 6.1.1.1 (i.e., for mercury).		Yes, partially	Not really. Although AWQC were added, the assumed hardness adjustment noted in comment 153 results in elevated screening criteria for lead and chromium. Additionally, the magnitude and frequency of exceedances were not discussed.	Additional review of surface water data shows that Total Homolog PCBs exceeded screening criteria in three of four samples collected at Reference Location 2. Please add a discussion with a comparison of concentrations measured on-site and in reference areas. Reference 2 should be discussed separate from the upstream reference locations. Add the reference locations to Figure 3.2.
153	Table D-2, Footnote C: Hardness adjustment should have been done on a sample-by-sample basis, not using an assumed value of 200 milligrams per liter (mg/L). The AWQC default calculations use a hardness value of 100 mg/L. Use of a 200 mg/L value results in much higher hardness adjusted criteria (e.g., acute and chronic criteria for lead at 100 mg/L are 64.58 and 2.52 micrograms per liter [µg/L]. At 200 mg/L, criteria are 136.14 and 5.31 µg/L). Provide a table with site-specific hardness data (hardness data are not included in Appendix E).	Surface Water	The following text was added as the 2nd paragraph in Section 6.2.3.5. "ADEM WQS/NAWQC for some metals are estimated based on hardness assumptions. For the BERA, 200 mg/L hardness was assumed. Because hardness data are not available for OU-4, site-specific adjustments could not be made. This assumption could over or underestimate the toxicity benchmarks. If hardness is lower, the toxicity benchmarks employed would underestimate possible risk and if hardness is higher, they would overestimate possible risk."	No		No. Additionally, footnote c of Table 5-2b states "Ambient water quality criteria were adjusted for hardness = 200 mg/L, which represents a mid-range of site hardness data." This should be revised to clarify that 200 mg/L hardness is assumed and no site-specific measures are available.	Because site-specific data are not available, conservative assumptions must be made to avoid underestimating risk. The default value used to derive numerous criteria (100 mg/L; ADEM, AWQC) should be used, unless data supporting the assumption that a hardness value of 200 mg/L is appropriate for Piedmont systems is available.

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154	Section 4.1.1.2.1 of the Phase 2 FSP states that the 95% UCL will be the value used as the EPC in the risk calculations. Section 4.1.1.2.2 states that if the 95% UCL calculations result in HQs > 1, then a more "realistic" scenario will be evaluated using the SWAC as the EPC. However, the SWAC was used as the sediment EPC for all risk calculations. Tables 4-4 and 4-5 must be revised to present summary statistics similar to Table 4-6 (minimum, maximum, mean, number of detects, 95%UCL, EPC and EPC basis). Risk calculations need to be re-done using the 95%UCL as the sediment EPC for PCBs and Hg. The SWAC should not be used as the sediment EPC for PCBs and Hg. Table 4-4 should also present PCBs on an organic-carbon normalized basis.	Surface Weighted Average Concentration	As requested, the sediment EPCs for aquatic birds and mammals were calculated as an upper bound on the mean (i.e., a 95 th percentile of the boot strap means) with areas having no recoverable sediment removed from the calculation process. The spatial weighting by textural class was included as the data were collected in a biased manner focused on fines (see response to Comment No. 95 for discussion of area for each class). Invertebrates and other prey items for fish, birds, and mammals may forage or reside in all texture classes (including fines, coarse, and the interstitial sediment in gravel areas). The areas with no sediment recovery were excluded in this revision because of the uncertainty associated with having to assume a concentration for these areas. This approach provides an upper bound on the exposure area while still accounting for the difference in area of the different sediment classes. Section 4.2.1 was updated to reflect the revised approach. Tables 4-4 and 4-5 a and b provide summary statistics by texture class for PCBs and mercury respectively. As described in response to Comment No. 25, PCBs were not evaluated on an organic carbon normalized basis.	No		No. Instead of a standard 95%UCL, a UCL of SWACs was generated and used. PCBs were not evaluated on an organic carbon normalized basis, however normalization is not essential.	No. EPA does not need to see the risk calculations performed on the standard 95% UCLs, but the standard 95%UCL for all of the measured sediment data (by Reach and by AA) is needed for comparison purposes. The SWAC 95% UCLs with the standard 95% UCLs should be presented on Tables 4-4 and 4-5 and discussed in the uncertainty section. Additionally, in table 4-4, weighting factors should sum to 1 for each reach and they do not. The SWAC weighted values appear to be under estimated.
155	It is not clear whether the sediment textural class used in the SWAC calculations was assigned based on field observations or laboratory grain size measurements, but it seems to have been based on the field observations. Discuss the uncertainty associated with doing this calculation based on visual field observations. For sediments that have grain size analysis, how well does the field observation correlate with the lab grain size analysis?	Surface Weighted Average Concentration	The following text was added to the uncertainty analysis as new subsection 6.2.1.2. "Exposure Point Concentrations" The primary uncertainty associated with any EPC is associated with how well it may actually represent the true exposure concentration. In all cases in this BERA, an upper bound on the mean was selected as the EPC to mitigate this uncertainty. For sediment EPCs, specifically, the EPC is weighted based on the estimated spatial extent of the three texture classes (i.e., fine, coarse, gravel) identified in OU-4 sediments. Because the texture class are factored into the sediment EPC estimation, the uncertainty associated with the class assignments may affect the estimated values. The areas associated with the sediment EPC calculations were based on 769 attempted core locations from 187 transects in Choccolocco Creek. At each location where a core was collected it was visually classified using the Unified Soil Classification System. The photographs and field descriptions of each core were reviewed in the office and the sediments were classified into fine, coarse, and gravel categories. Organics (OL, PT), clays (CH, CL), silts (MH, ML), and fine sands (SC, SM) were called "fine grained" while coarse sands (SP, SW) were called "coarse grained). Gravels included classifications GM, GP, and GW.		Yes, in part	No	A lot of the classifications are based on visual, not lab measured texture The comparisons between lab and visual estimates should be included when both were done on the same samples

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			Samples from 28 core locations were submitted for laboratory analysis of grain size, and for these 28 cores, the grain size results were used along with the visual descriptions to classify the sediments in the fine, coarse, and gravel categories. For the surficial data used for the PCB contribution to the sediment EPC calculations, 57 of the 266 samples used a combination of grain size results and visual criteria to classify the sediments. The remaining samples were based on visual criteria only. The use of both laboratory and visual classification mitigates some of the uncertainty associated with the texture class assignments but for those samples where visual classification alone was employed, there is uncertainty. The primary way in which this would affect sediment EPCs is if fines were mis-classified as coarse or gravel, thereby underestimating the area of fines (which contain relatively higher COPC concentrations). The degree to which this uncertainty over or under predicts the EPC is unknown.				
156	To derive the SWAC, 187 transects along Choccolocco Creek (37 river miles; page 4-4) were sampled. What is the uncertainty associated with using a limited number of data points (approximately 5 transects per river mile) to define the surface area associated with each textural class? Did sampling density vary within the EUs? The presented SWAC is a calculation of the average PCB or mercury concentration across a designated area; it provides a false representation of precision, and has an associated measure of uncertainty or variability. U.S. EPA guidance for sediment sampling states that samples be collected from depositional areas, (U.S. EPA/ERT 1994). Is it appropriate to use a SWAC approach based on sediment textural classes that include textural classes that would not be the dominant grain size found in depositional areas? It is assumed that the few samples collected from each grain size class accurately represent the range of concentrations within a given class. This is not known. This uncertainty should be included with each SWAC, and the substantial uncertainties associated with this approach should be clearly discussed in the Uncertainty Section.	Surface Weighted Average Concentration	See responses to Comment Nos. 95, 155 and 138.		Only in part.	Comment 95 addresses data from depositional areas and is responsive. Comment 138 (sampling depth and BAZ) is unrelated to this comment. Comment 155 does address sediment texture, however, it does not appear to directly address the comment.	No. The response does not address the uncertainty associated with extrapolation from such a small sample size to such a large area. The RTC did not address the comparison of laboratory and field grain-size classifications. Section 6.2.1.1 did not face the uncertainty head on and did not address the basis of each SWAC. All of the points raised by the comment were not addressed.
157	The following T&E species are known to exist within OU-4: Painted rock snail, <i>Leptoxis taeniata</i> (Threatened), Cylindrical lioplax, <i>Lioplax cyclostomaformis</i> (Endangered),	Threatened and Endangered Species	The following revision has been made to the last paragraph of the problem formulation (Section 2): "Threatened and endangered species that may be found in OU-4 include the blue shiner (<i>Cyprinella</i>	No		No	Although the revised BERA acknowledges that T&E taxa may be present, that is all that was done. A

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	Tulotoma snail, <i>Tulotoma magnifica</i> (Threatened). Other endangered, threatened, and proposed species that may also occur in OU-4. The 2006 Problem Formulation states "Risks to threatened and endangered species will not be explicitly evaluated. Rather, appropriate surrogate species will be identified as focal points for risk characterization for determining if risks to threatened and endangered species could be unacceptable. Surrogate species and appropriate risk assessment parameters will be developed in the BERA." This was not done in the BERA and should be done.		<i>caerulea</i>), painted rock snail (<i>Leptoxis taeniata</i>), Cylindrical lioplax (<i>Lioplax cyclostomaformis</i>), Tulotoma snail (<i>Tulotoma magnifica</i>). In addition, the United States Fish and Wildlife Service (USFWS; 2014) lists two mammals (Indiana bat [<i>Myotis sodalist</i>] and Gray bat [<i>Myotis grisescens</i>]), one bird (Red-cockaded woodpecker [<i>Picoides borealis</i>]), four flowering plants, eight clams, and two fishes (Pygmy Sculpin [<i>Cottus Paulus</i>] and Blue Shiner [<i>Cyprinella caerulea</i>]), as potentially occurring within Calhoun County, Alabama. In addition, one sensitive snail species (Wicker Ancyliid [<i>Rhodacmea filose</i>] limpet), formerly thought to be extinct, has been observed in lower Choccolocco Creek (O Foighil et al., 2011). Therefore, a range of risk estimates are provided in this OU-4 BERA to allow evaluation of the potential for adverse effects at both the individual and population levels."				sentence or two in each part of the risk characterization that ties the observed risk results to conclusions for T&E species should be added. In many instances, the conclusion may be that there could be risks (due to the more conservative nature of exposure and effects for T&E species) Page 6-5 states that risks to individuals (T&E species) will be evaluated based on NOAEL HQs > 1. This was not done. The long-eared bat (<i>Myotis septentrionalis</i>) was not identified as a T&E species, and risks to bats were not modelled.
158	The TEQ EPC is an OU4-wide mean concentration. The EPC should be the 95UCL, and should be evaluated on an assessment area basis. If data are limited, they should be evaluated on a point-by-point basis.	Toxic Equivalents (TEQ) - Congeners	See responses to Comment Nos. 165 and 163.		Yes	Yes	
159	The mean TEQ values reported in Table F-1 cannot be reproduced using the values reported in Appendix E, 'Calculated TEQ values' table. Which samples were included in the total calculations? Only surface soil or sediment? Only the samples in Column N indicated as "within 50 feet of BSA"? Were duplicates removed? For Total TEQ, Non-detects (ND) Sub, the footnote needs to indicate the value used to substitute for NDs. The DL-PCB TEQ should be presented along with the total and PCDD/PCDF TEQs,	TEQ - Congeners	The approach for evaluating risk associated with TEQ has been revised. PCDD/PCDF and DL-PCB data collected within the BSAs were used to derive congener-specific BAFs, which were used to model prey tissue concentrations and calculate EPCs for dioxin/furan TEQ, DL-PCB TEQ, and total TEQ. Data included in the BAF datasets are presented in Appendix F Attachment 1 Tables F1-4 and F1-5. Modeled tissue calculations, including soil and sediment PCDD/PCDF and DL-PCB congener data included for the modeled tissue calculations (all soil and sediment data), are presented in Appendix F Attachment 2. The data employed are consistent with OU-4 samples presented in Appendix E.		Partially	No	The calculations in Appendix F in general show that the risk posed by the combination of dioxin-like PCBs and dioxin/furans is less than risks estimated for total PCBs. The most sensitive receptor was the Carolina wren. The most toxic congener was PCB 126. To complete the revisions to Appendix F, the tables should be revised to address the following: The maximum concentration of PCB 126 in terrestrial wildlife food was detected in earthworms at 0.043 mg/kg. Table F-6 lacked a bioaccumulation factor for PCB 126. Exposure to the Carolina wren from PCB 126 in soil and diet does

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							not appear to have been assessed. Run the maximum detected concentration of PCB 126 in earthworms in the wren model and correct tables accordingly.
160	Appendix F, page F-23: States "There is also some question whether the concentrations reported as PCB-126 are actually that congener. PCB-126 has been associated with Aroclor 1254 (Frame et al. 1996), which was only manufactured from 1974 to 1977 and was not produced in Anniston. Therefore, the possible source of any reported PCB-126 is unclear and not likely site-related." The detection limit for congeners in the Frame et al. (1996) study was 100 mg/kg. A more recent study determined the concentration of individual congeners in nine Aroclors to the sub-mg/kg level; PCB-126 was present in all nine Aroclors evaluated (Rushneck et al. 2004). This discussion should be included in the Uncertainty Section of the BERA, and the above statement should be deleted.	TEQ - Congeners	The discussion related to the source of PCB 126 been removed, as PCB 126 has been found in nine Aroclors, including 1254 (Rushneck 2004). The Rushneck (2004) findings were cited in the uncertainty analysis of Appendix F and the BERA.		Yes	Yes	
161	A Table with summary data (mean, range, sample size, number of detects) for all PCDD PCDF and DL-PCBs needs to be provided.	TEQ - Congeners	Summary statistics for PCDD/DF and DL-PCB data were added to Appendix F.		Yes	Yes	
162	The TEQs should be presented as toxic units. Evaluate the PCB signal versus the dioxin/furan signal.	TEQ - Congeners	Appendix F of the BERA has been revised and includes evaluation of DL-PCB TEQ in addition to PCDD/PCDF TEQ and total TEQ. Toxic units (TUs) are presented on Figures F-2 and F-3 to indicate the relative contribution of PCDD/PCDF and DL-PCBs to the total TEQ concentrations.		Yes	Yes, this comment appears to have been addressed. However, looking at figures F2 and F3, why does total TEQ HQ differ from summed HQs from DL-PCB and dioxin-furan? Total and sum should be the same. However, total is sometimes higher and sometimes lower	
163	Report the number of samples that exceed the calculated site-specific risk-based concentrations (SSRBCs).	TEQ - Congeners	The TEQ evaluation is conducted as a forward assessment. HQs are presented based on AA-specific 95% UCL EPCs (soil) or maximum detected concentrations (sediment) The complete analysis is provided in Appendix F and key elements are summarized in Sections 6.1.4.1 for fish, 6.1.5.1.1 for birds, and 6.1.6.1.1 for mammals.		Yes	Yes	

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				No	Yes		
164	Sections 4.1 and 4.2, Page F-21: Use forward risk calculations based on 95UCL tissue concentrations to evaluate effects of TEQ exposure for mammals.	TEQ - Congeners	See response to Comment No. 163.		Yes	Yes	
165	Section 4.4, Page F-22: Do not just use SSRBCs and average concentrations. Also use measured 95UCLs and forward risk calculations.	TEQ - Congeners	As described in response to Comment No. 163, DLCs were evaluated using forward risk assessment methods. Measured tissue UCLs were not included due to limited sample size. Tissue concentrations estimated in the calculations were modeled on a congener-specific basis as directed by USEPA (See response to Comment No. 27)		yes	Yes	
166	Although use of effect concentration (EC) values or dose-response curves would be the best approach, the current NOAEL and LOAEL value approach that is in the BERA will be followed. The percent effect associated with the LOAEL values will be incorporated in the risk characterization discussion.	Toxicity Reference Values (TRVs)	The percent effect associated with the LOAEL values selected as the basis for TRVs and CTCs has been included in the Appendix D text. When relevant, this information is also discussed in the risk characterization weight-of-evidence (6.3).	No		No.	I spot-checked the following two TRVs: Restum mortality endpoint is associated with an 85% reduction in kit survival. PCB egg TRV: 83% reduction in hatching and 92% reduction in fledging. Although the effects observed in the critical study are stated in Section 6.3, there is no discussion of the impacts of this on the interpretation of the calculated HQs. All of their HQ conclusion are HQ > 1 and < 10, moderate risk, HQ > 10 high risk For example, in Section 6.3.5, it notes that the egg tissue risk is moderate (yellow-shaded boxes) for most receptors, but does not note that a LOAEL HQ of 1 indicates an 83-92% reduction in reproduction. Same for the mink discussion. The conclusion if the two above LOECs are used should be all HQs ≥ 1 indicate high risk.

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167	Surface water benchmarks: 1) Table 5-2b should have the Tier II screening values for chronic and acute, not alternate values from Tables 1 and 2 in Suter and Tsao (1996). 2) Add AWQC as screening benchmarks.	TRVs – Specific TRVs	Table 5-2b includes Tier II values protective of aquatic life for barium, cobalt, vanadium, and PCBs (acute) because these lack ADEM WQ standards. Alternate screening levels specific to the individual receptor groups (aquatic plants, aquatic invertebrates, fish) from Tables 1 and 2 of Suter and Tsao (1996) are presented because the Tier II values are not specific to a particular receptor group. Surface water HQs for these receptor groups are presented using the values in Table 5-2b as well as ADEM WQS. NAWQC values for chromium, lead, and PCB are equivalent to ADEM values. For mercury, the NAWQC is higher for chronic and lower for acute and is based on inorganic mercury. Mercury ADEM values are based on methylmercury but apply to total mercury. Both the NAWQC and ADEM WQS for mercury were evaluated.	No		As noted in Comment 149, the fish-specific number is wrong, it should be 0.2 ug/L. This does not change the risk conclusion for fish.	See Comments 149. 150, 151: The species-specific conclusions cannot be used to downgrade risk based on an ARAR. In the BERA, the final WOE conclusion for aquatic plants, aquatic invertebrates, and fish is that although the aquatic life criterion indicates high risk, the receptor-specific group benchmarks indicate negligible risk.
168	Soil Benchmarks: · The Oak Ridge National Laboratory (ORNL) values are either the lowest reported LOEC or the 10 th percentile of observed LOEC values. These values are assumed to be protective, as many studies were carried out under high bioavailability conditions, or on unweathered spiked soils. The text should be revised to clarify the soil screen.	TRVs – Specific TRVs	Soil benchmarks are described in Section 2.3 of Appendix D as follows: "...These benchmarks are considered conservative screening levels equivalent to NOAELs. Although the ORNL values are either the lowest reported low observed effect concentration (LOEC) or the 10 th percentile of observed LOEC values, these values are assumed to be protective, as studies were carried out under high bioavailability conditions, or on unweathered spiked soils."		Yes	Yes	
	· The original soil benchmark for PCBs was the Region 4 screening value. Those values have been updated, and the equilibrium partitioning (EqP) approach should be used to develop the PCB soil screening numbers.		The USEPA Region 4 EqP-based approach was used to develop PCB soil screening values. NOAEL-equivalent and LOAEL-equivalent soil benchmarks were calculated using the EqP equation and toxicity threshold for aquatic invertebrates derived by Fuchsman (2006) using NAWQC methodology (Stephen et al. 1985). The NOAEL and LOAEL PCB soil benchmarks based on this approach are 3.6 and 36 mg/kg, respectively. Methods are described in detail in Appendix D Section 2.3.		Yes	Yes	
	· EPA provided several papers describing effects of PCBs in soil on soil invertebrates.		The USEPA-provided papers were reviewed as noted in response to Comment No. 168a, the soil PCB benchmark was revised based on the USEPA Region 4 screening value calculation methodology (2015) and a water quality benchmark from Fuchsman et al. (2006). The papers provided by USEPA related to this comment (Jensen et al. 2012, Paine et al. 1993, and Parmalee et al 1997) are discussed in the uncertainty section (Section 6.2.3.4).		Yes	Yes – they provide an analysis that the values they developed are actually lower than what we had suggested.	

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	· Effects of mercury in soil on soil invertebrates have been reported by Son et al. (2007).		Son (2007) provides a Hg LOAEL-equivalent benchmark of 0.23 mg/kg based on reduced offspring production in springtail (collembola). This LOAEL value was evaluated in addition to the NOEC-equivalent SL for soil (0.1 mg/kg) from Efroymsen et al. (1997) that was evaluated in the draft BERA. An alternate effect level of 2 mg/kg based on neutral population growth rate in soil invertebrates from Son et al. (2007) is also discussed in Section 6.2.3.4.		Yes	Yes	
169	Amphibian/Reptile : 1) As per the Phase 2 FSP, concentrations of COCs measured in surface water will be compared with TRVs protective of herptiles, primarily those for amphibian eggs and larvae. The TRVs should be compared with the calculated 95UCL EPCs. This comparison should be included in the risk characterization section. 2) Tissue-based TRVs for amphibians and reptiles are scarce. Measured tissue concentrations in amphibians should be compared to available CTCs. This discussion can remain in the uncertainty section.	TRVs – Specific TRVs	Amphibian toxicity studies were provided by EPA for PCBs and Hg. Values for total PCBs (Aroclor 1254) include an acute survival LOEC of 10 mg/L. Lower effects values provided by EPA are not appropriate (for congeners or effects other than growth, reproduction, or survival). This value is orders of magnitude higher than the WQS value of 0.014 µg/L and is not appropriate for evaluation of chronic exposures. For mercury, aqueous toxicity thresholds are similar to or less sensitive than ADEM WQS. Available benchmarks and tissue CTCs, included data provided by EPA, have been evaluated in the Uncertainty Section (Section 6.2.3.8 and Section 6.2.3.13), but are not used as a LOE.		Yes	Yes, The response and edits to Sections 6.2.3.8 and 6.2.3.13 adequately address this comment	
170	Fish: The benchmark value of 2.2 nanograms (ng) TCDD/gram (g) lipid, was selected as the TRV for fish. This value is based on the 95% UCL effects residue (based on the geometric mean of no observed effect residue [NOER] and lowest observed effect residue [LOER] values) from the Steevens et al. (2005) study. Use of the UCL of the 90th percentile is not protective. The mean value (0.699 ng/g lipid) should be used as the TRV.	TRVs – Specific TRVs	The UCL of the 90th percentile was selected because the Steevens (2005) dataset includes a large proportion of salmonid data. Salmonids are more sensitive to TCDD and are not present in OU-4. Discussion of uncertainty associated with species sensitivity and evaluation of the mean of the 90 th percentile is included in the uncertainty analysis (Section 5.2) of Appendix F.	No		No.	No. An alternative would have been to recalculate the mean of values from the Steevens study, but with the salmonids excluded.
171	Bird Egg Critical Tissue Concentration: · The critical threshold for tPCBs in eggs of 6 micrograms per gram wet weight (ug/g ww) for intermediate sensitivity bird species cited in Harris and Elliott (2011) should be used as the egg tissue CTC for mid-sensitivity birds. This equals 24 ug/g dry weight (dw), assuming 75% moisture. * · If the Fernie et al. (2001a) value is retained, the following issues should be clearly addressed in the risk characterization section: 1) The kestrel is a low-sensitivity species, not a mid-sensitivity species. 2) At the egg concentration identified as a LOAEL from the Fernie et al. (2001a) study, 50% of nestlings produced by PCB-exposed adults died within 3 days of hatching, and 60% of PCB-exposed	TRVs – Specific TRVs	The recommended CTC of 6 µg/g ww is based on hatching success from Arenal et al. 2004 and Neigh et al. 2006. Arenal et al. (2004) is based on the European starling, which is a AhR Type I (high sensitivity) bird. As high sensitivity birds are evaluated in the BERA based on the domestic chicken TRVs, this value is not applicable. For Type 2 or 3 species, the egg concentrations reported in Neigh et al. 2006 are associated with reduced clutch size, but there were numerous confounding factors in the study and authors concluded that birds were not impacted. An alternate egg LOAEL TRV of 16.5 mg/kg ww based on mid-sensitivity birds was developed based on data from Peakall et al 1972, Peakall and Peakall 1973, as described in Section 5.5.1.1 and Appendix D (Section 3.1.2.2).	No		After looking at the range of values presented in Harris and Elliot, the 16.5 value suggested by Arcadis is probably an OK mid range value.	The PCB egg TRV from the Peakall studies is associated with an 83% reduction in hatching and 92% reduction in hatching. Section 6.3.6 does not mention the severity of the effect observed at the selected egg CTC. The severity of the effect is not discussed in Section 6.3.6.

Commented [E6]: Which of the 3 Neigh papers are they referencing? Neigh et al. (2006) is not in the references for the main text or the appendix D. I suspect that this is actually Neigh et al. (2007): Reproductive success of passerines exposed to polychlorinated biphenyls through the terrestrial food web of the Kalamazoo River.

Commented [KK7]: I think it is Neigh, A. M., et al. (2006). "Productivity of tree swallows (*Tachycineta bicolor*) exposed to PCBs at the Kalamazoo River Superfund Site." J. Toxicol. Environ. Health Part A **69**: 395-41

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	adult pairs with hatchlings failed to produce fledglings (Fernie et al. 2001b). In ovo exposure suppressed egg laying completely in 25% of PCB-exposed females (Fernie et al. 2001a).						It is agreed that the Arenal CTC is from a Type I bird. Although there are methodological problems associated with the Neigh et al. 2006 study, the peer-review report (Dickson et al. 2008. Final Report. Peer review of Michigan State University's PCB Exposure and Effects Studies in the Floodplain of the Kalamazoo River) states that "Despite the small sample sizes, the data contain a number of indications that reproductive success was lower at Trowbridge compared to the Fort Custer reference area" "MSU's presentation of nest success ... is also parsed into smaller subsets (years and causes), perhaps missing larger picture differences. Simply summing the data across years ... suggests much lower rates of nest success in bluebirds at Trowbridge and marginally higher rates of nest abandonment in both species at Trowbridge" The peer review report does note that the study design did not support conclusions that PCB exposure was the cause of the observed effects. Recommendation: Use the egg concentrations from Neigh et al. 2006 or integrate the severity of the effects observed in the Peakall study into the HQ interpretation is Section 6 (e.g., based on

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				No	Yes		
							the observed effects at the LOEC, a HQ ≥ 1.0 indicates high risk).
172	Mid-sensitivity Bird PCB TRV: The ingestion rate and body weight values selected to convert dietary doses in mg COPC/kg diet to milligrams COPC per kilogram body weight per day (mg COPC/kg BW/day) have a large impact on the calculated TRV value. For the mid-sensitivity bird study, ERT used an ingestion rate (15 g/day) and body weight (160 g) for ring doves cited in Schwarzbach et al. (1991) for the conversion. Arcadis used a body weight of 150 g (source not specified—Table D-4) and the allometric equation from Nagy (2001) to calculate a food ingestion rate. Because the article (Peakall and Peakall 1973) noted that the diet concentration was wet weight, the fresh matter ingestion rate equation was used, resulting in a LOAEL TRV of 4.3 mg/kgBW/day. However, the article also noted that diet percent moisture was 10%, which is more of a dry weight diet than COCs incorporated into prey tissue (typically 60 to 85% moisture). Recalculating the TRV using the dry matter ingestion rate equation results in a LOAEL value for the Peakall study of 1.3 mg/kgBW/day, which is very close to the Koval et al (1987) study TRV of 1.4 mg/kgBW/day. The Nagy equations are a valid method for estimating food ingestion rate, the use of the Koval TRV as the mid-sensitivity bird dietary TRV is acceptable.	TRVs – Specific TRVs	Comment noted.		yes	Yes – no revision really needed	

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				No	Yes		
173	Mammal PCB TRV: Arcadis will use the TRV associated with the growth endpoint from the Restum et al. (1998) study. The alternate mink TRVs from the Aulerich and Ringer (1977) paper will be removed. This value is similar to an effect level reported in a more recent study by Bursian et al. (2013), which identified a dietary concentration estimated to result in 20% kit mortality at six weeks of age (0.34 µg PCBs/g feed; 0.033 mg/kg/day). It is also similar to an EC20 value that can be calculated using a dose response curve derived by Fuchsman et al. (2008), which describes the relationship between PCB exposure and production of surviving kits per female (EC20 = 0.059 mg/kg/day) [the paper reports an EC50 value of 0.17 mg/kg/day].	TRVs – Specific TRVs	Mink TRVs for growth (LOAEL = 0.05 mg/kg bw-d) and reproduction endpoints (NOAEL/LOAEL 0.05 / 0.1 mg/kg BW-d) from Restum et al. (1988) are both included in the revised BERA, and the TRV from Aulerich and Ringer (1977) was removed. The updated mink TRVs are described in Section 5.4.6 and Appendix D (Section 3.2.2).	No—are giving more weight to reproduction endpoint based on wrong summary			Page 6-93 states: "However, mink data available from a recent study by Bursian et al. (2013) provide similar but slightly higher TRVs based growth and reproduction [sic] and Fuchsman et al. (2008) calculated a similar mink reproduction EC20. Based on these considerations, the reproductive NOAEL and LOAEL are considered adequately protective, while growth effects are not clearly tied to population-level impacts in mink, and therefore the mink TRV based on the growth endpoint is more uncertain. HOWEVER: The reproductive LOAEL TRV from Bursian is 0.033 mg/kg/day, while the reproductive EC20 from Fuchsman is 0.059 mg/kg/day. These values bracket the Restum growth TRV (0.044 mg/kg/day—stated as 0.05 mg/kg/day in Anniston BERA), and are much lower than the Restum reproductive TRV (0.1 mg/kg/day). None of the text discusses the severity of the effect observed at an exposure concentration of 0.1 mg/kg/day—85% reduction in kit survival (see comment 166).

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				No	Yes		
174	Field studies should be discussed as supporting information when discussing the HQ calculation results. Revise the text so it does not state that field study results were excluded from the risk evaluation phase.	TRVs – Use of field studies in TRV development	Revised text does not state that field studies were excluded. Field studies are discussed in specific examples as appropriate (e.g., Housatonic shrew study is discussed in the uncertainty analysis regarding small mammal analysis).	Not really		Probably not a big deal	
175	Include the Foekema et al. (2014) study of the effects of a mixture of 25 PCBs similar to Aroclor 1254 in the common sole (<i>Solea solea</i>). The study reported effects concentrations in lipid weight which can be converted to whole body concentrations using the lipids measured in sole in Foekema et al. (2012). Increased mortality, disrupted larval development, and edema between 6 and 40 days post fertilization was observed at a tissue-residue of 3.48 mg/kg. Disrupted or delayed development of larvae between 6 and 40 days post fertilization was observed at a tissue-residue of 6.82 mg/kg. Lethality to 50% of larvae, within 6 days post fertilization, occurred at a tissue-residue of 7.48 mg/kg. These results are of similar magnitude to the Hansen et al. (1973) study of the sheepshead minnow. The Foekema et al. (2014) study appears to be more conservative for establishing a fish tissue-based TRV for PCBs. Please incorporate the Foekema et al. (2014) study and lower the TRVs. EPA compared the lipids-normalized fish tissue concentrations were compared to the fish tissue benchmarks from Foekema et al. (2014) for disrupted development of common sole larvae. Based on calculated uptake curves for PCBs into forage fish, bottom fish, and predatory fish, the organic carbon normalized concentration in the fines to achieve the 341 mg/kg-lipid ww LOAEL would be 94 mg/kg-oc for the predatory fish, 255 mg/kg-oc for bottom fish, and 420 mg/kg-oc for forage fish. Apart from the lower reaches, the concentrations of PCBs in fine sediments are greater than the estimated protective values for the fish community.	TRVs – Specific updates requested using literature sources that have been released since TRVs were developed	The Foekema et al. (2014) study measured only 25 congeners associated with Aroclor 1254. The resulting TRVs are similar to TRVs from Hansen et al. (1973) used in the BERA in which Aroclor 1254 was measured. The discrepancy may be due to analytical methods, not toxicity. Therefore, the fish tissue TRVs based on Hansen et al. (1973) BERA were retained.	No		no	The CTC from Foekema et al. (2014) is 6.82 mg/kg ww (IC50 for developmental effects) while that from Hansen et al. (1973) is 9.3 mg/kg (dry weight concentrations of 27.3 versus 37.2). Use of the Foekema CTC may result in a difference in the risk conclusions. If the Foekema CTC is not acceptable based on analysis of only 25 congeners, Table 1 presents three alternative CTCs from studies conducted with a non-salmonid species. EPA recommends use of the CTC from the Hugla and Thome (1999) paper, a LOEC of 2.6 mg/kg dw.
176	The benthic invertebrate tissue TRVs for PCBs and Hg noted in comments 7 (Van Geest et al. 2011) and 8 (Mendez-Fernandez et al. 2015) should be included as tissue TRVs.	TRVs – Specific updates requested	See responses to Comment Nos. 7 and 8.	No		No	See the responses on Comments 7 and 8
177	One commenter noted that tissue residue data could be matched up with closest Aroclor profile and then the appropriate Aroclor toxicity data could be used to estimate risk. This approach was used for Housatonic River BERA. See Moore et al. (2016).	TRVs - Specific updates requested	This approach does not account for differential uptake and metabolism of PCB congeners. Historical sources of PCBs are well understood within OU-4. This approach is not necessary to evaluate PCB risk in the revised BERA.	no		no	Contrary to their statement, the suggested approach would in fact account for differential uptake and metabolism of PCB congeners. Their

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				No	Yes		
							response is also in conflict with their response to comments concerning evaluation of PCDD/PCDF congeners. That said, I'm not sure that it would make a substantive difference in the TRVs.
178	Review Moore et al. (2016) to determine if the small mammal tissue TRV should be revised.	TRVs - Specific updates requested	Moore et al. (2016) used a Aroclor 1254 dose-response curve for small mammals from the Spencer et al. (1982) gestational exposure study. The EC20 (assumed to be LOAEL-equivalent) appears to be between 1 and 10 mg/kg-d, which is greater than both the NOAEL and LOAEL values in the Draft BERA from the McCoy et al. (1995) multigenerational study with mice. No change to the small mammal TRV employed in the BERA based on this comment.		Yes	No revision was made, but the TRV value used is lower than the TRV from Moore et al. (2016).	
179	Dioxin/furan concentrations in fish tissues were not compared to a tissue-residue TRV possibly because one was not available. Dioxin/furan concentrations in fish tissues were in the hundreds of pico-grams per gram (pg/g) and did not exceed the tissue-residue TRVs for dioxin in fish of 3 –16 nano-grams per gram (ng/g) (King-Heiden et al. 2012).	TRVs - Specific updates requested	King-Heiden (2012), a review article, cites the tissue CTC range for fish of 3-16 ng/g based on wasting/lethality in adult yellow perch, carp and bullhead, adult rainbow trout, bluegill, and largemouth bass. This comparison has been added to Appendix F.		Yes	Yes	
180	Comment 37 recommends evaluating mercury as both MeHg and as inorganic Hg. Bird and mammals TRVs for dietary exposure to inorganic Hg are needed for the BERA. For birds, use the NOAEL of 0.45 mg/kgBW/day and the LOAEL of 0.9 mg/kgBW/day from Hill and Schaffner as cited in Sample et al. (1996). For mammals, use the LOAEL of 0.37 mg/kgBW/day reported by Atkinson et al. (2001).	TRVs - Specific updates requested	An analysis comparing methyl and inorganic mercury is provided in the uncertainty analysis (Section 6.2.3.9) for Carolina wren using the methylmercury TRVs from the BERA, inorganic TRVs from Hill and Schaffner (1976) for birds and from Aulerich et al. (1974) and Atkinson et al. (2001) for mammals, and the percentage methylmercury in prey items provided by USEPA (Table 6-22).		Yes	No. Although the revision was not done exactly as requested, what was done was sufficient to address the comment. The assumption that Hg is 100% MeHg is a conservative approach.	
181	There has been no consideration of the congener mixture at the site versus the congener mixtures in the various toxicity test results. Toxicity varies between Aroclor mixtures quite substantially for wildlife. Aroclors were only analyzed in fish, crayfish and mollusks; 1242, 1254, 1260 and 1268 were the only detected Aroclors. 1242 was detected in 63, 30, and 78% of fish, crayfish, and mollusks respectively. 1254 was 100% detects. 1260 was detected in 100, 96, and 100% of fish, crayfish and mollusks. 1268 was detected in 2 of 135 fish samples (1%), and not detected in crayfish or mollusks. Measured concentrations	TRVs – Additional Issues	Aroclor composition in fish, crayfish and mollusc tissue compared with Aroclors that provide the basis for CTCs are discussed in the uncertainty analysis in Section 6.2.3.12 and 6.2.3.14.1.		Yes	Yes	

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	of Aroclor 1254 were highest in all species groups, followed by 1260. Discuss the toxicity of site-specific Aroclors versus the Aroclors used to develop the TRVs.						
182	Page 6-75 identifies a NOAEL soil concentration of 21.1 mg/kg from a study conducted on shrews for the Housatonic. According to Moore et al. (2016, section 9 of supplementary material), this concentration is associated with about 15% additional mortality of shrews than occurs at 1-2 mg/kg dw tPCBs (Aroclor 1254 is dominant mixture at the site). The Housatonic River shrew study did not measure concentrations of PCBs in the diet or in the shrews. The degree of exposure to shrews is too uncertain or unknown to use the study to estimate a toxicity reference value. The power of the Housatonic River study to measure an effect was low due to low sample sizes. The study was confounded by the effect of the habitat differences among the sampling areas. During flooding it was suspected that the shrews moved among the sampling areas, so that shrews collected in one area might not have been exposed exclusively to the soils in that area. Due to the uncertainty in exposure, and the observed additional mortality, this concentration should be a LOAEL, not a NOAEL, concentration.	TRVs – Additional Issues	The Housatonic values were not included in the draft BERA as specific TRVs but were included as uncertainty discussion. The last sentence in the 3rd paragraph of Section 6.2.3.7 has been revised as follows: "While there is some uncertainty in this direct comparison because of possible limitations in the Housatonic River field study, different study design and differences in endpoints that were measured, this comparison does provide context for interpretation of modeled HQs primarily based on laboratory studies, relative to actual field observations of the robustness of a local community or population."		Yes	Yes, the text was changed so that it no longer describes the study result as a LOAEL.	
183	Sensitivity analyses can be performed to see how much of an effect varying parameters has on results, and which parameters have the most influence in driving specific risk estimates.	Uncertainty Analysis	A quantitative sensitivity analysis was not performed. Additional examples of parameter sensitivity were added to the uncertainty analysis, such as evaluation sediment depth profile and the predictive nature of Aroclor vs homolog data (Section 6.2.1.1), implications of evaluation of mercury as 100% methyl mercury (Section 6.2.3.9) and evaluation of alternative BAFs for emergent insects and small mammals (Section 6.2.2.1)	no		No, but probably OK – Lack of a sensitivity analysis only hurts their ability to explain uncertainties better. Not really a show stopper.	Notes: depth profile discussion on Page 6-41 references Figure 6-22. This is the wrong figure. Probably should be Figure 6-23, but 6-23 is missing from hardcopy and pdf.

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184	Comments regarding definition of the riparian zone as the 100-foot corridor adjacent to the river: This was based on a historic agreement. Concentrations in the floodplain are higher near the river. If you used the whole riparian zone, it would dilute those samples. It was an operational decision--spatially restricted, but representative of highest exposure concentrations. This should be explained more clearly in the BERA.	100-foot Riparian Corridor	The following text replaces the text in the 3rd paragraph in Section 4.1. "The location, size, and shape of the foraging area may be influenced by the available food base and habitat due to the potential uncertainty in assigning EUs/AAs for a given receptor species. In addition, the PCB concentrations tend to be higher in the floodplain area closest to the creek with concentrations decreasing with distance away from the creek. Because, some receptors feed primarily on aquatic prey either within the creek itself or within the riparian corridor (the area of the floodplain closest to the creek) and other receptors feed more generally within the larger floodplain, the floodplain areas of each reach were divided into multiple EUs." The last sentence of the 2nd bullet below this paragraph was revised to "The riparian EUs and AAs are defined operationally as a 100-foot wide riparian corridor along both sides (200 feet in total) of the creek and are associated with creek miles. This 100-foot wide riparian zone is also consistent with much of the upland areas lining the creek with natural vegetation as opposed to the open field areas that are located beyond this treed buffer zone."		Yes	Yes	
185	New Comment	Remedial Goal Calculations		NA	NA	Tables that show the calculation of the remedial goals were not included in the revised BERA.	Table with the remedial goal calculations must be added.

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Table 1. Critical Issues in the Revised Baseline Ecological Risk Assessment that must be Addressed

Issue	Specific Concerns
Hazard Quotient Interpretation and Weight of Evidence Evaluation	The effective concentration (EC _x) is a concentration at which a response is reduced by that value; e.g., at the EC20 concentration, you would expect a 20% reduction in reproduction relative to the control. For this risk assessment, the EC20 was identified as an endpoint that could result in population-level impacts. For the benthic risk evaluation, the risk categories should have been defined as: < EC0; ≥ EC0, < EC10; ≥ EC10, < EC20; ≥ EC20. (comment 6)
	Polychlorinated biphenyl (PCB) homologs were detected in some of the reference samples at low concentrations. The average homolog PCB concentration at the reference stations is low, however it is unclear that these low concentrations represent acceptable risk. Since acceptability of risk is being defined as comparison to the bottom of the reference envelope, there is uncertainty in whether the EC0 or EC0* can be described as a threshold for adverse effects, when the shape of the dose-response curve (Figure C-3c) does not suggest a threshold. There does not appear to be an actual threshold where risks begin at the site. The EC0 and EC0* cannot be considered a No Observed Effect Concentration (NOEC). (comment 140)
	The interpretation of the hazard quotient (HQ) calculations also needs to have the risk categories revised. A lowest observed adverse effect level (LOAEL) is an exposure concentration at which an adverse effect has been observed; any exposure concentration equal to or greater than this value (HQ ≥ 1) indicates calculated risk. The following risk categories should be used consistently throughout the BERA: No observed adverse effect level (NOAEL)-based HQ < 1, <i>de minimus</i> risk; NOAEL HQ ≥ 1 and LOAEL-based HQ < 1, low risk; LOAEL HQ ≥ 1 indicates risk. The magnitude of the adverse response observed in the critical study the LOAEL toxicity reference value (TRV) was derived from should be used to interpret LOAEL HQs ≥ 1. The BERA currently defines high risk as calculated LOAEL-based HQ > 10. (Comments 68 and 134)
	The revised BERA rounded calculated HQs to whole numbers, meaning that NOAEL-based HQs < 1.5 fall in the <i>de minimus</i> risk category and LOAEL-based HQs < 1.5 fall in the low risk category. All LOAEL-based HQs greater than or equal to 1.0 indicate calculated risk to a receptor. (comments 134, 135, 136)
	Many of the EPA comments on the conservatism associated with each line of evidence (LOE) and the confidence associated with the risk prediction were not addressed. Specifically, Tables 6-24 through 6-26 require significant revision.
	In the weight of evidence (WOE) section, there are numerous places where it is stated that there is risk due to chemistry-based lines of evidence (LOEs); then this estimate is downgraded based on the community analysis results. Statements indicating risk was overestimated need to be evaluated and removed if not appropriate.
	In many cases, revisions in response to a comment regarding LOE and WOE conclusions were addressed at a specific place in the document. However, these revisions were not always carried through to the rest of the document, particularly throughout Section 6 (Comment 69 and 103)
Exposure Point Concentrations (EPCs)	EPA requested that the 95 percent upper confidence limit of the mean (95UCL) for PCBs and mercury (Hg) in sediment be presented along with the surface weighted average concentration (SWAC) identified as the sediment EPC in the initial draft BERA. Arcadis presented the 95UCL of the boot strap means calculated for the SWAC. Tables 4-4 and 4-5 need to show the 95UCL not based on the SWAC, but simply for PCBs and Hg measured in sediment by Reach and by Assessment Area (AA). Risk calculations do not need to be rerun using the 95UCL, but the 95UCL values calculated using all the sediment data utilized in the risk calculations need to be presented, the values compared, and the implications for risk conclusions discussed. (comment 154)
Sediment Toxicity Tests	The most sensitive endpoint identified from the sediment toxicity tests, the adult midge biomass endpoint, was not used in the calculation of the site-specific toxicity thresholds. This endpoint must be added to this analysis.
	The toxicity test results were used to calculate protective sediment cleanup goals (CUGs) for PCBs and mercury. The endpoints used to calculate the remedial goal options (RGO) were based on <i>Chironomus dilutus</i> and <i>Hyalella azteca</i> reproduction and survival. Including the <i>C. dilutus</i> adult biomass as an endpoint would have produced a lower CUG. RGOs calculated using the <i>C. dilutus</i> endpoint should also be presented.
	Footnote b of Table 5-2a states that “EC0 was set at a concentrations of 0.05 (the mean reference sediment concentration)”. However, total PCB Aroclors were not detected (ND) in any of the reference sediment samples; 0.05 mg/kg is the maximum reporting limit (RL). Looking at Figure C-3c, the curve drops rapidly for the Young/female normalized to survival (% of control) endpoint. If you use a value of ½ the RL as the EC0, what is the effect on the calculated EC0* and EC10* values? Please provide a sensitivity analysis evaluating the effect on the site-specific toxicity thresholds calculated using a value of ½ RL versus using the RL as the EC0
	The sediment toxicity tests were not used as a separate LOE for the benthic macroinvertebrate evaluation, as stated in the Response to Comment (RTC) with regards to comment 139: “Individual sediment samples used for toxicity testing were collected from various depths to capture a range of PCB concentrations and therefore are not representative of the exposure of a benthic organism in the biologically active zone (0-6”)”. However, surface samples were used for toxicity testing at three of the six locations from which the toxicity test samples were collected (Section 3.5). At a minimum, results from the surface samples must be used to evaluate effects of exposure to the mixture of contaminants of concern (COCs) present in sediment at the Site.
Community Surveys	The community survey results are not clearly identified as a secondary LOE and cannot be used to support the conclusion that there appear to be no adverse effects of PCBs on receptor communities, since PCBs were not measured in their community samples, and the studies were not conducted in a manner to support quantitative conclusions concerning the influence of contamination on community attributes. The results of the community surveys cannot be used to down weight WOE conclusions based on chemistry measurements. (comments 9 and 12)

Toxicity Reference Values (TRVs)	Most of the EPA-recommended critical tissue concentrations (CTCs) were not used. Issues identified with the CTC values used in the BERA are summarized in comments 7a to 7f and 8a to 8f; updated EPA-recommended CTCs are presented in Table 2. The most critical issue with the proposed CTCs is that tissue concentrations were assumed to be wet weight (ww) if basis was not stated in the article. If dry or ww is not specified, the conservative assumption that the cited value is dry weight (dw) must be used. Assuming the value is ww and converting it to dw results in a much higher CTC value that may not be protective.
	There is high uncertainty associated with some of the TRVs used in this risk assessment. The uncertainty analysis and WOE summary (Tables 6-24 through 6-26) over-weight the risk conclusions based on the LOEs where less conservative or questionable TRVs were used in the risk characterization.
Data Quality Issues	The analysis of total Aroclor PCBs and the homolog Selected ION Method (SIM) analysis conducted on 10% of the soil, sediment, surface water and tissue samples might not have picked up on the site-specific composition of PCB congeners indicated by the high resolution method used for the toxicity test data. The toxicity test samples showed a relatively high fraction of mono-chlorinated PCBs rather than the PCB congeners typically associated with Aroclor 1242. The concentrations of total PCBs by homolog SIM were underestimated in biota tissue samples relative to total Aroclor concentrations; this should be included in the WOE discussion. The WOE summary for AEs using food-chain models for birds and mammals need to change the “level of conservatism” entry from high to moderate when the food-chain models relied heavily on homolog SIM data.
	The surface water samples were not analyzed using the high resolution homolog analytical method. Pore water results indicate that mono- and dichloro- PCBs comprise a large portion of the detected homologs in pore water (Table A1-3a, Appendix A, Ingersoll et al. 2014). The total PCB concentrations in surface water may have been underestimated due to the analytical methods used for these samples. Pore water data should be discussed in the BERA and evaluated against toxicity, at least for the 3 sites with surface sediment samples. Looking at the toxicity test data, toxicity is associated with high concentrations of PCBs in pore water. It is important to consider the influence of low-molecular weight PCBs in the pore water on toxicity and mobility through their high concentrations. However, other PCB components found in lower concentrations, such as dioxin-like PCBs, might also contribute to sediment toxicity. The concentrations of suspected toxicants should be reported for the 3 or more sediment samples collected from the surface.
	The data for metals other than mercury appears not to have been validated.

Table 2. EPA-Recommended Critical Tissue Concentrations

Receptor Group	COPC	Specific COPC	Species	Exposure route	Recommended CTC, mg/kg ww	Recommended CTC, mg/kg dw	Source	CTC used in the BERA, mg/kg dw	Source	Reason for recommended study	Notes
Benthic Invertebrates	PCBs	Total PCBs	Hexagenia sp.	sediment	NOEC, 0.59; LOEC, 1.4	NOEC, 1.9; LOEC, 4.52	Van Geest et al. 2011	NOEC range 21 to 541; LOEC range 27 to 1875	Various	Although there are some issues with the Van Geest et al. 2011 study, numerous issues were identified in the proposed studies from which PCB CTCs were derived. These issues are discussed in detail in comments 7 through 7e. If the Van Geest et al. study is not considered appropriate for deriving the benthic invertebrate CTC, the Milani et al. 2013 is recommended.	
Benthic Invertebrates	PCBs	Total PCBs	Odonates	sediment	Values cited as dry weight	NOEC, 0.514; LOEC, 1.009	Milani et al. 2013	NOEC range 21 to 541; LOEC range 27 to 1875	Various	There are a limited number of studies available to derive a CTC for benthic invertebrates; the quality of some of these studies is questionable. EPA recommends using a single study as representative of benthic invertebrates. This study utilized toxicity testing, community surveys, and tissue concentrations to evaluate the benthic community. Sediment LC12 was classified as severely toxic. Survival of C. riparius, H.azteca, and Hexagenia sp. was 64, 75, amd 46%, respectively. Caenidae mayflies, amphipods, caddisflies, and Coenagrionidae odonates were absent from community samples collected at this location. The measured concentration of PCBs in Odonates from this locationwas selected as the CTC.	
Benthic Invertebrates	Mercury	mercury	Tubifex	sediment	Values cited as dry weight	NOEC, 12.7; LOEC, 17.97	Mendez-Fernandez et al. 2014	NOEC range 0.06 to 56; LOEC range 90 to 150	Various	As above, there are a limited number of studies available to derive a CTC for benthic invertebrates; the quality of some of these studies is questionable. EPA recommends using a single study as representative of benthic invertebrates. No significant issues were identified in two of the proposed CTC studies (Saouer et al. 1989 and Borgmann et al. 1993; comments 8b and 8c). The Dillon et al. 1977 paper shows 14% mortality at the 6 mg/kg ww tissue concentration; this should be the acute LOEC and not the NOEC. Using an acute-to chronic ratio of 0.1 gives you a LOEC of 0.6 mg/kg ww, or 8 mg/kg dw (comment 8d).	
Fish	PCBs	25 congeners that are found in Aroclor 1254	Common sole	water	LOEC, 6.82	27.3	Foekema et al. 2014	37.2	Hansen et al.	The Foekema et al. 2014 was not used as only 25 congeners were measured, and the CTC values were similar to the CTC from Hansen et al. 1973 study. Although the wet weight values are similar (6.82 versus 9.3), converting the CTCs to dry weight results in a greater difference and may affect risk conclusions. If the Foekema et al. 2014 study is not considered appropriate to derive a CTC, EPA recommends any of the three studies below conducted with non-salmonid species (Hugla and Thome 1999; Orn et al. 1998; Hillis et al. 2015).	
Fish	PCBs	Aroclor 1260	Barbus barbus; common barbel	diet	Values cited as dry weight	2.6	Hugla and Thome 1999	—	—	A significant decrease in fecundity was observed at this whole body tissue concentration; non-salmonid species	
Fish	PCBs	20 PCB congeners	Danio rerio; zebrafish	diet	2.7	10.8	Orn et al.	—	—	A significant decrease in median larval survival time was observed at this whole-body tissue concentration; non-salmonid species	liver and ovary removed before PCB concentration measured (not whole-body; likely underestimates CTC)
Fish	PCBs	28 PCB congeners were measured and summed	Bluegill	field-collected fish; 8 lakes with varying PCB concentrations	Values cited as dry weight	1.7	Hillis et al. 2015	—	—	Mesocosm study; relative density of juvenile bluegill produced by fall was negatively correlated with PCB concentrations in males (P = 0.002, r2 = 0.71)	tissue concentration estimated from bar graph, Figure 1
Fish	Dioxin	TCDD and DL-compounds	10 species used to develop SSD; 3 of 10 were salmonids		0.699 ng/g lipid; 20.3-45.4 ng/kg ww	81.1 - 182 ng/kg dw	Steevens et al. 2005	2.2 ng/g lipid; 255 -572 ng/kg dw	Steevens et al. 2005	EPA recommends using the mean benchmark value that is protective of 90% of fish species. Arcadis used the 95% UCL of the mean benchmark value that is protective of 90% of fish species. Ten species were used to develop the SSD. Only three of the 10 species were salmonid species. Use of the mean value protective of 90% of fish species is not overly protective.	
Bird egg	Dioxin	TCDD	Common pheasant	egg injection	0.18 ug/kg	0.72 ug/kg	Cohen-Barnthouse 2011	NA	NA		
Bird egg	PCBs	Total PCBs	tree swallow		NOEC, 0.81; LOEC, 5.1	NOEC, 3.24; LOEC, 20.4	Neigh et al. 2006	LOEC, 64 mg/kg	Peakall and Peakall 1973	Although the Neigh study has methodological problems, the peer review panel for the Kalamazoo River BERA noted that the data did indicate lower reproductive success at Trowbridge compared to the reference area. If the Peakall 1972/Peakall and Peakall 1973 CTC is used, an HQ ≥ 1 must be interpreted as high risk based on an 83% reduction in hatchng and a 70 - 92% reduction in number of young fledged at this concentration	

^A converted using average % solids for emergent insects of 31%

Cohen-Barnhouse, A. M., M. J. Zwiernik, et al. (2011). "Sensitivity of Japanese quail (Coturnix japonica), common pheasant (Phasianus colchicus), and white Leghorn chicken (Gallus gallus domesticus) embryos to in ovo exposure to TCDD, PeCDF and TCDF." Toxicol. Sci. 119(1): 93-103.

Foekema, E. M., M. L. Parron, et al. (2014). "Internal effect concentrations of organic substances for early life development of egg-exposed fish." Ecotox. Envir. Safety 101: 14-22.

Hillis, J. J., J. E. Garvey, et al. (2015). "Contaminants reduce male contribution to reproduction at the population scale." Ecosphere 6(4): 1-12.

Hugla, J. L. and J. P. Thome (1999). "Effects of polychlorinated biphenyls on liver ultrastructure, hepatic monooxygenases, and reproductive success in the Barbel." Ecotox. Envir. Safety 42: 265-273.

Mendez-Fernandez, L., P. Rodriguez, et al. (2015). "Sediment toxicity and bioaccumulation assessment in abandoned copper and mercury mining areas of the Naol. River Basin (Spain)." Arch Environ. Contam. Toxicol. 68(1): 107-123.

Milani, D., L. C. Grapentine, et al. (2013). "Sediment contamination in Lyons Creek East, a tributary of the Niagara River: Part I: Assessment of benthic macroinvertebrates." Arch Environ. Contam. Toxicol. 64: 65-86.

Neigh, A. M., M. J. Zwiernik, et al. (2006). "Productivity of tree swallows (Tachycineta bicolor) exposed to PCBs at the Kalamazoo River Superfund Site." J. Toxicol. Environ. Health Part A 69: 395-415.

Orn, S., P. L. Anderson, L. Forlin, M. Tysklind and L. Norrgren. 1998. The impact on reproduction of an orally administered mixture of selected PCBs in zebrafish (Danio rerio). Arch Environ. Contam. Toxicol. 35: 53-57.

Steevens, J. A., M. R. Reiss, et al. (2005). "A methodology for deriving tissue residue benchmarks for aquatic biota: A case study for fish exposed to 2,3,7,8-tetrachlorodibenzo-p-dioxin and equivalents." Integ. Envir. Assess. Mgmt. 1(2): 142-151.

Van Geest, J. L., D. G. Poirier, et al. (2011). "A comparison of the bioaccumulation potential of three freshwater organisms exposed to sediment-associated contaminants under laboratory conditions." Environ. Toxicol. Chem. 30(4): 939-949.

Appendix B - EPA Outline for the OU4 BERA Addendum

OUTLINE FOR OU4 BERA ADDENDUM (PROPOSED & SUBJECT TO CHANGE**)**

v1, 06/14/2017

Introduction (Written by EPA)

Executive Summary

Global Issues

Hazard Quotient (HQ) Rounding

Issue: Calculated HQs are being rounded to a single digit. (comments 134, 135, 136)

Resolution: HQs will be shown to one decimal point.

Resolution: Toxicity thresholds on Table 5-2a will be reported to the same number of significant figures as on Table C-1.

HQ/Effective concentration (EC_x) Interpretation

Issue: Calculated LOAEL-based HQs greater than 1.0 are being interpreted as moderate risk, while HQs of 1.0 are interpreted as low risk. As per ERAGS, “unity (HQ = 1.0) becomes a more certain pass/fail decision point”. (Comments 6, 68, 134)

Resolution: The following risk categories will be used consistently throughout the BERA: No observed adverse effect level (NOAEL)-based HQ < 1.0, *de minimus* risk; NOAEL HQ ≥ 1.0 and LOAEL-based HQ < 1.0, low risk; LOAEL HQ ≥ 1.0 indicates risk. The HQ summary spreadsheets in Excel will be requested by EPA to facilitate this revision.

For the benthic risk evaluation, the risk categories should have been defined and will be revised as: < EC0; ≥ EC0, < EC10; ≥ EC10, < EC20; ≥ EC20. (comment 6)

Calculated HQs will be evaluated based on the number and magnitude of exceedances. Additionally, the magnitude of the adverse response observed in the critical study the LOAEL toxicity reference value (TRV) was derived from will be used to interpret LOAEL HQs ≥ 1.0.

Data Quality Issues

Issue: The data tables in Appendix E include the Laboratory qualifiers, not the data validator qualifiers. Were the metals data validated?

Resolution: Every sample went through Level 2 validation, and 1 of 20 samples went through Level 4 validation. Arcadis will provide Sharon with a table showing qualifiers that changed during the validation process.

Issue: The Aroclor data indicate that Aroclors 1254 and 1260 are present on-site, however the homolog data indicate that low- and highly-chlorinated homologs are present in tissues, while the mid-range homologs that would be associated with Aroclors 1254 and 1260 are not.

Resolution: Sharon will discuss this issue with a PCB chemist.

Data Issues

Issue: Only SWACs and the 95%UCL of the SWAC were presented in the BERA. EPA requested the 95%UCL of the measured sediment PCB and mercury concentrations by Reach and by Assessment Area (AA).

Resolution: The slide presentation, which included a Table with the 95%UCL values, will be requested by EPA. The 95UCL values calculated using all the sediment data utilized in the risk calculations will be presented, the SWAC and 95%UCL values compared, and the implications for risk conclusions will be discussed.

Issue: Instead of using the maximum measured concentration for Reach C1 as the exposure point concentration (EPC), the mean concentration for the UAA was used.

Resolution: The EPC will be evaluated to determine if risk conclusions would be affected. If not, the addendum will document this issue was observed, but would not affect the overall conclusions. Additionally, soil data is available from reaches C1 and C10, but these samples were not labelled riparian although there is a small riparian zone that parallels the creek. Use of an EPC calculated from these soil data will be evaluated.

Issue: For the sediment samples used in the toxicity tests, homologs were analyzed using a high resolution analytical method whereas PCB homologues in the 10% of samples (soil, sediment, surface water and 100% of some tissues) were analyzed using selected ion monitoring (SIM). In the toxicity testing samples collected from the backwater area, concentrations of mono- and di-chlorinated homologs are high, but the Aroclor analysis is not picking up the lower chlorinated Aroclors. The total Aroclor data may be under-predicting the actual PCB concentrations present.

Resolution: This issue will be discussed in the uncertainty section. The discussion will include noting that although the lower chlorinated congeners are present in sediment, Choccolocco Creek is a gaining waterbody, and the presence of lower chlorinated congeners in sediment should not be a groundwater concern.

Community Survey Metrics

Issue: We need to check and verify how this line of evidence (Community Metrics) was used for each AE – confirm it was used as a secondary LOE and not as a leading LOE.

Reference Locations

Issue: PCBs were detected in surface water and aquatic plant samples at Reference location 2 (comment 44).

Resolution: The Addendum will note that the reference locations were selected through a systematic process. It will note that the PCBs observed at Reference location 2 were anomalous, and the source of the PCBs is unknown.

Non-Mercury Metals

Issue: Due to limited data and high RLs for ND samples, the strength of evidence for stating metals concentrations on-site are similar to reference is low. (comments 87 and 90)

Resolution: May need to consider constituents monitored in surface water in post-remedy monitoring.

Threatened and Endangered Species

Issue: The 2006 Problem Formulation states “Risks to threatened and endangered species will not be explicitly evaluated. Rather, appropriate surrogate species will be identified as focal points for risk characterization for determining if risks to threatened and endangered species could be unacceptable. Surrogate species and appropriate risk assessment parameters will be developed in the BERA.” This was not done in the BERA.

Resolution: A risk characterization summary that includes a brief paragraph clarifying that EPA does not do ERA for T&E species or for individuals thereof should be added. Any T&E species that are, may, or should be present at the site, where appropriate need to be listed as receptors. Threatened and endangered species should not be used as assessment endpoints in EPA ecological risk assessments. Rather, appropriate surrogates are chosen for the assessment endpoints that represent site receptors and are inclusive of threatened or endangered species (i.e., receptors), if present. It is important to note that EPA does not do ecological risk assessments on endangered species and does not characterize risks for individual organisms (as may be wrongfully assumed in a focus on an endangered species). EPA ecological risk assessments are site population level assessments.

Assessment Endpoint (AE)-Specific Issues

AE #1: Survival, Growth and Reproduction of Aquatic Receptors

Issue: Observed surface water exceedances of the Alabama Department of Environmental Management (ADEM) Water Quality Standards (WQS) and Ambient WQS are down-weighted using species-specific toxicity values.

Resolution: The ADEM WQS and AWQC will be identified and weighted as the primary LOE.

AE #2: Survival, Growth and Reproduction of Benthic Invertebrate Communities

- **Benthic Invertebrate Community Survey (BICS)**

Issue: The benthic community surveys were not clearly identified as a secondary Line of Evidence (LOE) and no co-located chemistry data was collected with the benthic community samples.

Resolution: The text will not state that there appear to be no adverse effects of PCBs on the benthic receptor communities, since PCBs were not measured in the community samples. The results of the community surveys will not be used to down weight WOE conclusions based on chemistry measurements.

Issue: The BERA evaluated the BICS data by comparing reference results to on-site results.

Resolution: The Addendum will add an up- to down-stream comparison. Initial evaluation showed impairment in the upper and lower assessment areas (AAs).

Issue: The BERA utilized the Hilsenhoff (1988) protocols to evaluate the BICS data. ADEM protocols, which include region-specific reference locations, are available and should have been used.

Resolution: The Addendum will include an evaluation of the BICS data using the ADEM protocols.

- **Site-Specific Toxicity Tests**

Issue: The BERA discounts use of the 42-day *Hyaella* reproductive endpoint due to high variability in the control samples.

Resolution: Discuss acceptable/often observed variability associated with this endpoint.

Issue: The BERA does not include the most sensitive endpoint measured in the toxicity tests, *Chironomus dilutus* adult biomass due to calculation of adult biomass from measured 13-day old *C. dilutus* biomass.

Resolution: Discuss the method for and uncertainty associated with calculation of a parameter (adult biomass) from a measured parameter.

Resolution: Calculate a Remedial Goal Option (RGO) using the *C. dilutus* adult biomass endpoint.

Issue: Surface samples utilized in the toxicity tests were not evaluated as a separate LOE.

Resolution: The surface samples utilized in the toxicity tests will be identified and the toxicity associated with these samples will be compared with the reference envelope.

Issue: Footnote b of Table 5-2a states that “EC0 was set at a concentration of 0.05 (the mean reference sediment concentration)”. However, total PCB Aroclors were not detected (ND) in any of the reference sediment samples; 0.05 mg/kg is the maximum reporting limit (RL). Looking at Figure C-3c, the curve drops rapidly for the Young/female normalized to survival (% of control) endpoint. If you use a value of ½ the RL as the EC0, what is the effect on the calculated EC0* and EC10* values?

Resolution: The Addendum will evaluate the effect on the site-specific toxicity thresholds calculated using a value of ½ RL versus using the RL as the EC0.

Issue: There is uncertainty whether the EC0 and EC0* can be considered a NOEC (comment 140).

Resolution: The reference envelope, which is independent of concentration, is used to identify the EC0* and EC0. The Addendum will discuss the uncertainty associated with the use of the RL for total Aroclors, and the shape of the dose-response curve. If appropriate, it will note that exposure at the EC0 does not present an unacceptable risk.

- **Porewater**

Issue: Porewater data was not discussed as an additional LOE.

Resolution: A discussion of the porewater data will be added in the addendum and to the WOE tables. This discussion will note that the sediment and porewater toxicity analysis are complementary and lead to similar conclusions.

- **Benthic Invertebrate Tissue Concentrations**

Issue: The Critical Tissue Concentrations (CTCs) recommended for benthic invertebrates by EPA were not utilized in the revised BERA.

Resolution: Discuss the uncertainty associated with available benthic CTCs and present the range of measured values. Note that there is low confidence in these numbers due to uncertainty, and that this is a secondary LOE. Note that the primary reason this data was collected was for use in the dietary exposure models.

Issue: The most critical issue with the proposed CTCs is that tissue concentrations were assumed to be wet weight (ww) if basis was not stated in the article. If dry or ww is not specified, the conservative assumption that the cited value is dry weight (dw) must be used. Assuming the value is ww and converting it to dw results in a much higher CTC value that may not be protective.

Resolution: The slide in the May 16 presentation with the dry weight/wet weight information will be reviewed to confirm that the basis conclusions in comments 7a to 7f and 8a to 8f are consistent with the slide. Basis issues will be clearly noted in the Addendum.

- **Emergent Insect BAFs**

Issue: Hymenoptera are not aquatic insects, but were included in the emergent insect samples.

Resolution: Revise Table 6-24 to reflect lower conservatism and moderate confidence in the risk prediction.

AE #3: Survival, Growth and Reproduction of Fish Communities

- **Fish Tissue Concentrations**

Issue: The CTC from the Foekema et al. 2014 for PCBs was not included in the BERA.

Resolution: The CTC from the Foekema et al. 2014 does not need to be included in the BERA.

Issue: The recommended CTC for dioxin in fish tissue was not included in the BERA (comment 170).

Resolution: A discussion will be added to the Addendum that the selected CTC from the Steevens paper is within the range of CTCs cited in Tillett et al. 2017.

AE #4: Survival, Growth and Reproduction of Bird Communities

- **Bird Egg COPC Concentrations**

Issue: Dioxin concentrations in bird eggs were not estimated using the OEHHA (2015) method and transfer coefficient.

Resolution: Addendum will note that this estimate is not needed due to uncertainty associated with the method and the limited dioxin/furan data available to estimate exposure dose. Cite the sentence from the BPF that this LOE may be evaluated.

Issue: The equation used to estimate bird egg concentrations should be adjusted by the bird's body weight to make it applicable to ecological risk assessment for smaller bird species.

Resolution: The Addendum will note that ideally the model should be scaled to bird size; however this calculation is highly uncertain and this LOE will be given lower weight than the dietary exposure models. This uncertainty will be added in the uncertainty section, will refer back to the 2006 BPF, and note that a best faith effort was made to model maternal transfer of COPCs to eggs.

- **Bird Dietary Exposure Models for Dioxin**

Issue: The calculations in Appendix F in general show that the risk posed by the combination of dioxin-like PCBs and dioxin/furans is less than risks estimated for total PCBs. The most sensitive receptor was the Carolina wren. The most toxic congener was PCB 126, however there is no BAF for PCB 126 in Table F-6.

Resolution: The maximum concentration of PCB 126 in terrestrial wildlife food was detected in earthworms at 0.043 mg/kg. Exposure to the Carolina wren from PCB 126 in soil and diet will be assessed by running the maximum detected concentration of PCB 126 in earthworms in the wren model and correcting the tables accordingly.

Revised Weight of Evidence Tables

Issue: Tables 6-24 to 6-26 will require significant revision once the HQs are presented with one digit after the decimal point and the greater than or equal sign is used appropriately.

Resolution: Tables 6-24 to 6-26 will be revised as appropriate when the HQ interpretation/whole number rounding issues have been resolved.

Issue: The BICS LOE is given moderate weight in the BERA.

Resolution: The BICS LOE will be given low weight in the Addendum. However, this LOE will be considered in the selection of the RGO for benthic invertebrates, as the site-specific information can reduce the uncertainty associated with the toxicity tests

Issue: Alan noted that a species previously declared extinct has been observed in Choccolocco Creek, and that T&E mussel species are being seeded there.

Resolution: Discuss in terms of the environmental setting.

Issue: In the weight of evidence (WOE) section, there are numerous places where it is stated that there is risk due to chemistry-based LOEs; then this estimate is downgraded based on the community analysis results.

Resolution: Statements indicating risk was overestimated will be evaluated and removed if not appropriate.

Issue: In many cases, revisions in response to a comment regarding LOE and WOE conclusions were addressed at a specific place in the document. However, these revisions were not always carried through to the rest of the document, particularly throughout Section 6 (Comment 69 and 103)

Resolution: It will be noted in the Addendum that the LOE and WOE conclusions in the Addendum reflect final EPA interpretation of the data/perspective.

Issue: The concentrations of total PCBs by homolog SIM may have been underestimated in biota tissue samples relative to total Aroclor concentrations.

Resolution: The WOE summary for AEs using food-chain models for birds and mammals may need to change the “level of conservatism” entry from high to moderate when the food-chain models relied heavily on homolog SIM data.

Remedial Goal Options

Issue: RGO calculations are not presented in the BERA.

Resolution: EPA will request the RGO spreadsheets from Arcadis, noting that we have constructed our own spreadsheets, but have not been able to reproduce the Arcadis calculations. A Section will be included in the Addendum that discusses the RGOs.

Resolution: RGOs identified as needing to be added to the BERA will be calculated and included in the summary tables. The risk assessment needs to document that the lower numbers were calculated where appropriate; the decision may not necessarily be based on the low numbers.

Issue: Were the RGOs identified in the BERA calculated using a site-overall BAF?

Resolution: Sharon’s tables calculate RGOs using the UAA, MAA, and LAA-specific BAFs. The Addendum will evaluate whether these risk ranges overlap. Is the range applicable to all three AAs and can it be utilized as a site-overall value?

Conclusions (written by EPA)

Information needed from Arcadis to complete Addendum

- The HQ summary spreadsheets in Excel are needed to facilitate revising the low, moderate and high risk categories.
- The RGO calculation spreadsheets.
- A copy of the slide presentation from the Tuesday, May 16 meeting, which includes the 95UCL concentrations for sediment PCBs and mercury and the information on the basis review for the CTCs.
- Arcadis will provide Sharon with a table showing qualifiers that changed during the validation process.

Appendix C - P/S Comments on the OU4 BERA Addendum Outline



July 6, 2017

Ms. Pamela J. Langston Scully, P.E.
Remedial Project Manager
United States Environmental Protection Agency, Region IV
Atlanta Federal Center
61 Forsyth St.
Atlanta, GA 30303-8960

Re: Comments from Pharmacia LLC/Solutia Inc. on the Draft Outline Prepared by the United States Environmental Protection Agency for the Operable Unit 4 Baseline Ecological Risk Assessment Addendum
Anniston PCB Site (Docket No. 1:20-cv-0749-KOB); Anniston, Alabama

Dear Ms. Langston Scully:

On behalf of Pharmacia LLC and Solutia Inc. (P/S), as parties to the Partial Consent Decree (PCD) for the Anniston Polychlorinated Biphenyl (PCB) Site, attached please find comments on the United States Environmental Protection Agency's (USEPA) draft outline for the Operable Unit 4 (OU-4) Baseline Ecological Risk Assessment Addendum (OU-4 BERA Addendum) dated 6/14/17. The comments developed by P/S are presented in a matrix format along with the issues and proposed resolutions identified by the USEPA in the draft outline for the OU-4 BERA Addendum. P/S are providing these comments to assist the USEPA team in resolving the identified issues as they prepare the OU-4 BERA Addendum.

P/S are also requesting an update from the USEPA regarding when we will receive the analysis of benthic invertebrate communities that was discussed at the May 16, 2017 BERA meeting. This is further discussed in the P/S comment responding to the proposed resolution to Issue Number 15. The P/S team is also available to support the USEPA as your team prepares the OU-4 BERA Addendum. This includes any additional data needs or talking through the proposed approach to resolve any of the issues identified by the USEPA.

Please contact me if you have any questions.

Sincerely,

A handwritten signature in blue ink, appearing to read "E. Macolly Harris", is written over a horizontal line.

E. Gayle Macolly Harris
Manager, Remedial Projects

Solutia Inc.

Attachment

cc: Mr. Chip Crockett (ADEM)
Mr. G. Douglas Jones, Esq.
Mr. Thomas Dahl

Comments on the Proposed USEPA OU-4 BERA Addendum Outline – June 14, 2017
Anniston PCB Site, Anniston, Alabama

1	Hazard Quotient (HQ) Rounding	<u>Issue:</u> Calculated HQs are being rounded to a single digit. (comments 134, 135, 136) <u>Resolution:</u> HQs will be shown to one decimal point. <u>Resolution:</u> Toxicity thresholds on Table 5-2a will be reported to the same number of significant figures as on Table C-1.	As discussed in the May 2017 meeting with USEPA, HQs in the BERA are rounded to whole numbers because the level of precision in the input parameters does not justify use of more significant figures in the HQs. Use of additional significant figures in the HQs implies an artificial level of precision. This concept is supported by the USEPA Staff Paper on HHRA (USEPA 2004¹) which states that "In a final risk description, all cancer risks and non-cancer hazard indices should be presented with <u>one</u> significant figure only." It would be acceptable to change values currently reported in the BERA as ≤ 1 to one significant figure rather than the whole number.
2	HQ/Effective concentration (ECX) Interpretation	<u>Issue:</u> Calculated LOAEL-based HQs greater than 1.0 are being interpreted as moderate risk, while HQs of 1.0 are interpreted as low risk. As per ERAGS, "unity (HQ = 1.0) becomes a more certain pass/fail decision point". (Comments 6, 68, 134) <u>Resolution:</u> The following risk categories will be used consistently throughout the BERA: No observed adverse effect level (NOAEL)-based HQ < 1.0, <i>de minimus</i> risk; NOAEL HQ ≥ 1.0 and LOAEL-based HQ < 1.0, low risk; LOAEL HQ ≥ 1.0 indicates risk. The HQ summary spreadsheets in Excel will be requested by EPA to facilitate this revision. For the benthic risk evaluation, the risk categories should have been defined and will be revised as: < EC0; $\geq$ EC0, < EC10; $\geq$ EC10, < EC20; $\geq$ EC20. (comment 6) Calculated HQs will be evaluated based on the number and magnitude of exceedances. Additionally, the magnitude of the adverse response observed in the critical study the LOAEL toxicity reference value (TRV) was derived from will be used to interpret LOAEL HQs ≥ 1.0.	The USEPA proposed risk categories are similar to those employed in the BERA with one important distinction, the BERA indicates that when a NOAEL-based HQ = 1, this is considered to represent no unacceptable or <i>de minimus</i> risk, while USEPA would indicate risk in this situation. ERAGS does not employ low, moderate, and high risk categories. These categories were defined in the BERA to provide summary information to demonstrate general magnitude of HQs for the complex set of receptors evaluated rather than as bright lines. ERAGS actually categorizes NOAEL HQ ≥ 1 and LOAEL-based HQ < 1 as uncertain. Risk is identified by ERAGS only when LOAEL HQs are equal to or greater than 1, which is consistent with HQ interpretation in the BERA. Recommend changing the low risk category to uncertain risk. It is agreed that HQs are most appropriately interpreted based on the magnitude of the HQ with specific consideration of the underlying toxicity study that provides the basis for the HQ.

¹ USEPA. 2004. An Examination of EPA Risk Assessment Principles and Practices: Staff Paper Prepared for the U.S. Environmental Protection Agency by Members of the Risk Assessment Task Force. EPA/100/B-04/001. March.

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	3	Data Quality Issues <u>Issue:</u> The data tables in Appendix E include the Laboratory qualifiers, not the data validator qualifiers. Were the metals data validated? <u>Resolution:</u> Every sample went through Level 2 validation, and 1 of 20 samples went through Level 4 validation. Arcadis will provide Sharon with a table showing qualifiers that changed during the validation process.	Resolution noted. Arcadis provided tables showing qualifiers changed during the data validation process on June 23, 2017.
	4	Data Quality Issues <u>Issue:</u> The Aroclor data indicate that Aroclors 1254 and 1260 are present on-site, however the homolog data indicate that low- and highly-chlorinated homologs are present in tissues, while the mid-range homologs that would be associated with Aroclors 1254 and 1260 are not. <u>Resolution:</u> Sharon will discuss this issue with a PCB chemist.	Pharmacia LLC/Solutia Inc. (P/S) recognize that the USEPA has yet to resolve this issue and request that we be part of the mentioned resolution. As part of resolving this issue, it is important to review the PCB data for the Site that were generated using analytical methods described in the Site-Wide Quality Assurance Project Plan (Site-Wide QAPP) that was approved by the USEPA. The results of these analyses document that the sum of detected PCB Aroclors provides an accurate estimate of total PCBs in comparison to total PCBs based on the sum of PCB homologs. There are a limited number of cases where total PCBs based on the sum of homologs results in a higher total PCB concentration than the value based on the sum of detected Aroclors. Most of these cases are associated with samples collected in the Backwater area which represents a very small geographic portion of Operable Unit 4 (OU-4).
	5	Data Issues <u>Issue:</u> Only SWACs and the 95%UCL of the SWAC were presented in the BERA. EPA requested the 95%UCL of the measured sediment PCB and mercury concentrations by Reach and by Assessment Area (AA). <u>Resolution:</u> The slide presentation, which included a Table with the 95%UCL values, will be requested by EPA. The 95UCL values calculated using all the sediment data utilized in the risk calculations will be presented, the SWAC and 95%UCL values compared, and the implications for risk conclusions will be discussed.	Resolution noted. The table containing 95UCL sediment concentrations was provided to USEPA on June 23, 2017.
	6	Data Issues <u>Issue:</u> Instead of using the maximum measured concentration for Reach C1 as the exposure point concentration (EPC), the mean concentration for the UAA was used.	For reach C1 floodplain soil, the 95UCL EPCs for the east (11.38 based on 95UCL, N=94) and west (206.5 mg/kg based on max, N=6) EUs were used. For C1 riparian soil, the UAA EPC (10.22 mg/kg based on 95UCL, N=91) was used instead of a riparian soil EPC for C1 because riparian habitat is not present in most areas along this reach of the Creek.

		<u>Resolution:</u> The EPC will be evaluated to determine if risk conclusions would be affected. If not, the addendum will document this issue was observed, but would not affect the overall conclusions. Additionally, soil data is available from reaches C1 and C10, but these samples were not labelled riparian although there is a small riparian zone that parallels the creek. Use of an EPC calculated from these soil data will be evaluated.	While it is P/S's position that a riparian-specific HQ for reach C1 is not warranted, if USEPA feels one must be calculated, it is agreed that using the data points that are within the area defined for other reaches as the riparian zone (i.e., data that fall within 100 feet of the Creek on either side) to calculate this EPC would be most appropriate.
7	Data Issues	<u>Issue:</u> For the sediment samples used in the toxicity tests, homologs were analyzed using a high resolution analytical method whereas PCB homologues in the 10% of samples (soil, sediment, surface water and 100% of some tissues) were analyzed using selected ion monitoring (SIM). In the toxicity testing samples collected from the backwater area, concentrations of mono- and di- chlorinated homologs are high, but the Aroclor analysis is not picking up the lower chlorinated Aroclors. The total Aroclor data may be under-predicting the actual PCB concentrations present. <u>Resolution:</u> This issue will be discussed in the uncertainty section. The discussion will include noting that although the lower chlorinated congeners are present in sediment, Choccolocco Creek is a gaining waterbody, and the presence of lower chlorinated congeners in sediment should not be a groundwater concern.	P/S agree with the USEPA that sediment in OU-4 is not impacting groundwater.
8	Community Survey Metrics	<u>Issue:</u> We need to check and verify how this line of evidence (Community Metrics) was used for each AE – confirm it was used as a secondary LOE and not as a leading LOE.	Based on the USEPA comments on the draft BERA, P/S revised the document to clarify that community metrics were used as a secondary line of evidence and were given low confidence in the WOE, except for benthic invertebrates. This is presented on Tables 6-24 through 6-26 and described in Section 6.3. As described in Section 6.3.3, the highest confidence LOE (moderate/high) for benthic invertebrates was given to the point-by-point evaluation using site-specific toxicity thresholds, as requested by USEPA. The community metrics evaluation for benthics was ranked as having a moderate level of confidence because although it was based on 158 site-specific observations, the survey was spatially limited in scope. The community metrics were not used as a leading LOE in the BERA.

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9	Reference Locations	<u>Issue:</u> PCBs were detected in surface water and aquatic plant samples at Reference location 2 (comment 44). <u>Resolution:</u> The Addendum will note that the reference locations were selected through a systematic process. It will note that the PCBs observed at Reference location 2 were anomalous, and the source of the PCBs is unknown.	Resolution noted.
10	Non-Mercury Metals	<u>Issue:</u> Due to limited data and high RLs for ND samples, the strength of evidence for stating metals concentrations on-site are similar to reference is low. (comments 87 and 90) <u>Resolution:</u> May need to consider constituents monitored in surface water in post-remedy monitoring.	Metals samples were collected according to approved sampling work plans at the frequency of 10% of PCB samples. Although RLs are elevated for some metals in some media, non-mercury metals do not appear to be present in OU-4 due to releases from the site. These metals have multiple natural and anthropogenic sources along Choccolocco Creek and lack an upstream to downstream gradient in sediment or biota that would be expected from site-related releases. Additionally, remedial options and post-remediation monitoring are beyond the scope of the BERA and do not warrant discussion in the BERA.
11	Threatened and Endangered Species	<u>Issue:</u> The 2006 Problem Formulation states "Risks to threatened and endangered species will not be explicitly evaluated. Rather, appropriate surrogate species will be identified as focal points for risk characterization for determining if risks to threatened and endangered species could be unacceptable. Surrogate species and appropriate risk assessment parameters will be developed in the BERA." This was not done in the BERA. <u>Resolution:</u> A risk characterization summary that includes a brief paragraph clarifying that EPA does not do ERA for T&E species or for individuals thereof should be added. Any T&E species that are, may, or should be present at the site, where appropriate need to be listed as receptors. Threatened and endangered species should not be used as assessment endpoints in EPA ecological risk assessments. Rather, appropriate surrogates are chosen for the assessment endpoints that represent site receptors and are inclusive of threatened or endangered species (i.e., receptors), if present. It is important to note that EPA does not do ecological risk assessments on endangered species and does not characterize risks for individual organisms (as may be wrongfully assumed in a focus on an endangered species).	Resolution noted. P/S would like to clarify the wording proposed by USEPA defining T&E species as any species "that are, may, or should be present at the site" is ambiguous and needs refinement. P/S concurs with the species noted in USEPA's March 2017 comments, with any relevant updates.

Comments on the Proposed USEPA OU-4 BERA Addendum Outline – June 14, 2017
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No	Category	Outline Element	Comment
		EPA ecological risk assessments are site population level assessments.	
13	AE #1: Survival, Growth and Reproduction of Aquatic Receptors	<u>Issue:</u> Observed surface water exceedances of the Alabama Department of Environmental Management (ADEM) Water Quality Standards (WQS) and Ambient WQS are down-weighted using species-specific toxicity values. <u>Resolution:</u> The ADEM WQS and AWQC will be identified and weighted as the primary LOE.	P/S disagrees with the proposed resolution, as the ADEM WQS and AWQC for PCBs are not based on risk to lower trophic level aquatic receptors. Use of the WQS will be included as an ARAR in the Feasibility Study. For evaluation of potential risk to aquatic life in the BERA however, these values are not applicable and should not be used as the primarily LOE.
14	AE #2: Survival, Growth and Reproduction of Benthic Invertebrate Communities	<u>Issue:</u> The benthic community surveys were not clearly identified as a secondary Line of Evidence (LOE) and no co-located chemistry data was collected with the benthic community samples. <u>Resolution:</u> The text will not state that there appear to be no adverse effects of PCBs on the benthic receptor communities, since PCBs were not measured in the community samples. The results of the community surveys will not be used to down weight WOE conclusions based on chemistry measurements.	P/S disagrees with the proposed resolution. The benthic community data were not given the highest confidence in the WOE and were not used to “down weight” the primary LOE. This LOE was simply used as supporting site-specific information. Potential for adverse effects to benthic invertebrates was determined primarily based on the point-by-point site-specific toxicity threshold comparison, which, as stated in Section 6.3.3, found that “Based on the most sensitive reproduction endpoint, risk is considered negligible across the majority of samples, with a few samples indicating localized low, moderate, or high risk, primarily in reaches C1 and C2. Based on the survival endpoints negligible risk is predicted for the majority of samples and possible low risk for a small number of samples in reaches C1, C2, and C4.” See response to Comment 8.
15	AE #2: Survival, Growth and Reproduction of Benthic Invertebrate Communities	<u>Issue:</u> The BERA evaluated the BICS data by comparing reference results to on-site results. <u>Resolution:</u> The Addendum will add an up- to down-stream comparison. Initial evaluation showed impairment in the upper and lower assessment areas (AAs).	P/S requests that the initial evaluation conducted be provided for review prior to the completion of the draft addendum.
16	AE #2: Survival, Growth and Reproduction of Benthic	<u>Issue:</u> The BERA utilized the Hilsenhoff (1988) protocols to evaluate the BICS data. ADEM protocols, which include	P/S notes that the reference locations were selected in consultation with USEPA and approved by USEPA for use in the BERA. Region-specific reference locations are not needed, and may not be appropriate. In theory, reference locations should be identical to OU-4 except for site-

	Invertebrate Communities Benthic Invertebrate Community Survey (BICS)	region-specific reference locations, are available and should have been used. <u>Resolution:</u> The Addendum will include an evaluation of the BICS data using the ADEM protocols.	related influences. Therefore, reference locations for the BERA should have the same level of impact from non-site anthropogenic sources, such as are likely in developed watersheds that serve urban and agricultural land-uses. Pristine reference locations are not appropriate for comparison to benthic invertebrate communities in OU-4.
17	AE #2: Survival, Growth and Reproduction of Benthic Invertebrate Communities Site-Specific Toxicity Tests	<u>Issue:</u> The BERA discounts use of the 42-day <i>Hyalella</i> reproductive endpoint due to high variability in the control samples. <u>Resolution:</u> Discuss acceptable/often observed variability associated with this endpoint.	Resolution noted.
18	AE #2: Survival, Growth and Reproduction of Benthic Invertebrate Communities Site-Specific Toxicity Tests	<u>Issue:</u> The BERA does not include the most sensitive endpoint measured in the toxicity tests, <i>Chironomus dilutus</i> adult biomass due to calculation of adult biomass from measured 13-day old <i>C. dilutus</i> biomass. <u>Resolution:</u> Discuss the method for and uncertainty associated with calculation of a parameter (adult biomass) from a measured parameter. <u>Resolution:</u> Calculate a Remedial Goal Option (RGO) using the <i>C. dilutus</i> adult biomass endpoint.	P/S agrees that discussion of the method for calculation of the <i>C. dilutus</i> biomass endpoint and associated uncertainty is appropriate for inclusion in the BERA addendum. However, based on the inherent uncertainty associated with this endpoint, calculation of an RGO based on the <i>C. dilutus</i> biomass endpoint is not appropriate.
19	AE #2: Survival, Growth and Reproduction of Benthic Invertebrate Communities Site-Specific Toxicity Tests	<u>Issue:</u> Surface samples utilized in the toxicity tests were not evaluated as a separate LOE. <u>Resolution:</u> The surface samples utilized in the toxicity tests will be identified and the toxicity associated with these samples will be compared with the reference envelope.	Resolution noted. This analysis is unlikely to provide information useful to interpreting potential for risk in OU-4, as only three samples are available and these were collected from depths greater than typically contacted by benthic organisms and were sieved and homogenized prior to testing. These sample characteristics change bioavailability and chemical concentrations in the sediments, limiting their usefulness for direct comparison to OU-4 sediments.

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20	AE #2: Survival, Growth and Reproduction of Benthic Invertebrate Communities Site-Specific Toxicity Tests	<u>Issue:</u> Footnote b of Table 5-2a states that "EC0 was set at a concentration of 0.05 (the mean reference sediment concentration)". However, total PCB Aroclors were not detected (ND) in any of the reference sediment samples; 0.05 mg/kg is the maximum reporting limit (RL). Looking at Figure C-3c, the curve drops rapidly for the Young/female normalized to survival (% of control) endpoint. If you use a value of ½ the RL as the EC0, what is the effect on the calculated EC0* and EC10* values? <u>Resolution:</u> The Addendum will evaluate the effect on the site-specific toxicity thresholds calculated using a value of ½ RL versus using the RL as the EC0.	The suggested resolution is of little value to interpreting potential for risk and is more likely to add noise to the assessment rather than reduce any uncertainty. Initial evaluation suggests that using a value of ½ RL would likely pull the curve left a little bit, but high variability in the reference samples will obscure any meaningful interpretation. It is clear that PCBs are not causing toxicity at those low concentrations (i.e., 0.05 mg/kg and below).
21	AE #2: Survival, Growth and Reproduction of Benthic Invertebrate Communities Site-Specific Toxicity Tests	<u>Issue:</u> There is uncertainty whether the EC0 and EC0* can be considered a NOEC (comment 140). <u>Resolution:</u> The reference envelope, which is independent of concentration, is used to identify the EC0* and EC0. The Addendum will discuss the uncertainty associated with the use of the RL for total Aroclors, and the shape of the dose-response curve. If appropriate, it will note that exposure at the EC0 does not present an unacceptable risk.	Resolution noted. See response to Comment 20.
22	AE #2: Survival, Growth and Reproduction of Benthic Invertebrate Communities Porewater	<u>Issue:</u> Porewater data was not discussed as an additional LOE. <u>Resolution:</u> A discussion of the porewater data will be added in the addendum and to the WOE tables. This discussion will note that the sediment and porewater toxicity analysis are complementary and lead to similar conclusions.	Resolution noted.

Comments on the Proposed USEPA OU-4 BERA Addendum Outline – June 14, 2017
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No	Category	Outline Element	Comment
24	AE #2: Survival, Growth and Reproduction of Benthic Invertebrate Communities Benthic Invertebrate Tissue Concentrations	<u>Issue:</u> The Critical Tissue Concentrations (CTCs) recommended for benthic invertebrates by EPA were not utilized in the revised BERA. <u>Resolution:</u> Discuss the uncertainty associated with available benthic CTCs and present the range of measured values. Note that there is low confidence in these numbers due to uncertainty, and that this is a secondary LOE. Note that the primary reason this data was collected was for use in the dietary exposure models.	Resolution noted. As discussed in the May 2017 meeting, although there is a high degree of uncertainty in the benthic invertebrate CTCs, some of the values recommended by USEPA are not appropriate for use in the BERA or BERA addendum. The range of CTCs presented by USEPA in the addendum should take into account P/S's comments that tissue CTCs based on irrelevant data not be included.
25	AE #2: Survival, Growth and Reproduction of Benthic Invertebrate Communities Benthic Invertebrate Tissue Concentrations	<u>Issue:</u> The most critical issue with the proposed CTCs is that tissue concentrations were assumed to be wet weight (ww) if basis was not stated in the article. If dry or ww is not specified, the conservative assumption that the cited value is dry weight (dw) must be used. Assuming the value is ww and converting it to dw results in a much higher CTC value that may not be protective. <u>Resolution:</u> The slide in the May 16 presentation with the dry weight/wet weight information will be reviewed to confirm that the basis conclusions in comments 7a to 7f and 8a to 8f are consistent with the slide. Basis issues will be clearly noted in the Addendum.	Resolution noted.
26	AE #2: Survival, Growth and Reproduction of Benthic Invertebrate Communities Emergent Insects BAFs	<u>Issue:</u> Hymenoptera are not aquatic insects, but were included in the emergent insect samples. <u>Resolution:</u> Revise Table 6-24 to reflect lower conservatism and moderate confidence in the risk prediction.	P/S disagrees with the proposed resolution. While Hymenoptera are not aquatic species, they were collected in the general area proximal to the creek where other emergent insects were collected. While they may not reflect the same uptake pathways, it is likely that avian aerial-feeding invertivores will consume any flying insect in their foraging area near the creek. This would likely include Hymenoptera and Halictidae. The measured tissue concentrations more accurately represent concentrations in prey material consumed by aerial-feeding invertivores.

Comments on the Proposed USEPA OU-4 BERA Addendum Outline – June 14, 2017
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27	AE #3: Survival, Growth and Reproduction of Fish Communities Fish Tissue Concentrations	<u>Issue:</u> The CTC from the Foekema et al. 2014 for PCBs was not included in the BERA. <u>Resolution:</u> The CTC from the Foekema et al. 2014 does not need to be included in the BERA.	Resolution noted.
28	AE #3: Survival, Growth and Reproduction of Fish Communities Fish Tissue Concentrations	<u>Issue:</u> The recommended CTC for dioxin in fish tissue was not included in the BERA (comment 170). <u>Resolution:</u> A discussion will be added to the Addendum that the selected CTC from the Stevens paper is within the range of CTCs cited in Tillett et al. 2017.	Resolution noted.
29	AE #4: Survival, Growth and Reproduction of Bird Communities Bird Egg COPC Concentrations	<u>Issue:</u> Dioxin concentrations in bird eggs were not estimated using the OEHHA (2015) method and transfer coefficient. <u>Resolution:</u> Addendum will note that this estimate is not needed due to uncertainty associated with the method and the limited dioxin/furan data available to estimate exposure dose. Cite the sentence from the BPF that this LOE may be evaluated.	Resolution noted.
30	AE #4: Survival, Growth and Reproduction of Bird Communities Bird Egg COPC Concentrations	<u>Issue:</u> The equation used to estimate bird egg concentrations should be adjusted by the bird's body weight to make it applicable to ecological risk assessment for smaller bird species. <u>Resolution:</u> The Addendum will note that ideally the model should be scaled to bird size; however this calculation is highly uncertain and this LOE will be given lower weight than the dietary exposure models. This uncertainty will be added in the uncertainty section, will refer back to the 2006 BPF, and note that a best faith effort was made to model maternal transfer of COPCs to eggs.	Resolution noted.

31	AE #4: Survival, Growth and Reproduction of Bird Communities Bird Egg COPC Concentrations Bird Dietary Exposure Models for Dioxin	<u>Issue:</u> The calculations in Appendix F in general show that the risk posed by the combination of dioxin-like PCBs and dioxin/furans is less than risks estimated for total PCBs. The most sensitive receptor was the Carolina wren. The most toxic congener was PCB 126, however there is no BAF for PCB 126 in Table F-6. <u>Resolution:</u> The maximum concentration of PCB 126 in terrestrial wildlife food was detected in earthworms at 0.043 mg/kg. Exposure to the Carolina wren from PCB 126 in soil and diet will be assessed by running the maximum detected concentration of PCB 126 in earthworms in the wren model and correcting the tables accordingly.	The BERA did not employ these data in a forward risk calculation. Because of the small sample size, the modelled estimates were considered to provide a better estimate of the range of potential exposure. However, if USEPA conducts this calculation, the uncertainty associated with using the limited data in this way should be acknowledged.
32	Revised Weight of Evidence Tables	<u>Issue:</u> Tables 6-24 to 6-26 will require significant revision once the HQs are presented with one digit after the decimal point and the greater than or equal sign is used appropriately. <u>Resolution:</u> Tables 6-24 to 6-26 will be revised as appropriate when the HQ interpretation/whole number rounding issues have been resolved.	Resolution noted. See responses to Comments 1 and 2.
33	Revised Weight of Evidence Tables	<u>Issue:</u> The BICS LOE is given moderate weight in the BERA. <u>Resolution:</u> The BICS LOE will be given low weight in the Addendum. However, this LOE will be considered in the selection of the RGO for benthic invertebrates, as the site-specific information can reduce the uncertainty associated with the toxicity tests	The logic of the resolution is inconsistent in that if the BICS LOE is given a low weight, it is considered highly uncertain. It would then be difficult to use this information to reduce uncertainty in selection of RGOs based on other LOEs. If the weight was to remain moderate, this would likely make this LOE more acceptable in supporting RGO selection.
34	Revised Weight of Evidence Tables	<u>Issue:</u> Alan noted that a species previously declared extinct has been observed in Choccolocco Creek, and that T&E mussel species are being seeded there. <u>Resolution:</u> Discuss in terms of the environmental setting.	The species previously declared extinct is discussed in the ecological setting of the BERA in Section 2.1.3 on p. 2-11 as follows. "Notably, sensitive species, such as Wicker Ancyloid limpet (<i>Rhodacmea filosa</i>) previously listed as an extinct species, as well as populations of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) which are organisms that are often most sensitive to pollution have been documented within OU-4 indicating that water quality conditions within Choccolocco Creek are sufficient to support the presence of these sensitive species." In addition, the Alabama Aquatic Biodiversity Center (AABC) has been seeding a range of mussels in Choccolocco Creek including species that

Comments on the Proposed USEPA OU-4 BERA Addendum Outline – June 14, 2017
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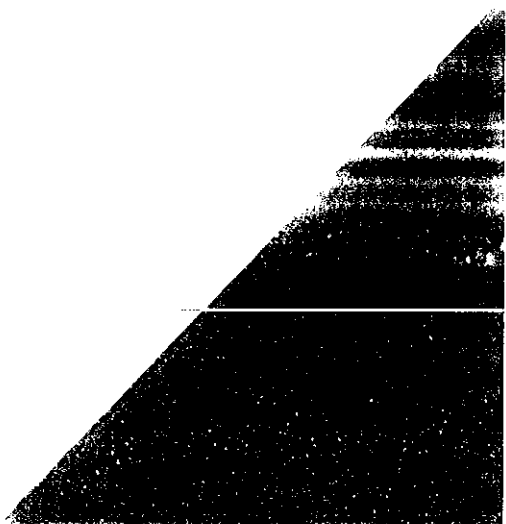
No	Category	Outline Element	Comment
			are listed as being threatened or endangered. A hyperlink to a news article discussing this work is provided below along with a hyperlink to the AABC's website. A PDF version of a newspaper article published in the Anniston Star is also included as Attachment A. http://blog.al.com/spotnews/2010/10/mussels_returned_to_alabamas_c.html http://www.outdooralabama.com/aquatic-biodiversity-center
35	Revised Weight of Evidence Tables	Issue: In the weight of evidence (WOE) section, there are numerous places where it is stated that there is risk due to chemistry-based LOEs; then this estimate is downgraded based on the community analysis results. Resolution: Statements indicating risk was overestimated will be evaluated and removed if not appropriate.	Resolution noted.
36	Revised Weight of Evidence Tables	Issue: In many cases, revisions in response to a comment regarding LOE and WOE conclusions were addressed at a specific place in the document. However, these revisions were not always carried through to the rest of the document, particularly throughout Section 6 (Comment 69 and 103) Resolution: It will be noted in the Addendum that the LOE and WOE conclusions in the Addendum reflect final EPA interpretation of the data/perspective.	Resolution noted.
37	Revised Weight of Evidence Tables	Issue: The concentrations of total PCBs by homolog SIM may have been underestimated in biota tissue samples relative to total Aroclor concentrations. Resolution: The WOE summary for AEs using food-chain models for birds and mammals may need to change the "level of conservatism" entry from high to moderate when the food-chain models relied heavily on homolog SIM data.	P/S disagree with the proposed resolution. PCB analysis via homolog SIM is an accurate measurement of total PCB concentrations and there are other factors such as the selection of TRVs that result in a high level of conservatism for birds and mammals. While total PCBs based on the sum of detected PCB Aroclors has the potential to double-count some of the PCB congeners, the data for this Site (including multiple media) show that total PCBs based on the sum of detected Aroclors is generally slightly higher than total PCBs based on the sum of homologs. As noted in the Response to Item No. 4, total PCBs based on the sum of detected

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Anniston PCB Site, Anniston, Alabama

				Aroclors is lower than total PCBs based on the sum of homologs for the Backwater area, which is a small geographic portion of the overall Site.
38	Remedial Goal Options	<u>Issue:</u> RGO calculations are not presented in the BERA. <u>Resolution:</u> EPA will request the RGO spreadsheets from Arcadis, noting that we have constructed our own spreadsheets, but have not been able to reproduce the Arcadis calculations. A Section will be included in the Addendum that discusses the RGOs. <u>Resolution:</u> RGOs identified as needing to be added to the BERA will be calculated and included in the summary tables. The risk assessment needs to document that the lower numbers were calculated where appropriate; the decision may not necessarily be based on the low numbers.	Resolution noted. Arcadis provided files with a brief memo providing additional detail on the RGO calculations and the RGO calculation excel workbook to USEPA on June 23, 2017.	
39	Remedial Goal Options	<u>Issue:</u> Were the RGOs identified in the BERA calculated using a site-overall BAF? <u>Resolution:</u> Sharon's tables calculate RGOs using the UAA, MAA, and LAA-specific BAFs. The Addendum will evaluate whether these risk ranges overlap. Is the range applicable to all three AAs and can it be utilized as a site-overall value?	Resolution noted. See response to Comment 38.	
40	Needed to complete Addendum	The HQ summary spreadsheets in Excel are needed to facilitate revising the low, moderate and high risk categories.	Resolution noted. Arcadis provided files with the RGO calculations on June 23, 2017.	
41	Needed to complete Addendum	The RGO calculation spreadsheets.	Resolution noted. See response to Comment 38.	
42	Needed to complete Addendum	A copy of the slide presentation from the Tuesday, May 16 meeting, which includes the 95UCL concentrations for sediment PCBs and mercury and the information on the basis review for the CTCs.	Resolution noted. Arcadis provided the presentation file on June 23, 2017.	
43	Needed to complete Addendum	Arcadis will provide Sharon with a table showing qualifiers that changed during the validation process.	Resolution noted. See response to Comment 3.	

ATTACHMENT A

Anniston Star Article



The Anniston Star

https://www.annistonstar.com/news/wow-check-out-those-mussels-they-may-help-choccolocco-creek/article_e1a2f956-6471-57c9-bd13-59b1961f7ce6.html

Wow, check out those mussels: They may help Choccolocco Creek look cleaner in coming years



Mussels released Thursday into Choccolocco Creek were numbered for easy identification later. (Anniston Star photo by Stepl Gross)

Laura Johnson
Star Staff Writer Oct 1, 2010

CHOCOLOCCO — Not so many decades ago, you could see clear to the bottom of Choccolocco Creek, even in its deepest parts.

Today, the current kicks up sediment, clouding the water at depths not greater than two feet. If, however, a developing water quality improvement plan proves successful, that could be reversed.

As part of preliminary stages of that plan, biologists with a new unit of the Alabama Wildlife and Freshwater Fisheries Division placed 1,600 mollusks, one by one, onto the creek bed Thursday. The division is a part of the Alabama Department of Conservation and Natural Resources.

The plan is part of a larger effort by the new unit, called the Alabama Aquatic Biodiversity Center. Its director, Paul Johnson, has already released the tiny animals into the tributaries of the Mobile River

basin, which the project aims to improve.

Mollusks, which include snails and mussels, are natural water filters and in some instances can filter several gallons of water per day. If the project is successful, the animals could restore the creek's water quality — but first the scientists have to ensure that the species being asked to do the work, the Alabama rainbow mussel, can survive the environment.

If it does, more mollusk species might be released later, making it more likely that the water quality would improve.

“If these releases are successful, there are at least 20 species, if not more, that could go back here,” Johnson said. “The river bottoms used to be paved with these animals.”

As journalists and a couple of volunteers placed the rainbow mussels onto the creek's floor Thursday, biologist Todd Fobian, in a wet suit and snorkel mask, swam in the chilly current between moss-covered rocks to examine the mussels' habitat up close.

Fobian said the animals not only purify water and enhance biodiversity, but also serve as an indicator of the water's quality. The more mollusks that can survive there, the better the water. Fobian has been working with Johnson to prepare for the release since last spring.

Back before strong chemical pollutants could be found in Choccolocco Creek, the water offered a clear view of the mussels and snails that covered its bed, but when the scientists checked earlier this year, few could be found.

Prior to Alabama Power's damming of the Coosa River Basin, there were 40 species of mussels and 30 species of snails in the Choccolocco Creek Basin. They were all but wiped out in the decades that followed as the water flow was disrupted and chemical pollutants began to affect the creek.

Today, only about a dozen mussel species remain in the creek and about 15 species of snails cling to the rocks that line the creek's bed. It's not known how many could be reintroduced to the creek, but Johnson said it is unlikely it will be restored to its pre-development conditions. Organizers of the species introduction have been pleased to see that a test sample of Alabama rainbow mussels, placed in the creek in small cages, has survived.



The latest release has new challenges for the animals, however. They will have to survive in the polluted creek bed, which the test samples were protected from.

However, a simple examination of the underside of a wet rock pulled from the creek bed indicates that the animal's chances are good. Johnson pointed to a number of more sensitive snail species that were thriving in the creek, and said if they could survive the new mussels would have a fair chance of doing likewise.

Calhoun County Commissioner Robert Downing, who dressed in waders and helped with the project Thursday, said it's the first part of a process he hopes improves both biodiversity and water quality at the creek.

"This is the first effort to turn back the clock so to start to restore the natural quality of the water that we've historically enjoyed," Downing said. "It's great that what we're doing now in our back yard is going to benefit all the back yards downstream."

Contact staff writer Laura Johnson at 256-235-3544.

Appendix D - Lockheed Martin Technical Memorandum



Leidos-SERAS
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DATE: December 20, 2017

TO: Marc S. Greenberg, US EPA/ERT Work Assignment Manager

FROM: Karen Kracko, SERAS/SRC Environmental Risk Assessor
Brad Sample, Ecological Risk Assessor, Ecological Risk Inc.

SUBJECT: **FINAL** TECHNICAL MEMO, BASELINE ECOLOGICAL RISK ASSESSMENT
ADDENDUM, ANNISTON POLYCHLORINATED BIPHENYL SITE, ANNISTON,
ALABAMA

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Executive Summary

The United States (US) Environmental Protection Agency (EPA) reviewed the draft Baseline Ecological Risk Assessment (BERA) prepared for Operable Unit 4 (OU-4) of the Anniston Polychlorinated Biphenyl (PCB) Site, Anniston, Alabama (AL). OU-4 includes Choccolocco Creek and its floodplain from the confluence with Snow Creek downstream to the confluence of the Coosa River (Figure ES-1 of the draft BERA). It also includes the lower portion of Snow Creek and its floodplain between Highway 78 and the confluence of Snow Creek and Choccolocco Creek. The OU-4 BERA focused on key ecological receptor groups that may reside in or forage within the terrestrial and aquatic habitat in OU-4.

Pharmacia LLC and Solutia Inc. (P/S) delivered the draft BERA to EPA in August 2015. EPA provided comments on the 2015 draft BERA, and met with P/S in December 2015 and February 2016 to discuss the comments and resolve issues with the draft BERA that had been identified by EPA reviewers. Following the February 2016 meeting, the EPA review team worked with P/S to address two critical issues: calculation of site-specific bioaccumulation factors (BAFs); and selection of toxicity reference values (TRVs) to be used in the revised draft BERA. P/S revised the 2015 draft BERA in response to EPA comments, and submitted a revised draft BERA for review in October 2016.

EPA reviewed the revised draft BERA and provided additional comments, focusing on revisions that were not made in response to the original comments, or conclusions that the EPA review team did not feel were supported by the data. EPA met with P/S in May of 2017 to discuss the outstanding issues associated with the revised draft BERA. Following the May meeting with P/S, EPA concluded that although some comments and concerns were adequately addressed in the revised draft BERA, EPA's interpretation of the data collected for the BERA differed significantly from the P/S interpretation of the data for some issues. EPA decided that rather than request a second revision of the draft BERA, EPA would identify the issues where there is significant divergence in the approach to data analysis and/or interpretation. EPA would then provide their evaluation of the data in a BERA Addendum report, including an analysis of how the EPA interpretation affected the weight of evidence (WOE) evaluation and risk conclusions. Remedial Goal Options (RGOs) would also be calculated for the various lines of evidence where EPA data interpretation concluded unacceptable risk is present.

The BERA Addendum report is organized into five sections as follows:

- 1) Introduction
- 2) Issues
- 3) RGOs
- 4) Conclusions
- 5) Literature Cited

The Issues section describes each critical issue that was identified, discusses how the issue was presented in the revised draft BERA report, and provides an analysis of the data related to that issue. If the EPA analysis differed from the analysis described in the BERA, a discussion of the impact of the different analysis on the risk conclusions is provided. In some cases, the EPA analysis resulted in similar conclusions to those presented in the revised draft BERA.

The issues identified to be included in the BERA Addendum fell into four broad categories:

- Global issues that impacted risk interpretation or conclusions;
- Assessment endpoint (AE) specific issues;
- TRV selection; and
- WOE interpretation.

Each of the critical issues identified by the EPA team after the May 2017 meeting with P/S was evaluated; data presented in the draft BERA were re-analyzed if needed. Results of the evaluations are presented in detail in each of the bulleted text sections that comprise the body of the Addendum. The WOE summary tables for PCBs in the revised draft BERA (Tables 6-24 through 6-26; incorporated into Addendum Tables AD8-1 through AD8-3, columns B through F) were updated to reflect EPA's interpretation of the data collected for the OU-4 BERA (Tables AD8-1 through AD8-3).

Based on the updated WOE evaluation, a summary table showing calculated risk by Reach and Assessment Area (AA) was compiled (Table ADES-1). The level of conservatism (higher conservatism was associated with the use of generic exposure and effects information that have a higher potential to overestimate risk) and confidence in the risk conclusions are identified for each WOE conclusion. Increased use of site-specific information in the risk evaluation is assumed to result in more realistic, less conservative, and less uncertain risk estimates. For some of the lines of evidence (LOEs), especially field survey data, a potential for underestimation of risk was identified.

Based on the summary table (Table ADES-1), the following risk conclusions for total PCBs can be made:

- Risk to aquatic plants throughout OU-4 is considered acceptable, however the LOEs used to evaluate this endpoint produced divergent results and are highly uncertain.
- Risk to terrestrial plants is acceptable in all AAs and Exposure Units (EUs) except C1 West, where risk to terrestrial plants is unacceptable.
- Risk to benthic invertebrates is unacceptable in Reaches C1 through C4, indeterminate in Reaches C5, C7, C8 and C10, and acceptable in Reaches C6 and C9. The lines of evidence with moderate to high confidence in the risk predictions (comparison of individual sediment samples with site-specific growth or reproduction-based toxicity thresholds and evaluation of the toxicity testing results from the surface samples) were given the highest weight in the WOE evaluation.
- Risk to terrestrial invertebrates is unacceptable in EU C1 West; indeterminate in Reach C2, C3, C4 and C10; and acceptable in Reaches C5 through C9. Most LOEs used to evaluate this AE had moderate to high conservatism and low confidence in the risk predictions.
- Risk to fish is unacceptable throughout OU-4, with predicted risk to predator and bottom fish higher than for forage fish.
- For all bird receptors, risk is highly unacceptable in Reach C1. For piscivorous and aquatic insectivorous birds, risk is highly unacceptable in Reach C2, and unacceptable throughout OU-4.

For terrestrial avian receptors (aerial insectivores, insectivores, carnivores) risk is generally unacceptable in Reaches C1 through C4, and indeterminate or acceptable in Reaches C5 through C10. For omnivorous birds with mixed terrestrial and aquatic diets, risk is unacceptable in Reaches C1 through C4 and indeterminate in Reaches C5 through C9.

- Risk to piscivorous mammals is highly unacceptable throughout OU-4. Risk to aerial insectivores and terrestrial insectivores and invertivores is unacceptable in Reaches C1 through C4, and indeterminate or acceptable in Reaches C5 through C10. Risk to herbivorous mammals is acceptable throughout OU-4. There is unacceptable calculated risk to carnivorous mammals feeding in Reach C1, indeterminate risk is Reaches C3 and C4, and acceptable risk in Reaches C2 and C5 through C9. For omnivorous mammals with mixed terrestrial and aquatic diets, risk is indeterminate throughout OU-4 when the raccoon is the surrogate receptor species, and highly unacceptable when the mink is used as the surrogate receptor species.

Risks were also evaluated for 7 additional secondary contaminants of potential concern (COPCs) (i.e., mercury, dioxin toxic equivalents [TEQs], barium, chromium, cobalt, lead, and vanadium). Although unacceptable risks were identified in some areas of OU-4 for some of these COPCs, overall risks in OU4 were dominated by PCBs.

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DRAFT TECHNICAL MEMO, BASELINE ECOLOGICAL RISK ASSESSMENT ADDENDUM, ANNISTON POLYCHLORINATED BIPHENYL SITE, ANNISTON, ALABAMA

Introduction

During the planning stages for the field studies conducted to support the Baseline Ecological Risk Assessment (BERA) for Operable Unit 4 (OU-4) of the Anniston Polychlorinated Biphenyl (PCB) Site, Anniston, Alabama (AL), numerous planning documents were reviewed by the United States (US) Environmental Protection Agency (EPA). In addition, several meetings were held between EPA and Pharmacia LLC and Solutia Inc. (P/S) to discuss the proposed field studies and data summary and analysis methods. The outcome of these meetings were documents prepared as part of a collaborative effort between the technical teams of P/S and EPA (BBL 2006a and b, Arcadis 2010a and Arcadis 2010b).

OU-4 includes Choccolocco Creek and its floodplain from the confluence with Snow Creek downstream to the confluence of the Coosa River (Figure ES-1 of the draft BERA). It also includes the lower portion of Snow Creek and its floodplain between Highway 78 and the confluence of Snow Creek and Choccolocco Creek. The OU-4 BERA focused on key ecological receptor groups that may reside in or forage within the terrestrial and aquatic habitat in OU-4.

P/S delivered the draft BERA for OU-4 to EPA in August 2015. During review of the draft BERA, critical deviations from the sample collection methods, data reduction and analysis methods, measurement endpoints, lines of evidence (LOE), and risk characterization methods outlined in the planning documents were identified. EPA provided comments on the 2015 draft BERA, and met with P/S in December 2015 and February 2016 to discuss the comments and resolve issues with the draft BERA that had been identified by EPA reviewers. Following the February 2016 meeting, the EPA review team worked with P/S to address two critical issues: calculation of site-specific bioaccumulation factors (BAFs); and selection of toxicity reference values (TRVs) to be used in the revised draft BERA. P/S revised the 2015 draft BERA in response to EPA comments, and submitted a revised draft BERA for review in October 2016.

EPA reviewed the revised draft BERA and provided additional comments, focusing on revisions that were not made in response to the original comments, or conclusions that the EPA review team did not feel were supported by the data. EPA met with P/S in May of 2017 to discuss the outstanding issues associated with the revised draft BERA. Following the May meeting with P/S, EPA concluded that although some comments and concerns were adequately addressed in the revised draft BERA, EPA's interpretation of the data collected for the BERA differed significantly from the P/S interpretation of the data for some issues. EPA decided that rather than request a second revision of the draft BERA, EPA would identify the issues where there is significant divergence in the approach to data analysis and/or interpretation. EPA would then provide their evaluation of the data in a BERA Addendum report, including an analysis of how the EPA interpretation affected the weight of evidence (WOE) evaluation and risk conclusions. The BERA Addendum report was organized into four sections as follows:

- 1) Introduction
- 2) Issues

- 3) Conclusions
- 4) Literature Cited

SECTION A GLOBAL ISSUES

Issue 1 - Hazard Quotient (HQ) rounding and interpretation, Comments 6, 134, 135 and 136: Calculated HQs are being rounded to a single digit: *Calculated HQs are being rounded to a single digit.*

Resolution: Calculated HQs will be shown to one decimal point.

The EPA team reviewed the Environmental Protection Agency (EPA) Staff Paper on Human Health Risk Assessment (HHRA) (U.S. EPA 2004), the document cited as a justification for rounding HQs to a single digit in the July 6 comments from Pharmacia LLC and Solutia Inc. (P/S) on the proposed BERA Addendum outline. U.S. EPA (2004) states “In a final risk description, all cancer risks and non-cancer hazard indices should be presented with one significant figure only”; this statement is specifically referring to data presentation in an HHRA. The U.S. EPA (2004) document also notes that the number of significant figures presented during a risk assessment changes to reflect the needs of the assessment. It states “For example, risk information presented in Risk Assessment Guidance for Superfund (RAGS) Part D tables (Tables 6 through 9 in RAGS) typically present cancer risk information with two significant figures. This summary information allows risk assessors reviewing the document to check the accuracy of the cancer risk calculations and provide appropriate comments.” Rounding the HQs to one significant figure did not facilitate review of the OU-4 BERA. Rounding the calculated HQs to one significant figure resulted in the risk conclusions for LOAEL-based HQs between 1.0 and 1.49 being characterized as “indeterminate” rather than “unacceptable”. Because rounding calculated HQs to a single digit impacts the risk conclusion for HQs between 1.0 and 1.49, the HQ must be presented to at least one decimal place.

Tables AD1-1 through AD1-15 show the revised NOAEL- and LOAEL-based HQ summaries.

Issue 2a, Hazard Quotient (HQ) Interpretation, Comments 134, 135: The following risk categories should be used consistently throughout BERA: no observed adverse effect level (NOAEL) $HQ < 1.0$, risk is acceptable; NOAEL $HQ \geq 1.0$ and lowest observed adverse effect level (LOAEL) $HQ < 1.0$, risk is indeterminate. LOAEL $HQs \geq 1.0$ indicate unacceptable risk and should be evaluated based on the magnitude and the ecological significance of the response in the selected critical study.

The risk categories used in the BERA were defined as follows: NOAEL $HQ \leq 1.0$, risk is negligible; NOAEL $HQ > 1.0$ and LOAEL $HQ \leq 1.0$, low risk. LOAEL $HQs > 1.0$ and ≤ 10 , indicate moderate risk, and LOAEL $HQs > 10$ were interpreted to indicate high risk.

HHRAs are typically more conservative than ERAs. For an HHRA, the reference dose (RfD) is a NOAEL value and uncertainty factors (UFs) are incorporated into the RfD. RfDs can be based on any toxicity endpoint, whereas toxicity reference values (TRVs) selected for ERAs are limited to effects on growth, reproduction or survival. For an ERA, the LOAEL, the dose at which an adverse effect is observed, is used as a TRV. Because the LOAEL-based TRV in an ERA is a dose at which an adverse effect on an ecologically relevant endpoint has been observed, any exceedance of this exposure indicates potential risk.

The Ecological Risk Assessment Guidance for Superfund (ERAGS; U.S. EPA 1997) states that a NOAEL-based HQ less than one (unity) indicates that the contaminant alone is unlikely to cause adverse effects (Section 2.3). An HQ equal to 1 is a pass/fail decision point. This decision point also applies for LOAEL-based HQs. Based on guidance, the following risk categories will be used in this OU-4 BERA addendum: NOAEL-based HQ < 1.0, acceptable risk; NOAEL-based HQ $\geq$ 1.0 and LOAEL-based HQ < 1.0, indeterminate risk; and LOAEL-based HQ $\geq$ 1.0, unacceptable risk. Calculated HQs $\geq$ 10.0 will be identified (high unacceptable); these criteria are summarized in the Table below. Calculated HQs will be evaluated based on the number and magnitude of exceedances. Additionally, the magnitude of the adverse response observed in the critical study that the LOAEL TRV was derived from will be considered when interpreting LOAEL-based HQs $\geq$ 1.0.

Calculated HQ	Risk Conclusion
NOAEL-based HQ < 1.0	Acceptable risk
NOAEL HQ $\geq$ 1.0 and LOAEL HQ < 1.0	Indeterminate risk
LOAEL-based HQ $\geq$ 1.0	Unacceptable risk ^A
LOAEL-based HQ $\geq$ 10.0	High unacceptable risk ^A

^A Risk interpretation will consider the magnitude and severity of the adverse effect observed in the critical study.

Issue 2b, Effective Concentration (EC) comparison interpretation, Comment 6.

Risk to benthic invertebrates was evaluated on a point-by-point basis, and the risk conclusions were based on the number of samples within an Exposure Unit (EU) (Reach or Assessment Area [AA]) that exceeded the toxicity threshold for the most sensitive endpoint (Table AD2b-1),. As described above for the LOAEL, the EC20 is a sediment concentration where a response/effect 20 percent (%) lower than the control response is expected. For the benthic risk evaluation, the risk categories will be revised similar to those described above: < EC0; $\geq$ EC0, < EC10; $\geq$ EC10, < EC20; $\geq$ EC20. In BERA Table 6-4a (Table ADb-2), the measured PCB concentration in two sediment samples from Reach C1 is 4.4.mg/kg and the EC20 is 4.4 mg/kg. Table 6-4a from the BERA has been revised to reflect the above risk categories (Table AD2b-1).

Ingersoll et al. (2014) defined the Toxicity Threshold High Risk (TT_{HR}) as the sediment PCB concentration that corresponded to a 10% reduction compared to the lower limit of the reference envelope (equivalent to the EC10* concentration in the OU-4 BERA). Seven percent, 0.7% and 0.4% of the sediment samples collected for the BERA are $\geq$ EC10* and < EC20* for the *Hyalella azteca* 42-day young per female endpoint, the *Chironomus dilutus* percent emergence endpoint, and the *C. dilutus* survival endpoint, respectively. Five percent and 2% of the sediment samples are $\geq$ the EC20* for the *H. azteca* reproductive endpoint and the *C. dilutus* % emergence endpoint, respectively. None of the sediment samples exceed the EC20*for the *C. dilutus* survival. Most of the EC20* exceedances are for sediment samples collected in Reaches C1, C2 and C4 (Table AD2b-1).

For the Weight of Evidence interpretation (Table AD8-5), risk was identified as unacceptable based on exceedance of the EC10*, high unacceptable based on exceedance on the EC20*, indeterminate based on exceedance of the EC0*; and acceptable if less than the EC0* (Table AD2b-1).

Issue 3, Data Validation, Comment 63: *The data tables in Appendix E include the Laboratory qualifiers, not the data validator qualifiers. Were the metals data validated?*

Resolution: Every sample went through Level 2 validation, and one of 20 samples went through Level 4 validation. P/S provided a revised Appendix E with added columns showing validation level and qualifiers that changed during the validation process.

The validation of the data for metals in sediments and soils generally added “J” values to many of the laboratory data that originally had no data quality flags. Rarely was an unqualified result or a U-flagged result changed to a “J” flag or vice versa. In the few instances where the flag changed to a non-detect, the concentration was low.

The non-mercury (Hg) metal concentrations in tissues were impacted by the validated data and data qualifier revisions added to Appendix E. Figures 6-15 through 6-19 of the are no longer valid. Revised Figures AD3-1 through AD3-5 were created for this Addendum. The original BERA Figures (6-15 to 6-19) are included as Addendum Figures AD3-6 through AD3-10. As a result of the revisions based on validated data, the non-Hg metals in sediment, soils, and biota cannot be ruled out as contaminants of potential concern (COPCs) based on comparison to reference or by upstream to downstream trends.

The tables in Appendix B of the BERA appear to have incorporated the non-detects from the validated data in the calculation of the Bioaccumulation Factors (BAFs), so no changes to the tables are necessary. The error appeared to be limited to Figures 6-15 through 6-19 and not propagated throughout the report. There are a few non-Hg metals with LOAEL HQs above 1 in BERA Table 6-8a (Addendum Table AD3-1) for aquatic and terrestrial mixed diet receptors.

Issue 4, Aroclor and Homolog data, RTC comment 3, discussion at 5-16-17 meeting: *The Aroclor data indicate that Aroclors 1254 and 1260 are present on-site, however the homolog data indicate that low- and highly-chlorinated homologs are present in tissues, while the mid-range homologs that would be associated with Aroclors 1254 and 1260 are not.*

The laboratory measured PCB homolog groups by an in-house modification to Method 8270C. The Standard Operating Procedure (SOP) for the modification to Method 8270C was presented in the appendix to the Revision 5 Quality Assurance Project Plan (Arcadis 2008). The selective ion monitoring (SIM) method was used to analyze for total PCB homologs and homolog groups in surface water, soil, sediment, and biological tissues. Total PCB Aroclors were measured by Method 8082 in most soil and sediment samples and in fish and mollusc tissues. EPA has promulgated a method for analyzing for PCB homologues as PCB congeners (Method 1668B). The high resolution method for 209 PCB congeners eliminates the subjectivity of splitting the PCB mixture into homologs or identification of patterns for Aroclors.

The SOP for the laboratory’s in-house modification to Method 8270 GC-MS-SIMPCB requires a demonstration of analyst capability. EPA has requested from P/S information on the laboratory’s demonstration of capabilities and any validation provided for the method. The Stage 4 validation packages

for the homolog SIM data were requested from P/S. The information will be placed in the administrative record for the site. The additional information was requested due to the fact that the method was modified.

Judgments for how the instrument data is split into homolog groups can depend on the analyst. The homolog groups were split out by chromatogram retention time with standards for Aroclor 1242, Aroclor 1260 and Aroclor 1268. PCB mixtures were used to determine beginning and ending retention times for homolog groups instead of using individual PCB congeners for this purpose. The average of the response for the first and last eluting compound within each level of chlorination was used for quantification. 40% for soils, 50% for sediments, and 56% for tissues of the PCB homolog SIM data was “J” qualified. 66% of the data for total pentachlorobiphenyls in soils, 88% of the data for total pentachlorobiphenyls in sediments, and 90% of the data for total pentachlorobiphenyls in tissues was “J” qualified. The tissue data for benthic invertebrates (Odonata) was 100% “J” qualified. More of the PCB homolog data was “J” qualified compared to the PCB Aroclor data measured by Method 8082.

The same extract was used to run the PCB Aroclor analysis and the homolog SIM analysis when a sample was tested by both methods. While it is expected that the PCB Aroclor analysis and the homolog SIM analysis might give slightly different results, it is troubling that the homolog SIM method measured higher concentrations of total PCBs in samples containing lower-chlorination PCBs, while the PCB Aroclors method measured higher concentrations of total PCBs in samples containing mid-range chlorination PCBs. Both the homolog SIM method and the PCB Aroclor method depend on the judgment of the analyst when deciding how to break the mixture of 209 PCB congeners into groups of either PCB Aroclors or PCB homologs. It is possible for the PCB Aroclor method to double count overlapping peaks. However, this is also true of the homolog SIM analysis. Corrections are applied to the quantification of each chlorination level by the homolog SIM method based on mass spectrometer responses. The corrections for overlapping peaks are specific to a particular instrument. Without supporting information on the demonstration of the method by the particular analyst, the overall method performance cannot be evaluated.

The information the EPA has requested will help correct the unknown or undocumented data quality. The Region 4 is agreeable to discuss the method with a bench chemist. However, EPA does not have adequate information at this time that would allow a chemist to evaluate the method. As of preparing this Addendum, the EPA had received a validation report from P/S for a single sample delivery group. The actual data package that was evaluated was not provided. The validation report described how the data were validated. The “J” qualifier was assigned to the results for particular homologs when the matrix spike or matrix spike duplicate recovery was less than the 50% lower limit on recovery specified in the SOP. In the particular sample delivery group when there was a problem, the laboratory control sample recovery was lower than the 50% lower limit. Since the laboratory control sample is a spike into a clean matrix, it should represent the best performance of the method/instrument, free of matrix issues; and problems with it could be expected to extend across the sample delivery group.

Specific procedures for how the data would be validated and when data would be rejected were not provided in the QAPP. The validation protocol rejected data only when the sample was non-detect and the matrix spike or matrix spike duplicate recovery was less than 10%. A detected homolog with matrix spike recovery of less than 10% was J-flagged, and data was not rejected. Given the high proportion of J flagged data, especially for total pentachlorobiphenyls, it is concluded that the PCB homolog SIM method might

have underestimated the concentrations of total PCBs more often than the concentrations were overestimated. The underestimation appears to have affected the tissue samples to a greater degree than the soil or sediment samples. Conclusions are based on a single sample delivery group. If more validation reports are provided to the Agency, EPA will consider those as well. If validation reports for other sample delivery groups also show low recovery of the laboratory control sample, this can be indicative of method performance.

Concentrations of PCBs in benthic invertebrates measured using the homolog SIM analytical method may have been underestimated. Risk conclusions based on exposure of higher trophic level receptors to measured PCB concentrations in benthic invertebrates may be less conservative.

Issue 5, Only Surface Weighted Average Concentrations (SWACs) and the 95% Upper Confidence Limit (95%UCL) of the SWAC were presented in the BERA, Comment 154: *EPA requested the 95%UCL of the measured sediment PCB and Hg concentrations by Reach and by AA.*

Resolution: At the May 16, 2017 meeting, P/S presented two tables, one that summarized the 95%UCLs of the measured sediment polychlorinated biphenyl (PCB) and Hg concentrations by Reach and by AA (Tables AD5-1 and AD5-2, respectively), and one that summarized the 95%UCLs of the SWACs that were presented in the BERA in Tables 4-4 and 4-5a and b (Addendum Tables AD5-3 through AD5-5). The 95%UCLs of the SWACs were used as exposure point concentrations (EPCs) in the BERA. The 95%UCLs of the measured concentrations in sediment were compared to the 95%UCLs of the SWACs for PCBs and Hg. The ratio of the 95%UCLs of measured concentrations to the 95%UCLs of the SWACs was calculated for each AA and Reach to quantify the implications of the use of these two summary statistics on risk estimates.

For PCBs, in all but one instance (i.e., the Lower AA [LAA]), the total PCB EPC derived as the 95%UCL of the SWAC was less than or equal to the EPC derived as the 95%UCL of the measured concentrations (Table AD5-1). On average, total PCB EPCs derived as the 95%UCLs of the SWAC were 28% to 38% lower than EPCs derived as the 95%UCL of the measured concentrations.

For Hg, five of nine EPCs derived as the 95%UCLs of the SWAC were less than or equal to the EPC derived as the 95%UCL of the measured concentrations (AD5-2). On average, Hg EPCs derived as the 95%UCLs of the SWAC were 34% to 73% lower than EPCs derived as the 95%UCL of the measured concentrations.

The comparison of EPC calculation approaches for total PCBs and Hg indicates substantial variability depending upon the approach chosen (measured or surface-weighted). In general, calculation of the EPC using the 95%UCL of the SWACs produced lower values as compared to the 95%UCL of the measured concentrations. Risk conclusions based on the 95%UCL of the SWAC should, therefore, be considered less conservative than would risk estimates based on the 95%UCL of the measured concentrations.

Issue 6, Comment #40: *For data-poor Reach C1, the maximum detected concentration in Reach C1 floodplain soil should have been used as the EPC instead of the 95%UCL concentration for all riparian soils from the Upper AA (UAA) reaches combined.*

Resolution: Utilization of the maximum detected concentration in Reach C1 as the EPC for Reach C1 will be evaluated to determine if risk conclusions presented in the BERA would be affected. If there is no significant difference in risk estimates, the addendum will document this issue was observed, but would not affect the overall conclusions. Additionally, the discussion at the 5-17 meeting indicated that there were soil samples collected from Reach C1 that were not labelled riparian although there is a small riparian zone that parallels the creek. Use of an EPC calculated from these soil data will be evaluated.

The soil data in Appendix E were reviewed. There are 94 soil samples from Reach C1 East and 6 soil samples from Reach C1 West that are not labelled riparian (Column G, Riparian EU indicates NA). The only COPCs analyzed in these samples were Aroclors, Total PCBs and solids. There are no metals data for soil samples from Reach C1, and no tissue data was collected in Reach C1.

The area defined as the riparian zone for OU-4 is 100 feet on either side of Choccolocco Creek. Defining the riparian zone for Snow Creek using the same 100 foot metric, based on Figure 4-2b of the BERA, 18 of the soil samples from Reach C1 East and 4 of the soil samples from Reach C1 West were collected within the riparian zone. Total PCBs in Reach C1 east “riparian” soils ranged from 2.13 to 59 milligrams per kilogram (mg/kg), and in Reach C1 west “riparian” soils ranged from 0.115 to 206.5 mg/kg. Although a sufficient number of samples are available to calculate a 95%UCL for “riparian” soil in Reach C1 East, the recommended 95%UCL selected by ProUCL is an H-statistic UCL of 25.02 mg/kg. ProUCL notes that 95%UCLs based on the H-statistic often result in unstable (both high and low) values of the 95%UCL, and recommends avoiding the use of 95%UCLs based on the H-statistic (U.S. EPA 2015). Therefore, the maximum concentration measured in “riparian” soils in both C1 Reaches is the preferred EPC for PCBs.

Table 6-18a in the BERA (Addendum Table AD6-1) indicates calculated risk for the Sandpiper-1 in Reach C1 riparian, and Table 6-21 of the BERA (Addendum Table AD6-2) indicates calculated risk for Raccoon-2 and Mink-1 in Reach C1 riparian using the SWAC 95%UCL for UAA riparian soils as the EPC. Table 6-18d of the revised BERA (Addendum Table AD6-3) shows that LOAEL HQs for Hg, vanadium (V), lead (Pb) and chromium (Cr) exceed 1.0 for the Spotted Sandpiper-1 in Reach C-1.

The food chain models (FCM) were re-calculated using the maximum measured PCB concentration in Reach C1 East and C1 West sediment and “riparian” soil for the sandpiper and raccoon instead of the 95%UCL for the UAA, and measured tissue concentrations (Tables AD6-4 and AD6-5). Because the “riparian” samples in C1 were not analyzed for metals, the maximum concentration measured in UAA soils was used as the EPC for inorganics. The mink exposure parameters assume 0% for the soil ingestion rate (Table 4-2a of the BERA; Addendum Table AD6-6), so use of the maximum soil/sediment concentrations would not affect the risk estimate for this receptor, and re-calculation is not necessary.

Except for Hg, the use of the maximum soil metal concentration had little impact on the calculated HQs for the spotted sandpiper and exposure to inorganics (Table AD6-7); use of the maximum measured Hg concentration in UAA riparian soils (17.4 mg/kg) instead of the 95%UCL (2.809 mg/kg) resulted in a higher calculated LOAEL-based HQ (14.4 versus 8). Use of the maximum measured concentrations of PCBs in “riparian” soils from C1 instead of the 95%UCL for all UAA riparian soils resulted in a calculated HQ almost three times higher for birds exposed to soil in EU C1-West (92 versus 36 in the OU-4 BERA). Use of the maximum measured concentration of PCBs in “riparian” soils from C1 resulted in calculated HQs

for omnivorous mammals (raccoon) that indicate unacceptable risk; the OU-4 BERA had a LOAEL-based HQ less than 1.0 for this receptor.

In summary, use of the 95%UCL for the UAA instead of the maximum soil concentration in C1 underestimated risk from exposure to PCBs and Hg for aquatic ground-feeding invertivorous birds. Use of the measured concentrations of PCBs in “riparian” soils from C1 instead of the 95%UCL for all UAA riparian soils resulted in calculated unacceptable risk for exposure of omnivorous mammals; whereas the original calculations resulted in an indeterminate risk conclusion. Use of the 95%UCL for UAA riparian soils as the EPC underestimated risk to aquatic ground-feeding invertivorous birds and omnivorous mammals from PCBs, and to aquatic ground-feeding invertivorous birds exposed to Hg.

Issue 7, discussion at the 5-16-2017 meeting: *In the toxicity testing samples collected from the backwater area, concentrations of mono- and di-chlorinated homologs are high, but the Aroclor analysis is not picking up the lower chlorinated Aroclors. The total Aroclor data may be under-predicting the actual PCB concentrations present. Additionally, the presence of lower chlorinated congeners in sediment may be a concern for groundwater, particularly in the Backwater Area.*

Resolution: This issue will be discussed. It was stated at the May 16, 2017 meeting that although the lower chlorinated congeners are present in sediment, Choccolocco Creek is a gaining waterbody, and the presence of lower chlorinated congeners in sediment should not be a groundwater concern.

Based on discussion with a Region 4 hydrogeologist, conditions within a gaining stream could reverse during high flow storm events. Seasonal variation in flow could also reverse the stream condition. EPA is not aware of any information that supports the assertion that Choccolocco Creek is a gaining stream, or information to evaluate the threat to groundwater posed by the presence of lower chlorinated congeners in the backwater area. The potential impact of lower chlorinated congeners in sediment on groundwater in OU-4 is an unresolved issue.

Issue 8, Community Survey Metrics: **Verify how this LOE was used for each AE; confirm the community data were used as a secondary LOE.**

The BERA WOE tables (Tables 6-24 through 6-26; incorporated into Addendum Tables AD8-1 through AD8-3) were revised to clearly identify the community surveys as a secondary LOE, and discuss the limitations associated with the surveys (Tables AD8-1 to AD8-4). In addition, a table was created in the addendum (Table AD8-5) to visually summarize the WOE results for PCBs using each line of evidence for each assessment endpoint.

Risks were also evaluated for 7 additional secondary contaminants of potential concern (COPCs) (i.e., mercury, dioxin toxic equivalents [TEQs], barium, chromium, cobalt, lead, and vanadium) (Tables AD8-6 to AD8-12). Although unacceptable risks were identified in some areas of OU-4 for some of these COPCs, overall risks in OU4 are dominated by PCBs.

Issue 9, Reference Locations. Comment #44: **PCBs were detected in surface water and aquatic plant samples at Reference Location #2.**

Resolution: The Addendum will provide a more detailed description of how the reference locations were selected, and will note that the PCBs observed at Reference Location 2 were anomalous with no known PCB source.

The Phase 2 Field Sampling Plan (FSP) described the procedures used to select the three reference locations. Reference locations were selected based on a systematic process that evaluated the following criteria: habitat and ecological conditions at the proposed reference locations were similar to conditions in OU-4; and the reference location had no proximity to known point sources of PCBs or other COPCs. A single sediment sample was collected at each proposed reference site, and submitted for analysis of the same list of chemical constituents as the sediment samples collected for toxicity testing. PCBs were not detected in any of the sediment samples collected at the reference locations in April 2009.

PCBs were not detected in the additional reference sediment samples collected for the OU-4 BERA, but were detected in the three surface water samples collected at Reference Location 2 and one surface water sample collected at Reference Location 3. The highest PCB concentration measured in aquatic plant tissue collected for the BERA was in a sample collected at Reference Location 2. One small mammal tissue sample collected at Reference Location 1 contained PCBs at concentrations higher than some small mammal tissue concentrations measured in OU-4. The PCBs observed in surface water (Reference Locations 2 and 3), aquatic plants (Reference Location 2), and one small mammal (Reference Location 1) were anomalous, and the source(s) of these PCBs is unknown. Detection of PCBs in samples from the reference areas adds to the uncertainty associated with comparison of site results with reference results.

Issue 10, Comments 87 and 90: Due to limited data and high reporting limits (RLs) for non-detect (ND) samples, the strength of evidence for stating metal concentrations on-site are similar to reference is low.

Resolution: May need to consider constituents monitored in surface water in post-remedy monitoring. Issue 10 pertained to the uncertainty in the risk conclusions caused by the use of unvalidated data for screening non-Hg metals for background. The original detailed comment is repeated below.

Original Comment:

Figures 6-10 through 6-19, Summary of OU-4 and reference concentrations in sediment. Topic: Data Quality. The figures compare metals concentrations among the reference stations and the functional reaches. Since the non-Hg metals concentrations are fairly low at all stations, comparison between the concentrations detected at the reference stations and the concentrations detected at site is problematic. Comment Number 87 noted that the general statement in the draft BERA “For these metals, concentrations in the OU-4 Areas are generally similar to or lower than in the reference areas, suggesting that metals concentrations in plant tissue along Choccolocco Creek are not different from reference areas.” Sections 6.1.1.2, 6.1.2.2.2, 6.1.3.2.2, 6.1.4.2.2, 6.1.5.1.2, and 6.1.6.1.2 discuss the comparison between concentrations detected in OU-4 and the reference condition. The data used to make the comparisons should be reviewed and validated to ensure that none of the B-flagged data is either rejected or U-flagged based on field blanks, method blanks or other considerations. Once the data is validated, the comparison to the reference condition should consider whether the constituent was detected at the reference station. The bar plots should not plot half the detection limit for non-detected metals and compare with a detected

concentration. The figures should be revised to a format that clearly depicts detected versus non-detected results.

Resolution:

P/S revised Appendix E to provide the missing information requested by the EPA. Upon review of the revised appendix, EPA concluded that the validation process changed the data quality flags from “B” or “J” to “U” for two sediment lead concentrations. The samples affected by this change had low concentrations of lead. Consequently, the use of unvalidated data in Figures 6-10 through 6-19 did not modify the appearance of the figures. There is still uncertainty in screening out the metals as COPCs in sediments and soils due to the limited number of samples.

Conclusion for Figures 6-10 through 6-14:

The assignment of data quality flags did not affect the conclusions for whether the metals in sediments and soils were site-related. There remains considerable uncertainty in the interpretation of the abiotic chemistry data results, as outlined below:

- There was one reference data point for non-Hg metals in soils.
- There were no data for non-Hg metals in Reach C1 soils, however C1 had the highest concentrations of metals in sediments. The lack of non-Hg metals data limits the ability to discern potential upstream to downstream trends in the concentrations of metals in soils.
- Vanadium in soils does not appear to be elevated in OU-4 compared to the reference station. However, results are compared to a single reference sample.
- The highest concentrations of non-Hg metals were detected in C1 sediments sampled as part of the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI). Concentrations of metals in C1 sediments were above concentrations in the reference stations. No data were collected for metals in C1 sediments in the Phase 1 or Phase 2 investigations.
- Figures 6-10 to 6-14 plotted concentrations of metals on a logarithmic scale that tended to mask the differences among the reaches and reference stations.

Issue Involving Non-Hg Metals in Tissues (Figures 6-15 through 6-19):

Section 6.1 of the BERA characterized non-Hg metals concentrations in biota as similar to the concentrations measured at the reference stations. However, excessive scatter in plots shown in Figures 6-15 through 6-19 may have affected the conclusions. The scatter was a result of using non-validated data to create the plots. Data validation showed that many of the highest reported metals concentrations in biota were actually non-detects. During the data validation process for non-Hg metals in tissues, many of the “B” flags became “U” flags. Most of the results with flags changed to “U” had high reported concentrations of metals. For example, Figure 6-15 for barium (Ba) in aquatic tissues included three data points for Ba concentrations over 100 mg/kg that were subsequently determined to be non-detected values. If non-detected values were eliminated, the trend in Ba concentrations in aquatic biota shows higher Ba concentrations in OU-4 compared to the reference stations.

Figures 6-15 through 6-19 depict concentrations of metals in fish, aquatic biota, and terrestrial biota. The EPA replotted the data in the figures by excluding the data for non-detected metals results from the validated data. For Ba in fish (Figure AD3-1), the highest concentrations, which were over 15 mg/kg, were identified

as non-detects by the data validation. Despite this change, Ba concentrations in fish remain similar to the reference station. Upstream to downstream trends were more apparent after removing the faulty data.

For Cr in aquatic biota (Figure AD3-2), the situation was similar to barium in aquatic biota. There were several results for Cr showing 4 mg/kg in biota that originally had a “B” flag, but upon validation assumed a “U” flag. The plot created by eliminating the non-detected values shows that concentrations of Cr in aquatic biota of OU-4 were higher than at the reference stations.

For Cr in fish (Figure AD3-2), the concentrations of Cr in fish above 4 mg/kg were determined to be non-detect in the data validation. However, the concentration of Cr in the fish from the reference station remains higher than in OU-4. While the conclusion does not change, Figure AD3-2 changed substantially.

Concentrations of Pb in fish tissues and other aquatic biota (Figure AD3-4) showed a decreasing trend from upstream to downstream. Concentrations of Pb were highest in the middle reach as a result of a single high data point for Pb in earthworms.

There were few samples of fish tissue in which V was detected. Results for V in tissues (Figure AD3-5) do not indicate a strong trend, but tend to show higher concentrations in OU-4 biota than in at the reference stations.

In summary, the error associated with the use of non-validated metals data appears to be limited to Figures 6-16 through 6-19.

Issue 11, Threatened and Endangered Species, Comment 157: The 2006 Problem Formulation states “Risks to threatened and endangered (T&E) species will not be explicitly evaluated. Rather, appropriate surrogate species will be identified as focal points for risk characterization for determining if risks to T&E species could be unacceptable. Surrogate species and appropriate risk assessment parameters will be developed in the BERA.” This was not done in the BERA.

Resolution: Under EPA Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) policy, ERAs are not conducted specifically for T&E species or for individuals thereof. Rather, appropriate surrogates are chosen for the assessment endpoints that represent site receptors and are inclusive of T&E (i.e., receptors), if present. EPA does not characterize risks for individual organisms, but rather at the level of the local population or higher levels of organization (USEPA 1999).

T&E species are known to be present in OU-4. The Anniston OU-4 BERA stated: “T&E that have been observed within Choccolocco Creek and may be found in OU-4 include the blue shiner (Cyprinella caerulea), painted rocksnail (Leptoxis taeniata), Cylindrical lioplax (Lioplax cyclostomaformis), and Tulotoma snail (Tulotoma magnifica). In addition, the United States Fish and Wildlife Service (U.S. FWS; 2014) lists three mammals (Indiana bat [Myotis sodalis], grey bat [Myotis grisescens], and northern long-eared bat [Myotis septentrionalis]), one bird (red-cockaded woodpecker [Picoides borealis]), four flowering plants, eight clams, and one fish (pygmy sculpin [Cottus Paulus]) as potentially occurring within Calhoun County, Alabama. In addition, one sensitive snail species (Wicker Ancyliid limpet), formerly thought to be extinct, has been observed in lower Choccolocco Creek (O Foighil et al. 2011). Therefore, a

range of risk estimates are provided in this OU-4 BERA to allow evaluation of the potential for adverse effects at both the individual and population levels”.

The potential for adverse effects to populations of T&E species that may occur in OU-4 was qualitatively evaluated based on the risk conclusions for each assessment endpoint that corresponds with the relevant T&E species. These are summarized below:

AE 1: Aquatic and terrestrial plant communities. The U.S. FWS (2014) lists four T&E flowering plant species as potentially occurring within Calhoun County, Alabama. However, no T&E plant species have been recorded during surveys within OU-4. Further, plants do not appear sensitive to PCBs (TRVs for plants are approximately 10-fold greater for plants than soil invertebrates; BERA Table 5-2b; Addendum Table 11-1). No unacceptable risk to local populations of T&E plants in OU-4 is therefore estimated.

AE2: Benthic Invertebrate Community. U.S. FWS (2015) found that bivalves are less sensitive to OU-4 sediments than either the midge or amphipod evaluated under the site-specific sediment toxicity program. This is important, as two T&E mollusc species have been observed within Choccolocco Creek and may be found in OU-4. These include the painted rocksnail and Tulotoma snail. The U.S. FWS (2014) lists eight T&E clam species as potentially occurring within Calhoun County, Alabama. In addition, one sensitive snail species, Wicker Ancyloid limpet, formerly thought to be extinct, has been observed in lower Choccolocco Creek (Zielinski 2011). The presence of these animals in OU-4, particularly in the lower portions of the system, is indicative of improving habitat quality and system health. However, the weight of evidence for benthic invertebrates (Table AD8-1) indicates unacceptable risks to the benthic invertebrate community in the UAA of OU4. Risks in the MAA and LAA were lower, being either indeterminate or acceptable. Taken together, these observations indicate that unacceptable risks to threatened or endangered benthic invertebrates **are** present in the UAA of OU-4, but either indeterminate or acceptable in the MAA and LAA.

AE3: Terrestrial Invertebrate Community. There are no known T&E terrestrial invertebrate species potentially occurring within Calhoun County, Alabama. No unacceptable risks to T&E invertebrates in OU-4 is therefore predicted.

AE4: Fish Community. One threatened fish species, the blue shiner, has been observed in Choccolocco Creek and the U.S. FWS (2014) lists the threatened pygmy sculpin as potentially occurring within Calhoun County, Alabama. The weight of evidence for fish (Table AD8-1) indicates unacceptable risks to forage fish (which would include blue shiner and pygmy sculpin) in the MAA of OU4 based on measured tissue concentrations. Tissue concentration based risks in the UAA and LAA were indeterminate. These observations indicate that unacceptable risks to threatened or endangered fish **are** present in the MAA of OU-4, but indeterminate in the UAA and LAA.

AE5: Birds. The U.S. FWS (2014) lists one T&E bird species (Red-cockaded woodpecker) as potentially occurring within Calhoun County, Alabama. No T&E birds have been observed within OU-4. Further, because red-cockaded woodpeckers rely on mature pine forest habitat (which is limited in OU-4) and forage for insects on tree trunks (Jackson 1994), exposure and risks from PCBs and Hg are unlikely.

AE6: Mammals. The U.S. FWS (2014) lists two T&E mammal species (Indiana bat and grey bat) as potentially occurring within Calhoun County, Alabama. The diet and habitats used by both the Indiana bat, the gray bat, and the northern long-eared bat greatly overlap with those of the little brown bat, a mammalian receptor for OU-4. Therefore, the risk conclusions for the little brown bat are directly applicable to the three T&E bats. The weight of evidence for little brown bats (Table AD8-3) indicates unacceptable risks in exposure units C1 through C4 based on both measured and modeled diet. Measured and modeled risks are acceptable in all downstream exposure units (i.e., C5-C10). These observations indicate that unacceptable risks to threatened or endangered bats **are** present in exposure units C1 through C4 of OU-4, but acceptable in all downstream exposure units (i.e., C5-C10).

Issue 12: The P/S comments on the Addendum outline did not include an Issue 12.

SECTION B ASSESSMENT ENDPOINT (AE)-SPECIFIC ISSUES

Issue 13, AE #1: Survival, Growth and Reproduction of Aquatic Receptors, Comment 167:
Observed surface water exceedances of the Alabama Department of Environmental Management (ADEM) Water Quality Standards (WQS) and Ambient WQS are down-weighted using species-specific toxicity values.

Resolution: The ADEM WQS and AWQC will be identified and weighted as the primary Line of Evidence (LOE).

The EPA team reviewed the WQS and the species-specific toxicity value from Suter and Tsao (1996), and concluded that the species-specific toxicity value used in the BERA is appropriately conservative. Comparison of a measured abiotic concentration to a benchmark for species-specific aquatic toxicity relates to potential impacts to the ecology in the realm of the ecological risk assessment.

Issue 14, Comment 44: *The benthic community surveys were not clearly identified as a secondary LOE and no co-located chemistry data was collected with the benthic community samples.*

Resolution: The text will not state that there appear to be no adverse effects of PCBs on the benthic receptor communities, since PCBs were not measured in the community samples. The results of the community surveys will not be used to down weight WOE conclusions based on chemistry measurements.

The WOE tables have been revised to clearly state that no conclusions on adverse effects of PCBs or other COPCs can be made based on the community surveys, as chemistry was not measured in samples collected where community survey samples were taken. It has also been revised to clearly identify the community surveys as a secondary LOE.

Issue 15: The BERA evaluated the Benthic Invertebrate Community Survey (BICS) data by comparing reference results to on-site results: At the 5-16-17 meeting, it was noted that the BERA compared the benthic community data on-site with reference, but did not evaluate the benthic community on an up-to downstream basis; and Issue 16, RTC memo comment 14, State of Alabama protocols for benthic community assessment: The BERA utilized the Hilsenhoff (1988) protocols to evaluate the

BICS data. ADEM protocols, which include region-specific reference locations, are available and should have been used.

Biological integrity can be measured utilizing a suite of metrics that measure diverse biological attributes and respond to different stressors. A benefit of using a multi-metric index approach is the ability to incorporate and integrate information from a number of metrics that, when integrated into a single measure, can provide a meaningful indicator of overall biological condition (Barbour et al. 1995; Barbour et al. 1999). Use of a multi-metric index helps to increase sensitivity to a broad range of ecosystem stressors and to minimize any weaknesses or limitations that each underlying metric may have if used individually.

At the May 2017 meeting, EPA proposed using the Wadeable Multi-Habitat Bioassessment Index (WMB-I) protocol developed by the Alabama (AL) Department of Environmental Management (ADEM) (ADEM 2014) to evaluate up- to downstream differences in the benthic invertebrate community structure (BICS) data; the OU-4 BERA only compared benthic community structure within OU-4 (site-overall) with reference conditions. The index was developed for streams that meet the following conditions:

- The water body must be lotic.
- Macroinvertebrates must be collected from late April through the end of June.
- Streams above the fall line (Interior Plateau/Transition Hills; Piedmont, Ridge and Valley; and Southwest Appalachians) must consist of riffle-run reaches.
- Streams below the Fall line should be low gradient, glide-pool reaches.
- The drainage area for the stream must be ≥ 5 square miles and ≤ 75 square miles.

The WMB-I protocol notes that streams outside the range of these characteristics should be analyzed using a comparable reference reach(es). The drainage areas for all except one of the Site stations exceed 75 square miles (range from 70 to 481 square miles) (P/S, comments on Issue #16).

The WMB-1 method is eco-region specific; the metrics developed for the Piedmont, Ridge and Valley ecoregion in AL were used to evaluate the Anniston BICS data. The metrics included in the index are: number of Ephemeroptera, Plecoptera, and Trichoptera (EPT) taxa; percent non-insect taxa; Shannon Diversity Index; percent of EPT individuals, excluding Hydropsychidae and Baetidae (more tolerant EPT families); and percent tolerant taxa. Although similar metrics were evaluated in the OU-4 BERA, the BERA only used analysis of variance (ANOVA) to test whether the benthic community metrics measured on-site differed from reference conditions. Percent of non-insect taxa was not evaluated in the BERA. It is recognized that this metric penalizes the presence of molluscs and gastropods, but this bias should be reflected equally across the site-specific reference and assessment areas. The formula used to calculate a metric for the Shannon Diversity Index will result in a loss of this metric from the WMB-I score when measured values are less than 2.7; again, this should also be reflected equally across the site-specific reference and assessment areas.

The Discrimination Efficiency (DE) describes the ability of each metric and overall indices to distinguish between reference and stressed sites. It is calculated as the percentage of metric scores in verified stressed sites that are worse than the worst quartile of those in verified reference sites (Definition 3.3, ADEM 2014). The Pennsylvania Department of Environmental Protection evaluated the DEs for various parameters across

drainage area sizes ranging from 0 to 1000 square miles (PA DEP 2012). DEs were excellent across all stream drainage area sizes for EPT taxa richness and % sensitive individuals, but decreased for the Shannon Diversity Index in streams draining more than 100 square miles of land. Rather than eliminating this metric from their large stream protocol, it was retained to be consistent with the small stream benthic community analysis.

The eco-region specific DE for each metric in the WMB-I protocol is not utilized in the index score calculations, it is utilized in the interpretation of the final index value (Section 8.1, ADEM 2014). The same formula is used to calculate a score for a particular metric, regardless of Ecoregion or Ecoregion-specific DE for each metric (Sections 7.1 through 7.5, ADEM 2014) (e.g., ecoregion-specific reference areas do not affect the calculated index values).

Even though the WMB-I analysis does not meet all of the criteria specified within the method, the BICS sample collection and analysis methods used in the OU-4 BERA also had problematic issues. Benthic community samples were collected using different sampling methods appropriate to the habitat type; measurements from the different habitats could not be standardized per unit area basis. No information was presented as to whether a similar level of effort was expended to collect samples from the different habitats. Co-located chemistry samples were not collected at the BICS sample locations. During each season, samples were collected from two locations per habitat within each AA. A replicate sample was collected at each sampling location. The ANOVA analysis presented in the OU-4 BERA treats the data as being four independent samples, not two samples and two replicates.

Although the portion of Choccolocco Creek that is OU-4 of the Anniston Site does not meet all of the specific stream characteristics specified in the WMB-I protocol, this protocol does indicate differences in benthic macroinvertebrate community structure between the three AAs and the reference locations, particularly in the UAA (Table AD15-1, Figures AD15-1 and 2). The index values calculated for each riffle or run are not dependent on the eco-region specific reference locations, which were developed for streams with drainage areas ≥ 5 square miles and ≤ 75 square miles. The up- to downstream analysis is appropriate to utilize to evaluate and interpret the BICS data. The WMB-I results indicate impacts to the benthic invertebrate community in the UAA, both in riffle and run habitats.

Issue 17, Site-Specific Toxicity Tests: *The BERA discounts use of the 42-day *Hyaella azteca* reproductive endpoint due to high variability in the control samples.*

Resolution: Discuss acceptable/often observed variability associated with this endpoint, and provide support for use of this endpoint to derive the site-specific sediment toxicity thresholds.

Section 3.3 of Appendix C states “U.S. EPA cautions about the uncertainties introduced by poor performance in laboratory control samples and states that even if reference sediment samples have acceptable performance, “any samples showing poor performance should not be judged to have shown toxicity, since it is unknown whether the adverse factors that caused poor control performance might have also caused poor performance in the test sediments.” This section concludes that “This variability in control

response adds significant uncertainty to the predictability of models based on these [the *Hyalella* 42-day reproductive] endpoints.”

The acceptability criterion for the 42-day sediment toxicity test with *H. azteca* is control survival of greater than or equal to 80% on Day 28. Laboratories participating in round-robin testing reported the following control sediment responses after 28-day exposures: survival > 80% for >88% of the laboratories, length > 3.2 millimeters (mm)/individual for >71% of the laboratories, and dry weight > 0.15 mg/individual for > 66% of the laboratories. Reproduction from Day 28 to Day 42 was > 2 young per female for > 71% of the laboratories. All three control batches tested met the above criteria (summarized below).

Endpoint	Round Robin Controls	Control Batch 1	Control Batch 2	Control Batch 3	Coefficient of Variation (CV)
28-day Survival	> 80	97.5	99.2	96.7	1.3%
Mm/individual	> 3.2	4.06	4.7	3.77	11%
Mg/individual	> 0.15	0.23	0.36	0.24	26%
Young per female	> 2	4.2	9.1	2.1	70%

There are no requirements for acceptable control variability for this test (pers. comm., Dave Mount). U.S. EPA (2000) notes that the reproduction endpoint is often more variable than growth. It also notes that based on 28-day length, larger amphipods (> 4.3 mm) tend to have higher reproduction. For the Anniston samples, the CV for the controls (sample size [n] equal to [=] 3 labs) for the 42-day young per female was 70%. Norberg-King et al. (2006) reported a CV of 49% for this endpoint (n = 5 labs). Ivey et al. 2016 reported CVs of 38% (n =6) and 51% (n = 6) for the same endpoint, tests conducted using two different diets. Variability associated with this endpoint is high across studies. Although variability in the Anniston control samples was higher than in the studies on which the acceptability is based, control sample size for Anniston was only n=3. Control normalization methods were used to normalize the batch data. Additionally, high variability does not indicate poor control performance; control performance was acceptable for all controls in the Anniston toxicity tests. The control-normalized 42-day number of young per female is a valid endpoint for characterizing toxicity of sediments and site-specific risk to the benthic invertebrate community in OU-4 for this BERA.

Issue 18, Site -Specific Toxicity Tests, Comment 142: The BERA does not include the most sensitive endpoint measured in the toxicity tests, *Chironomus dilutus* adult biomass, due to calculation of adult biomass from measured 13-day *C. dilutus* biomass.

Resolution: Discuss the method for and uncertainty associated with calculation of a parameter (adult biomass) from a measured parameter.

Percent emergence and 13-day biomass were measured during the study. The long-term midge sediment toxicity tests were run with 7-day old larvae instead of less than 24-hour old larvae, so the 13-day growth

endpoint corresponds to the 20-day weight endpoint specified in U.S. EPA (2000). Replicate adult biomass is calculated by first calculating the individual replicate dry weight and multiplying by the mean number of emerged larvae in the treatment. Then, mean total adult ash-free biomass is obtained by calculating the average of replicate total adult ash-free biomass for each sediment. This estimate of adult biomass assumes that the average weight of emerging adults is proportional to the average weight of larvae on day 13. P/S (2016) exclude this endpoint from their EC0*, EC10* and EC20* calculations, as they state that the above assumption cannot be verified and is not likely, leaving the calculated adult biomass endpoint highly uncertain.

The EPA review team consulted with aquatic toxicologists from the Columbia Environmental Research Center (CERC) regarding the use of and validity of this endpoint in the long-term midge toxicity test. The purpose of estimating adult biomass, or the contribution of biomass contributed by the emerging midges, is to provide an estimate of benthic productivity and the potential reduction of benthic productivity due to direct or dietary exposure to contaminants. Capturing this endpoint is important for characterizing a reduction in biomass at a life-stage that is ecologically important to fish, birds, and wildlife that consume emergent insects. However, data are not available to evaluate or support the assumption that adult biomass is proportional to larval biomass. Adult biomass is not included as a standard endpoint in the long term midge sediment toxicity test, and there are no criteria available to evaluate the acceptability of this endpoint (U.S. EPA 2000). Therefore, the EPA interpretation of the sediment toxicity test results will not include the adult biomass endpoint.

Both adult biomass and percent adult emergence classified 65% of sediments as toxic, and were the most sensitive of the *C. dilutus* endpoints. Day 13 biomass also classified 65% of sediments as toxic. Adult biomass and percent emergence classified a higher percentage of sediments as highly toxic (58%) compared with day 13 biomass (46%). The sediment toxicity thresholds calculated using these endpoints are shown below. The second most sensitive endpoint measured in the long term midge toxicity tests, percent emergence, will be used as the toxicity threshold derived from the site-specific toxicity tests for *C. dilutus*.

Endpoint	P/S (2016) ^A (mg/kg Total Aroclors)		Ingersoll et al. (2014) ^B (mg/kg total Homologs)	
	EC0*	EC10*	TT _{LR}	TT _{HR}
Percent Emergence	2.04	6.8	1.87	7.11
13-Day Biomass	6.02	13.6	15.0	35.9
Adult Biomass	0.894	2.29	1.14	3.37

^A EC0* and EC10* are the non-linear regression-predicted PCB concentrations (mg/kg dry weight [dw]) that would cause an additional 0% or 10% effect beyond the lowest response measured in the reference sediments.

^B Toxicity threshold low range (TT_{LR}) and high range (TT_{HR}) reported in Ingersoll et al. (2014).

Issue 19, Comment 120: *Surface samples utilized in the toxicity tests were not evaluated as a separate LOE.*

Resolution: Section 3.5 of the revised BERA indicated that three of the six locations from which sediment samples were collected for the sediment toxicity testing were collected from the top 1 foot of the sediment cores. The test results from these three surface sediments were evaluated as a separate line of evidence to support the risk evaluation for the benthic invertebrate community assessment endpoint.

The three locations where surface sediment for toxicity testing were collected were TX10, TX20, and TX50. The reference sample, TXR1, was also collected from the surface, but represented a depth of 0 to 6 inches. Depths from which bioassay samples were collected are also reported in Table C2-1 of Ingersoll et al. (2014). These samples represent three different reaches and AAs, TX50: UAA/Reach C2; TX20: middle AA (MAA)/Reach C5; and TX10: LAA/Reach C10. The number of sediment samples tested from each area also varied: 5 samples were tested from the reference location (TXR1), 4 samples from TX50, 2 samples from TX20, and 1 sample from TX10.

Toxicity in all samples was evaluated using both amphipod (*Hyaella azteca*) and midge (*Chironomus dilutus*) bioassays (Ingersoll et al. 2014). The reference envelope approach was used to determine whether bioassay results measured by 13 and 12 test endpoints for the amphipod and midge, respectively, were indicative of toxicity. The bioassay results and total PCBs measured in the surface sediment samples from the Anniston OU-4 BERA as reported in Ingersoll et al. (2014) are summarized in Table AD19-1. Although sediments from the reference location were not identified as toxic to either test species in any of the samples tested, toxicity of sediment from the OU-4 surface sediment locations varied by both location and test species. Surface sediments from location TX50 (Upper AA; Reach C2) contained the greatest total PCB concentrations (mean=655,000 micrograms per kilogram [$\mu\text{g/kg}$]) and were most consistently toxic to both test species; samples were identified as highly toxic (i.e., greater than 10% reduction in bioassay response) for 38% to 75% (mean=63%) and 0% to 89% (mean=47%) of test endpoints for amphipods and midges, respectively. Surface sediments from location TX20 (MAA; Reach C5) contained much lower total PCB concentrations (mean=265 $\mu\text{g/kg}$) and generally displayed little toxicity to both test species; samples were identified as not toxic for 85% to 92% (mean=89%) and 92% to 100% (mean=96%) of test endpoints for amphipods and midges, respectively. Although surface sediments from location TX10 (LAA; Reach C10) possessed the lowest total PCB concentration of any surface sediment location for which bioassays were performed (91.2 $\mu\text{g/kg}$), toxicity differed greatly between the two test species, however, only one sample from TX10 was tested. Sediment from this location was identified as highly toxic for 54% of test endpoints for the amphipod, no test endpoints were identified as highly toxic for midges.

The results of these bioassays on surface sediments suggest that while total PCBs are contributing to adverse effects to the benthic invertebrate community in Reach C2 of the Upper AA of OU-4, their contribution to adverse effects in Reach C5 or the Middle AA is minimal. The divergence of toxic responses between amphipods and midges, coupled with the low total PCB concentrations, suggests that effects observed in Reach C10 of the LAA are likely not associated with PCBs, but rather some other factor. These conclusions have been integrated into the updated Weight of Evidence analyses (Table AD8-1).

Issue 20, Comment 140: *Footnote b of BERA Table 5-2a (Addendum table AD20-1) states that “EC0 was set at a concentration of 0.05 (the mean reference sediment concentration)”. However, total PCB Aroclors were not detected (ND) in any of the reference sediment samples; 0.05 mg/kg is the maximum RL. Looking at Figure C-3c, the curve drops rapidly for the Young/female normalized to survival (% of control) endpoint. If you use a value of ½ the RL as the EC0, what is the effect on the calculated EC0* and EC10* values?*

Resolution: The effect of the selected numerical value for non-detected PCB concentrations on the derivation of site specific effects thresholds was evaluated. Dose-response analyses were performed using the U.S. EPA Toxicity Relationship Analysis Program (TRAP; version 1.30a; https://archive.epa.gov/med/med_archive_03/web/zip/trap1-30a.zip). Dose response analyses were performed on *Hyaella azteca* reproduction (42-d reproduction normalized to 42-d survival normalized to controls), survival (42-day survival), and growth (42-d measured total biomass [mg]) bioassay results and associated total PCB as Aroclor sediment concentrations presented in Anniston, OU-4 BERA, Appendix E. Dose response analyses were performed for reproduction, survival, and growth with values for non-detected PCB concentrations represented by the method detection limit (mdl) and by 0.5*mdl. Concentrations associated with a specific percent effect (i.e., ECx) were identified. The results of these analyses are presented in Tables AD20-2, AD20-3, and AD20-4 and Figures AD20-1a and b, AD20-2a and b, and AD20-3a and b for reproduction, survival, and growth, respectively.

The results indicate that the value selected to represent non-detected PCB concentrations has minimal effect on the resulting ECx estimates¹. Whereas setting non-detects to 0.5*mdl increased ECx values from 11% to 23% for reproduction (Table AD20-2), it produced no change on ECx values for survival (Table AD20-3) or growth (Table AD20-4). The lack of any change in survival and growth ECx values may be due to the steepness of the dose-response for these effects as compared to reproduction.

The conclusion from this analysis is that the value selected to represent non-detected values had little influence on the final ECx values derived from the site-specific bioassays for the Anniston OU-4 BERA. The EC0* and EC10* values calculated in the BERA are appropriate.

Issue 21, Comment 140: *There is uncertainty whether the EC0 and EC0* can be considered a No observed effect concentration (NOEC).*

Resolution: The reference envelope, which is independent of concentration, is used to identify the EC0* and EC0. The Addendum will discuss the uncertainty associated with the use of the RL for total Aroclors, and the shape of the dose-response curve. If appropriate, it will note that exposure at the EC0 does not present an unacceptable risk.

The Anniston OU-4 BERA developed two values, the EC0 and the EC0*, to quantify lower limit sediment thresholds based on the site-specific bioassays. Whereas the EC0 was defined as the sediment PCB (or Hg)

¹ Note that concentrations associated with a specific percent effect (i.e., ECx) obtained using the TRAP software differed slightly from those reported in the Anniston OU-4 BERA. This is likely an artifact of the software and type of model fit to the data.

concentration associated with the average response at the bottom of the reference envelope^[1], the EC0* is the sediment PCB (or Hg) concentration predicted by the dose-response analyses to produce 0% effect above the EC0. Although some effects may occur within the reference envelope, these effects are considered representative of reference conditions and not toxicity. Because some effects may occur at either the EC0 or the EC0*, neither threshold can be considered to be no effect concentrations. However, because these levels of effects are characteristic of the reference condition, exceeding the EC0 or EC0* does not present an unacceptable risk.

Issue 22, Porewater: *Porewater data was not discussed as an additional Line of Evidence [LOE]*

Resolution: A discussion of the porewater data will be added in the addendum and to the Weight of Evidence [WOE] tables. If appropriate, this discussion will note that the sediment and porewater toxicity analysis are complementary and lead to similar conclusions.

Porewater samples were collected from the toxicity testing samples by different methods, depending on the analyte. Samples for general water quality, major cations, major anions, and dissolved organic carbon (DOC) were collected by centrifugation of whole sediment at 5,200 revolutions per minute (RPM) for 15 minutes at 4 degrees centigrade (°C) at the start of the toxicity and bioaccumulation exposures. Concentrations of trace metals were sampled from each test sediment during the whole-sediment toxicity testing with a small dialysis chamber (“peeper”). Polydimethylsiloxane (PDMS) solid-phase microextraction samplers (SPMEs) were used to estimate pore-water concentrations of PCBs in each sediment evaluated in the toxicity testing.

Site-specific low-risk (_{LR}) and high-risk (_{HR}) toxicity thresholds (TTs) were developed for 24 COPCs or COPC mixtures in sediment and pore water to assess risks to benthic organisms associated with exposure to sediments located within the Site. TTs were developed for adult emergence and adult biomass of *C. dilutus*, and for reproduction of *H. azteca*. The TT_{LR} is the concentration of a COPC or a COPC mixture that corresponded to the lower limit of the reference envelope for the selected toxicity test endpoint. The TT_{HR} is the concentration of a COPC or COPC mixture that corresponded to a 10% reduction in biomass, emergence, or reproduction compared to the lower limit of the reference envelope. All of the TTs were evaluated to determine if these thresholds would provide a reliable basis for classifying sediment samples from the Anniston Site as toxic or non-toxic. A TT was considered to be reliable if the following conditions were met: if the incidence of toxicity (IOT) below the TT was less than or equal to 20%; if the IOT above the TT was greater than 50%, and; if the overall correct classification rate was greater than or equal to 80%. There were 69 reliable TTs derived for whole sediment, and 32 reliable TTs for pore water. The site-specific TTs for PCBs were compared with and were consistent with chronic TTs that have been estimated for benthic invertebrates using results of spiked-sediment toxicity tests, empirically based sediment quality guidelines (SQGs), and equilibrium-partitioning (EqP) based SQGs, indicating the site-specific TTs likely represent the concentration of PCBs that are sufficient to cause toxicity to benthic invertebrates. In contrast, the TTs for metals, polycyclic aromatic hydrocarbons [PAHs] and pesticides were generally lower than consensus-based SQGs and results from spiked-sediment toxicity tests, indicating these COPCs were not

^[1] The bottom of the reference envelope was defined in the Anniston OU-4 BERA as the lowest control-normalized response percentage observed in the six reference sediments

likely the main contributors to the observed toxicity. Importantly, the site-specific TTs for most of the homolog groups and total PCBs (as homologs) were demonstrated to accurately (reliably) classify sediment samples as toxic or not toxic to benthic invertebrates.

Although the results of the pore water analysis were not discussed as a separate LOE in the BERA, the correct classification rates for both the TT_{LR} and the TT_{HR} were generally similar for most homolog groups and total PCBs (as homologs) for the reliable TTs for whole sediment and for pore water (Table AD22-1). The TT concentrations for pore water are much lower than the TTs for whole sediment. Despite this, the sediment and pore water toxicity analyses done by Ingersoll et al. (2014) are complementary. The TT_{LR} and the TT_{HR} derived for the two matrices generally classify a similar percentage of samples as “toxic” or “not toxic” and result in similar risk conclusions.

Issue 23: The P/S comments on the Addendum outline did not include a number 23.

SECTION C TRV SELECTION

Issue 24: *The critical tissue concentrations (CTCs) recommended by EPA were not utilized in the BERA.*

Resolution: The Addendum will include a discussion of available benthic CTCs and present the range of measured values.

One LOE for evaluating risk to the benthic invertebrate community is comparison of tissue residues in benthic invertebrates collected on-site with tissue concentrations reported in published studies that were associated with adverse effects on survival, growth or reproduction. This LOE integrates multiple exposure pathways for invertebrates, including direct contact with sediment and water, ingestion of sediment and water, and ingestion of prey.

There are no available compendia of aquatic biota tissue CTCs for use in BERAs. There are often few studies in the toxicological literature for particular COPCs, and numbers of studies are further reduced when the search is limited to those reporting whole-body concentrations. Some studies report tissue concentrations but do not specify whether the reported concentration is on a dry- or wet-weight basis. Toxicity thresholds may be available for a limited number of species, however species-specific biology and physiology or life history characteristics may affect exposure to or uptake of a COPC; a CTC reported for an epibenthic species may not be representative of a CTC for an infaunal species. Some studies were not designed to identify a CTC, but report both tissue residues and a measured adverse effect, which allows calculation of a CTC from the data presented in the paper. Studies conducted in the field may evaluate effects on benthic invertebrates exposed to a mixture of COPCs. All of these issues contribute to and result in high uncertainty associated with tissue residue evaluations and conclusions. Additionally, the primary objective of the tissue sample collection efforts conducted for the OU-4 BERA was to use measured or modeled prey concentrations in site-specific dietary exposure models to evaluate risk to upper trophic level receptors that utilize OU-4 of the Anniston Site as a foraging area, to reduce the uncertainty associated with estimating prey concentrations using literature-based BAFs. Due to the uncertainty associated with the tissue evaluation, this LOE is considered a secondary LOE for this BERA.

The CTC TRVs from all of the studies proposed on slide 15 of the May 16, 2017 presentation for deriving a CTC are summarized in Table AD24-1. Sections 3.4 and 4.4 of Appendix D of the OU-4 BERA describe the rationale for selecting the studies used to derive the P/S-proposed lowest observed effect concentration (LOEC) and NOEC TRVs. The LOEC and NOEC for PCBs in benthic invertebrate tissue range from 5 to 1488 and 0.2 to 290 mg/kg dw, respectively. The LOEC and NOEC concentrations for Hg in benthic invertebrate tissue range from 18 to 90 and 12.7 to 56 mg/kg dw, respectively.

EPA recommended that CTC values from Van Geest et al. (2011) be used to evaluate toxicity of PCBs to all benthic invertebrates, and that CTC values from Mendez-Fernandez et al. (2015) be used to evaluate toxicity of Hg to all benthic invertebrates, rather than selecting receptor-group specific CTC values.

Van Geest et al. (2011) conducted a bioaccumulation study with three test species, and observed reduced survival (64% vs. greater than 80% in most tested sediments) of *Hexagenia* spp. (mayfly nymph) in a field-collected sediment containing 4.8 mg/kg PCBs; tissue accumulation was 1.4 mg/kg wet weight. Prior to the bioaccumulation study, sediments were screened for acute toxicity for 4 to 12 days; adequate survival was expected in all tested sediments. Greater than 80% survival was observed in a sediment with 1.3 mg/kg PCBs, while almost 100% mortality was observed in a sediment with 6.4 mg/kg PCBs. The sediments where reduced survival was observed contained elevated concentrations of other contaminants (PAHs, dioxins). The PAH concentrations in the 4.8 and 6.4 mg/kg PCB sediments were 9.4 and 5.5 mg/kg, respectively. The threshold effect concentration (TEC) for PAHs is 1.61 mg/kg, and the probable effect concentration (PEC) is 22.8 mg/kg. Although the PAH concentrations exceeded the TEC, both were well below the PEC. The polychlorinated dibenzodioxin/furan (PCDD/F) concentration in the sediment with 64% survival was 0.95 mg/kg, while greater than 80% survival was observed in a sediment with a PCDD/F concentration of 2.5 mg/kg. PCDD/Fs were not present in the 6.4 mg/kg PCB sediment. The TEC for PCBs is 0.0598 mg/kg, and the PEC is 0.676 mg/kg. The PCB concentration in both sediments where reduced survival was observed is well above the PEC for PCBs. The study authors noted that nymphs had difficulty burrowing into the sediment where 64% reduced survival was observed because of its coarse physical structure, however this behavior was not observed during the screening tests. Although co-contaminants were present, and grain size issues and effects on burrowing were observed, the results from the Van Geest et al. 2011 study have fewer shortcomings than the studies proposed by P/S to derive CTCs for PCBs (Slide 15, May 16, 2017 presentation). None of the congeners tested by Fisher et al. (1999) are dioxin-like congeners, and congener 47 (from which the LOEC value is derived) only comprises 0.14% by weight of Aroclor 1254, the primary Aroclor present at the Anniston site. Poor control survival was observed in both the Borgmann et al. (1990) (15% and 33%) and Nebeker and Puglisi (1974) (48%) studies.

Mendez-Fernandez et al. (2014) conducted toxicity tests on field-collected sediments to determine whether residue levels of arsenic (As), Hg, zinc (Zn) and Pb could be used to predict chronic toxicity and estimate effective tissue residues. Many of the tested sediments were from copper or Hg-mine impacted areas, but four of the tested non-reference sediments were collected from areas not impacted by mines, including sediments N19 (toxic) and N20 (non-toxic). The only metal in both sediments N19 and N20 that exceeded the TEC value (0.99 mg/kg) was cadmium (Cd) for both samples (1.7 and 1.1 mg/kg, respectively), and the Cd concentration in both was well below the PEC (4.98 mg/kg). Measured oligochaete tissue concentrations of all metals except Hg were within the range measured in the four reference sediments, all of which were non-toxic. All of the tissue concentrations for other metals except Zn in samples N19 and N20 are below

the threshold body burdens cited in Bervoets et al. (2016). The Hg concentration in N19 can be considered a LOEC (89.6 nanomols per gram [nmol/g] dw; 17.97 mg/kg dw), and in N20 can be considered a NOEC (63.5 nmol/g dw; 12.7 mg/kg dw). Both the Van Geest et al. (2011) (LOEC of 5 and NOEC of 2 mg/kg dw) and the Mendez-Fernandez et al. (2014) (LOEC of 18 and NOEC of 12.7 mg/kg dw) studies provide acceptable CTC values for evaluating risk to benthic invertebrates.

HQs were calculated using both the P/S proposed benthic invertebrate CTCs and the EPA recommended CTCs (Table AD24-2). Using the EPA recommended CTCs, calculated LOEC HQs exceed 1.0 for molluscs in all three AAs, and the calculated LOEC HQ for emergent insects in the UAA exceeds 1.0. None of the LOEC HQs calculated using the TRVs proposed by P/S exceed 1.0. The P/S-proposed receptor-specific TRVs fail to evaluate potential risk from PCBs in the benthic invertebrate group in which the highest tissue residues were measured (molluscs), and underestimate risk to benthic invertebrates in the UAA.

However, due to the uncertainty associated with the benthic invertebrate CTC values, this LOE will be treated as secondary LOE. The primary objective for collection of benthic invertebrate tissue for the OU-4 BERA was to have site-specific tissue data to utilize in the dietary exposure models for upper trophic level receptors.

Issue 25, Comment 54: *If basis (dry or wet weight [ww]) is not specified in a paper, the conservative assumption that the cited value is dry weight must be used.*

Resolution: The slide in the May 16 presentation with the dry weight/wet weight information (Slide 15) will be reviewed to confirm that the basis conclusions in comments 7a to 7f and 8a to 8f of Appendix A (from the comments sent to P/S on May 12 2017) are consistent with the slide. Basis issues will be clearly noted in the Addendum.

The studies cited on Slide 15 were carefully reviewed to determine the basis of the cited tissue concentrations. No information was found in the Duke et al. (1970) or the Nebeker and Puglisi (1974) stating whether the tissue concentrations in the paper were presented on a dry or wet weight basis. The CTCs derived from these studies were assumed to be dry weight.

Issue 26, Emergent Insect BAFs, Comment 105: *Hymenoptera are not aquatic insects, but were included in the emergent insect samples.*

Resolution: The WOE tables for potential risks to birds and mammals (Tables AD8-2 and AD8-3, respectively) have been revised to reflect lower conservatism and moderate confidence in the risk prediction for receptors that consume aquatic insects. Specifically, the weight of evidence for avian aerial insectivores (tree swallows) and mammalian aerial invertivores (brown bats) was revised.

Issue 27: CTCs for PCBs in fish tissue: *The CTC from the Foekema et al. 2014 was not used as the CTC for PCBs in fish tissue.*

Resolution: The CTC from the Foekema et al. 2014 does not need to be included in the BERA.

The derivation of fish tissue-based CTCs for PCBs is described in Section 3.3 of Appendix D. The critical study used to derive fish CTCs in the BERA was a study by Hansen et al. (1973) that evaluated reproductive effects in sheepshead minnows (*Cyprinus variegates*) exposed to Aroclor 1254 at six concentrations (0, 0.09, 0.14, 0.39, 1.1 or 5.6 micrograms per liter [$\mu\text{g/L}$]). NOEC and LOEC tissue concentrations of 1.9 and 9.3 mg/kg ww (7 and 34.4 mg/kg dw, respectively) based on fry survival were reported. At the LOEC concentration, a 26% decrease in fry survival was observed.

The EPA team compiled studies that reported CTCs for PCBs in non-salmonid fish. Additional data was extracted from the Environmental Residue Effects Database (ERED). Studies that reported greater than 80% mortality or an increase in growth or fecundity were not included in the summary table. Nine studies reported LOECs for whole body fish PCB concentrations, and reported values ranged from 0.14 to 65 mg/kg ww. The median CTC value was 7.5 mg/kg ww. The reported PCB CTCs for whole body fish are much less variable than the CTCs reported for benthic invertebrates (Table AD27-1).

EPA recommended using the CTCs derived from the Foekema et al. (2014) study, which evaluated the effects of a mixture of 25 PCBs similar to Aroclor 1254 in the common sole (*Solea solea*). The study reported effects concentrations in terms of lipid weight which can be converted to whole body concentrations using the lipids measured in sole in Foekema et al. (2012) (2%). Disrupted or delayed development of larvae between 6 and 40 days post-fertilization was observed at a tissue-residue of 6.82 mg/kg ww (27.3 mg/kg dw). Lethality to 50% of larvae, within 6 days post-fertilization, occurred at a tissue-residue of 7.48 mg/kg ww. Tissue-based HQs were recalculated using the LOEC from the Foekema et al. (2014) study (Table AD27-2). Use of the CTC from Foekema et al. (2014) study instead of the CTCs from Hansen et al. (1973) only changed the risk conclusion for forage fish in the LAA.

Issue 28: CTCs for dioxin in fish tissue: *The EPA-recommended CTC for dioxin in fish tissue was not included.*

Resolution: A discussion will be added to the Addendum that the selected CTC from the Steevens paper is within the range of CTCs cited in Tillett et al. 2017.

The derivation of fish tissue-based CTCs for dioxin-like compounds (DLCs) is described in Section 3.3 of Appendix F. Steevens et al. (2005) developed a residue effects distribution for fish eggs and embryos, the life stage that is most sensitive to toxicity mediated by the aryl hydrocarbon receptor (AHR). Residues reported on a whole egg or embryo basis were combined into a species sensitivity distribution (SSD) based on the geometric means of NOEC and LOEC values; endpoints included significant reductions in survival, growth, or reproduction. Because of the lipophilicity of DLCs, effect residues in fish eggs can be related to maternal tissue concentrations after lipid normalization. For nonpolar organic compounds, the ratio of a lipid-normalized chemical concentration in eggs to the concentration in adult fish was found to be approximately 1:1 egg to adult fish (Russell et al. 1999 as cited in P/S 2016).

Studies on lake trout (*Salvelinus namaycush*), brook trout (*Salvelinus fontinalis*), rainbow trout (*Oncorhynchus mykiss*), channel catfish (*Ictalurus punctatus*), lake herring (*Coregonus artedii*), fathead minnow (*Pimephales promelas*), Japanese medaka (*Oryzias latipes*), northern pike (*Esox Lucius*), white

sucker (*Catostomus commersonii*), and zebrafish (*Danio rerio*) were included in the SSD. Most of the studies included in the SSD were conducted using 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD). Mean, lower and upper 95%UCL benchmarks were selected at different species protection levels (i.e., protective of 99, 97.5, 95, or 90% of fish species). The DLC CTC selected for use in the OU-4 BERA was the 95% UCL effect residue protective of 90% of species, 2.2 nanograms (ng) TCDD/gram (g) lipid. To convert the lipid-based CTC to units of mg/kg dw, the mean and maximum lipid fraction of fish captured in OU-4 were used to calculate two CTC values for TCDD, 255 ng/kg and 572 ng/kg dw, respectively.

EPA recommended using the mean value (0.699 ng/g lipid) protective of 90% of species rather than the 95%UCL of the mean for the same protection level. This would result in CTCs for TCDD of 0.081 and 0.182 mg/kg dw for the mean and maximum lipid fraction fish, respectively.

A recent paper, published after the Anniston BERA was conducted, cites a median lethal dose (LD₅₀) for TCDD in lake sturgeon eggs of 0.61 ng/g ww (1.22 ng/g dw, assuming 50% solids for fish eggs [May et al. 2009]) (Tillett et al. 2017). Figure 5 of Tillett et al. (2017) presents a range of LD₅₀ values (0.04 to 13 ng/g ww) for TCDD in eggs of 16 fish species, including 3 salmonid species. The CTC value from the Tillett et al. (2017) study is higher than either of the CTCs from the Steevens et al. (2005) paper. Although the Steevens et al. (2005) does not report the endpoints measured in the studies used to develop the SSD, acceptable endpoints for inclusion in the SSD were significant reductions in growth, reproduction or survival. The Tillett et al. (2017) study summarized studies reporting an LD₅₀; the CTC value based on an LD₅₀ would be expected to be higher than a CTC based on a significant decrease in growth or reproduction.

HQs were calculated for TCDD and tetrachlorodibenzofuran (TCDF), the primary DLCs detected in fish tissue, using the P/S, EPA, and Tillett et al. (2017) CTC values (Table AD28-1). Seventeen fish were submitted for analysis of DLCs. The CTCs proposed for use by P/S resulted in estimated unacceptable risk for 6 and 24% (TCDD and TCDF, respectively) of fish submitted, using the mean lipid CTC, and for 0 and 6% using the maximum CTC. The CTCs recommended by EPA resulted in unacceptable risk for 6 and 47% of fish submitted (TCDD and TCDF, respectively), using the mean lipid CTC, and for 6 and 29% using the maximum CTC. The CTC values selected by P/S underestimated potential risk to fish from measured concentrations of DLCs in fish tissue. Tissue concentrations of TCDF were generally higher than tissue TCDD concentrations. Only fish collected from the MAA and LAA had tissue concentrations of TCDD or TCDF that exceeded the EPA-recommended CTC.

Issue 29, Comment 42: *Dioxin concentrations in bird eggs were not estimated using the Office of Environmental Health Hazard (OEHHA) (2015) method and transfer coefficient.*

Resolution: Comment 42 on the revised Anniston OU4 BERA requested that dioxin/furan concentrations in bird eggs be estimated using the OEHHA (2015) method, consistent with analyses performed and presented for total PCBs. The Baseline Problem Formulation (BPF) noted that this LOE may be evaluated. However, EPA has reviewed the OEHHA (2015) method used to estimate total PCBs in bird eggs in the BERA and determined that this additional analysis would not improve the risk estimation at the site and therefore is not necessary. This determination is based on a number of reasons:

- 1) OEHHA (2015) method is highly generalized and therefore estimates it produces have substantial uncertainty.
- 2) Data on sediment dioxin/furan concentrations are very limited (5, 3, and 2 samples collected in the Upper, Middle, and Lower AAs, respectively). Risk estimates based on these limited data would be highly uncertain.
- 3) The EPA-approved OU4 BPF (BBL 2006), identified daily dietary doses of COPCs as the primary measurement endpoint for evaluation of risks to terrestrial and aquatic birds. COPC concentrations in eggs were identified as a secondary exposure measure that may be used.

Given the high uncertainty associated with the OEHHA (2015) model, the limited sediment data upon which to apply the model, and the secondary nature of the egg concentration endpoint, additional analysis for dioxin/furans in eggs was determined to be unnecessary.

Issue 30, Comment 41: *The equation used to estimate bird egg concentrations should be adjusted by the bird's body weight to make it applicable to ecological risk assessment for smaller bird species.*

Resolution: The OEHHA (2015) model for estimating COPC concentrations in eggs includes food ingestion parameters that are not scaled to body size. Because smaller animals generally consume more food than larger animals (Nagy 2001), this lack of scaling will result in underestimation of modeled egg concentrations. However, because:

- 1) OEHHA (2015) method is highly generalized, and therefore the estimates it produces have substantial uncertainty. This uncertainty is unlikely to be substantially reduced by scaling to body weight.
- 2) Estimated egg concentrations were given a lower weight relative to dietary exposure estimates in the Weight of Evidence (see Section 6.3.6.1 in the OU4 BERA), and
- 3) The EPA-approved OU-4 BPF (BBL 2006), identified daily dietary doses of COPCs as the primary measurement endpoint for evaluation of risks to terrestrial and aquatic birds. COPC concentrations in eggs were identified as a secondary exposure measure that may be used.

Given the high uncertainty associated with the OEHHA (2015) model and the secondary nature of the egg concentration endpoint, inclusion of body weight scaling was determined to be unnecessary. EPA considers the egg analysis performed and presented by P/S to be a reasonable good faith effort to model maternal transfer of COPCs to eggs.

Issue 31, RTC memo Comment 159: *The calculations in Appendix F in general show that the risk posed by the combination of dioxin-like PCBs and dioxin/furans is less than risks estimated for total PCBs. The most sensitive receptor was the Carolina wren. The most toxic congener was PCB 126, however there is no BAF for PCB 126 in BERA Table F-6 (Addendum Table AD31-1).*

Resolution: Appendix F of the Anniston OU-4 BERA concludes that toxic equivalent (TEQ) concentrations are unlikely to pose an unacceptable risk to wildlife because modeled concentrations did not result in exposure estimates that exceeded NOAELs. The most toxic PCB congener, PCB 126, was not included in the BERA TEQ evaluation, because a BAF could not be calculated. To evaluate the uncertainty associated with the exclusion of this congener, dietary exposure for Carolina wren (the most sensitive

receptor) was estimated based on measured concentrations in earthworms collected from OU-4 and exposure parameters used in the OU-4 BERA. The results of this analysis are presented in Table AD31-2.

Analysis for PCB 126 in earthworm tissue was conducted in 5 samples (Appendix E from Anniston OU-4 BERA) and detected in only three. Exposure estimates were calculated using these data (Table AD31-2). For simplicity, soil ingestion was excluded from the analysis, earthworms were assumed to comprise 15% of the diet, and terrestrial spiders were assumed to comprise 31% of the diet (the same fractions used in the Anniston OU-4 BERA; BERA Table 4-1b; Addendum Table AD31-3). As spiders were not collected on-site, the BERA used the measured worm tissue COPC concentrations as representative of concentrations expected in spiders. The estimated exposure therefore only considered PCB-126 from earthworm/spider portion of the diet; all other food types and PCB or dioxin/furan congeners were excluded. Despite the very limited nature of the exposure estimates, NOAEL HQs greater than 1.0 were obtained for all three estimates (Table AD31-2).

These results suggest that modeled dioxin-like PCB and dioxin/furan exposure in the BERA may underestimate total exposure because of the exclusion of some of the more toxic congeners, such as PCB-126. However, it should be noted that PCB 126 was not detected at high frequencies in OU-4 soil (4 of 39, 0 of 35, and 7 of 28 samples from Upper, Middle, and Lower AAs, respectively; BERA Table F-2 (Addendum Table AD31-4), Anniston OU-4 BERA). This low frequency of occurrence of PCB-126 suggests that the underestimation of risk may vary spatially and be highly localized.

SECTION D REVISED WEIGHT OF EVIDENCE TABLES

Issues 32 through 37: Revised Weight of Evidence Tables

As noted in the discussion under Issue 8, the WOE tables presented in the draft BERA (Tables 6-24 to 6-26; incorporated into Addendum Tables AD8-1 to AD8-3) were revised based on the EPA team interpretations of the BERA data described in this BERA Addendum Report (Tables AD8-1 to AD8-3). Both the original WOE evaluation (labelled “Arcadis”) and the EPA team interpretation of the WOE (labelled “EPA Interpretation”) are presented for comparison purposes. In addition, a table was created in the addendum (Table AD8-5) to visually summarize the WOE results for PCBs using each LOE for each assessment endpoint.

WOE tables were also developed for 7 additional secondary contaminants of potential concern (COPCs) (i.e., mercury, dioxin toxic equivalents [TEQs], barium, chromium, cobalt, lead, and vanadium) (Tables AD8-6 to AD8-12). Although unacceptable risks were identified in some areas of OU-4 for some of these COPCs, overall risks in OU4 are dominated by PCBs.

Revised risk conclusions based on the updated WOE interpretation are summarized in the Conclusion Section.

SECTION E CONCLUSIONS

The OU-4 BERA was conducted using a wide range of scientific data and information to develop various LOEs for characterizing risks. To complete the OU-4 BERA, chemical data were collected from abiotic media (surface water, sediment and soil) and a range of biotic tissue; ecological community data were collected; and habitat studies were conducted over the course of 15 years. Site-specific sediment toxicity and bioaccumulation studies were also conducted. These studies and data collection activities provide extensive site-specific data with which to perform a robust risk assessment. The site-specific data, complemented with relevant literature-based information, were incorporated into the OU-4 BERA to support a range of conclusions regarding potential risks to ecological receptors that may reside or forage within OU-4.

Multiple MEs and LOEs were evaluated along with uncertainties associated with each to evaluate each AE identified for the OU-4 BERA. In many cases, identified uncertainties were mitigated by the use of conservative assumptions. Risk conclusions were developed based on comparison of measured COPC concentrations in Site media or estimated dietary exposure concentrations with toxicity benchmarks or TRVs.

EPA received the first draft of the BERA for OU-4 of the Anniston PCB Site in October, 2015, and provided comments on that draft in June of 2016. In early 2017, the U.S. EPA reviewed the revised draft OU-4 BERA. As a result of this review, and a subsequent May 2017 meeting with P/S, EPA concluded that although some comments and concerns were adequately addressed in the revised draft BERA, EPA's interpretation of the data collected for the BERA differed significantly from the P/S interpretation of the data for some issues. EPA therefore decided to develop their own evaluation of the data, WOE evaluation, risk conclusions. These are presented in this BERA Addendum Report. RGOs will be calculated for the all AEs evaluated in the BERA, for which potential risk was identified, for inclusion in the Feasibility Study (FS).

The BERA Addendum addressed a number of issues which fell into four broad categories:

- Global issues that impacted risk interpretation or conclusions (i.e., HQ rounding, HQ/effective concentration [EC_x] interpretation, data quality issues, community survey metrics, threatened or endangered species, etc.);
- Assessment endpoint (AE) specific issues (i.e., use of ADEM water quality standards, interpretation of site-specific sediment bioassays, interpretation of benthic invertebrate community surveys, avian dietary exposure to dioxins, etc.);
- TRV selection (i.e., selection of toxicity threshold values based on the site-specific sediment bioassays, use of CTCs recommended by EPA, etc.); and
- WOE interpretation (i.e., using field survey data to down-weight risks based on chemistry-based LOEs, risk underestimation due to HQ rounding, etc.).

Each specific issue was evaluated in detail and a revised conclusion based upon EPA's interpretation of the data was developed. These revised conclusions were then integrated into an updated WOE evaluation. In some cases, additional analysis resulted in similar conclusions as presented in the BERA. Based on the risk findings, PCBs are the primary risk driver in OU-4.

A summary table based on the updated WOE evaluation was compiled that shows calculated risk by Reach and Assessment Area (AA) (BERA Addendum Table ADES-1). The level of conservatism (higher conservatism was associated with the use of generic exposure and effects information that have a higher potential to overestimate risk) and confidence in the risk conclusions were identified for each WOE conclusion. Increased use of site-specific information in the risk evaluation is assumed to result in more realistic, less conservative, and less uncertain risk estimates. For some of the LOEs, especially field survey data, a potential for underestimation of risk was identified.

The approach EPA used to interpret risk calculation results was similar to the approach used by P/S in the draft BERA, but with two critical differences:

- The risk categories used in the draft BERA were defined as follows: NOAEL HQ ≤ 1.0 , risk is negligible; NOAEL HQ > 1.0 and LOAEL HQ ≤ 1.0 ; low risk. LOAEL HQs > 1.0 and ≤ 10 , indicate moderate risk; and LOAEL HQs > 10 were interpreted to indicate high risk. ERAGS (U.S. EPA 1997) defines a HQ equal to 1 as a pass/fail decision point. Based on guidance, EPA defined the following risk categories in the OU-4 BERA addendum: NOAEL-based HQ < 1.0 , acceptable risk; NOAEL-based HQ ≥ 1.0 and LOAEL-based HQ < 1.0 , indeterminate risk; and LOAEL-based HQ ≥ 1.0 , unacceptable risk.
- In the draft BERA, calculated HQs were rounded to a single digit. When this is done in concert with using the above defined risk categories, the risk conclusion for calculated LOAEL HQs between 1.0 and 1.49 becomes indeterminate (or low, as per the draft BERA), rather than unacceptable. EPA presented calculated HQs to one decimal place (Tables AD1-1 to AD1-15).

The potential risks predicted for ecological receptors exposed to PCBs in OU-4, based on the LOEs with the highest confidence (most site-specific and least uncertain), are summarized below.

Lower Trophic Level Receptors

A total of six lower trophic level receptors were evaluated, including four aquatic receptor groups and two terrestrial receptor groups (Table AD8-1). Risks based on the WOE for plants, fish and terrestrial invertebrates are summarized in Table ADE-1 (below, embedded in text), and risk to benthic invertebrates are summarized in Figures E-1a and b (below). For benthic invertebrates, the LOE with the highest confidence is a comparison of individual sample concentrations to the site-specific reproduction sediment toxicity thresholds.

Table ADE-1. Predicted Risk for Lower Trophic Level Receptors Exposed to PCBs in OU-4 based on the WOE

Receptors	OU-4 Reaches									
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
		UAA			MAA		LAA			
Aquatic Plants	A	A			A		A			
Forage Fish ^a	U	U			U		U			
Bottom Fish ^a	U	U			U		U			

Predator Fish ^a	U	U			U		U			
Terrestrial Plants	U	A			A		A			
Benthic Invertebrates	U	U	U	U	I	A	I	I	A	I
Terrestrial Invertebrates	U ^b	I	I	I	A	A	A	A	A	I

^a Results based on Assessment Area rather than individual reaches

^b C1 West only

A = Acceptable; I = Indeterminate; U= Unacceptable

LAA = Lower Assessment Area; MAA = Middle Assessment Area; UAA = Upper Assessment Area

Na = Not applicable

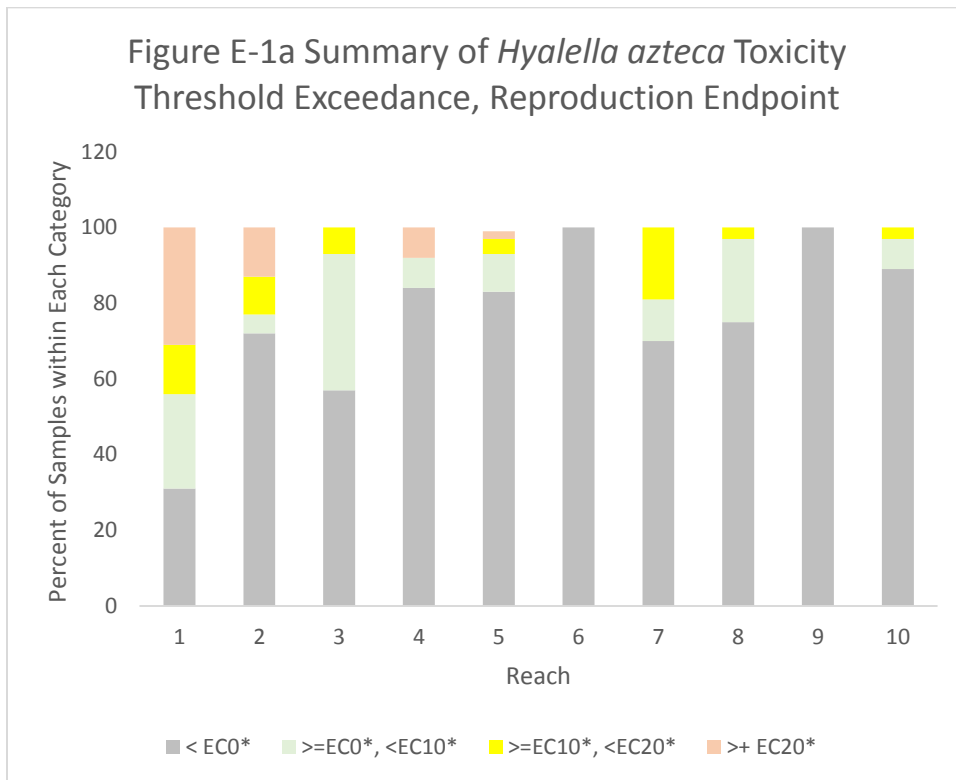
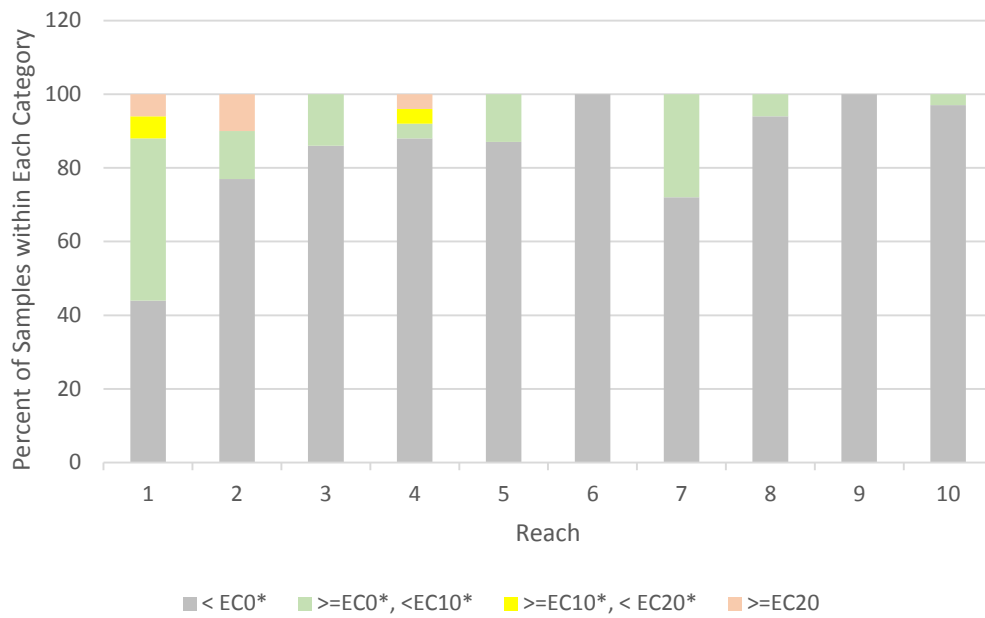


Figure E-1b Summary of *Chironomus dillutus* Toxicity
Threshold Exceedance, Reproduction Endpoint



Birds

Potential risks to nine surrogate receptor bird species were evaluated as part of the OU-4 BERA—five aquatic foraging birds (including piscivores, aquatic insectivores/invertivores, and aerial insectivores), and four terrestrial foraging birds (including herbivores, terrestrial insectivores/invertivores, omnivores, and carnivores). In addition, two scenarios for mixed aquatic and terrestrial diets were evaluated. Predicted risks based on the WOE (Table AD8-2) are summarized in Table ADE-2 (below, embedded in text).

Table ADE-2. Predicted Risk for Birds Exposed to PCBs in OU-4 Based on the WOE

Receptors	OU-4 Reaches									
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
Aquatic Birds										
Piscivores (heron, kingfisher, osprey)	HU	HU	U	U	U	U	U	U	U	U
Insectivores/ invertivores (spotted sandpiper)	HU	HU	U	U	U	U	U	U	U	U
Aerial Invertivores (tree swallow)	HU	HU	U	U	A	A	A	A	A	A
Terrestrial Birds										
Herbivores (mourning dove)	HU	I	U	A	A	A	A	A	A	A
Terrestrial insectivores/ invertivores (Carolina wren)	HU	U	HU	U	I	I	I	I	I	—
Omnivores (Blue jay)	HU	I	U	U	I	I	I	I	I	—
Carnivores (red-tailed hawk)	HU	U	U	U	I	I	I	I	I	—
Birds with mixed Aquatic and Terrestrial Diets										
Mixed diet omnivores (spotted sandpiper, Carolina wren)	HU	U	U	U	I	I	I	I	I	—

A = Acceptable (NOAEL HQ < 1.0); I = Indeterminate (NOAEL HQ ≥ 1.0, LOAEL HQ < 1.0); U= Unacceptable (LOAEL HQ ≥ 1.0, < 10.0); HU = High Unacceptable, LOAEL HQ ≥ 10.0)

LAA = Lower Assessment Area; MAA = Middle Assessment Area; UAA = Upper Assessment Area

Mammals

Potential risks to eight surrogate receptor mammal species were assessed by evaluating three aquatic foraging species (piscivores and aerial insectivores) and five terrestrial foraging mammals (including herbivores, terrestrial insectivores/invertivores, and carnivores). In addition, two scenarios for mixed aquatic and terrestrial diets were evaluated. Predicted risks based on the WOE (Table AD8-3) are summarized in Table ADE-3 (below, embedded in text).

As with birds, the LOE with the highest confidence for all mammals except carnivores is the dietary HQ based on measured prey tissue EPCs. For carnivores, the dietary HQ based on modeled prey tissue had slightly higher confidence.

Table ADE-3. Predicted Risk for Mammals Exposed to PCBs in OU-4 Based on the WOE

Receptors	OU-4 Reaches									
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10 ^a
Aquatic Mammals										
Piscivores (otter, mink)	HU	HU	HU	HU	HU	HU	HU	HU	HU	HU
Aerial Invertivores (bat)	U	U	U	U	A	A	A	A	A	A
Terrestrial Mammals										
Herbivores (deer)	A	A	A	A	A	A	A	A	A	—
Insectivores/ invertivores (Shrew)	U	U	U	U	I	I	I	I	I	—
Carnivores (weasel, red fox)	U	A	I	I	A	A	A	A	A	—
Mammals with mixed Aquatic and Terrestrial Diets										
Mixed diet omnivores (raccoon)	I	I	I	I	I	I	I	I	I	I
Mixed diet omnivores (mink)	HU	HU	HU	HU	HU	HU	HU	HU	HU	HU

^a Floodplain soil/riparian soil was not evaluated in Reach C10, therefore HQs were not calculated for terrestrial receptors.

A = Acceptable (NOAEL HQ < 1.0); I = Indeterminate (NOAEL HQ ≥ 1.0, LOAEL HQ < 1.0); U = Unacceptable (LOAEL HQ ≥ 1.0, < 10.0); HU = High Unacceptable, LOAEL HQ ≥ 10.0)

Amphibians and Reptiles

Toxicity data for evaluation of effects of PCB exposure on reptiles and amphibians are limited, therefore HQs were not calculated for these receptors. Section 6.2.3.8 of the BERA states that toxicity benchmarks protective of other receptors are protective of amphibians and reptiles. Comparison of site-wide sediment and surface water EPC concentrations of PCBs measured in OU-4 media to the limited toxicity data for herptiles available indicate that on-Site PCB concentrations are similar to or below the low effect concentrations (Section 6.2.3.8 of the BERA; Table ADE-4, embedded below). The only tissue TRVs available on the environmental residue effect database (ERED) for reptiles are for a non-ecologically relevant endpoint (metabolic rate). Concentrations of PCBs measured in frogs collected in the UAA are similar to tissue concentrations measured in forage fish, and concentrations of PCBs measured in reptiles are similar to tissue concentrations measured in predator fish site-wide; some fish tissue concentrations do exceed tissue TRVs (Table AD1-15). The risk evaluation for these receptors is highly uncertain, and no conclusions can be made regarding risk to amphibians and reptiles exposed to PCBs in OU-4.

Table ADE-4. TRVs for Amphibians and Reptiles and OU-4 EPCs

Medium	TRV (LOEC)	EPC
Sediment	325 mg/kg	16 mg/kg, Reach C1 ^a
Surface Water	0.5 µg/L	0.5 µg/L, Reach C1; 0.16 µg/L, Site-wide ^b
Fish Tissue	34 mg/kg ww	38 mg/kg, frogs collected in the UAA ^c
Fish Tissue	34 mg/kg ww	167 mg/kg, snakes collected in the UAA ^c

^a Table AD5-1

^b BERA Table 4-14; Table ADE-5

^c Table AD1-15

Summary

Based on the assessment completed for a wide range of COPCs and receptors, PCBs are the primary risk driver in OU-4. Risk findings are based on site-specific data, supplemented by literature-based inputs when necessary. The highest concentrations of PCBs in sediment and several biotic tissue types are present in Reaches C1 and C2, and there is an upstream to downstream decreasing trend in most cases with fish tissue concentrations being a notable exception. EPA made the following risk conclusions for total PCBs based on the WOE (Table ADES-1):

- Risk to aquatic plants throughout OU-4 is considered acceptable, however the LOEs used to evaluate this endpoint produced divergent results and are highly uncertain.
- Risk to terrestrial plants is acceptable in all AAs and Exposure Units (EUs) except C1 West, where risk to terrestrial plants is unacceptable.
- Risk to benthic invertebrates is unacceptable in Reaches C1 through C4, indeterminate in Reaches C5, C7, C8 and C10, and acceptable in Reaches C6 and C9. The lines of evidence with moderate to high confidence in the risk predictions (comparison of individual sediment samples with site-specific growth or reproduction-based toxicity thresholds and evaluation of the toxicity testing results from the surface samples) were given the highest weight in the WOE evaluation.
- Risk to terrestrial invertebrates is unacceptable in EU C1 West; indeterminate in Reaches C2, C3, C4 and C10; and acceptable in Reaches C5 through C9. Most LOEs used to evaluate this AE had moderate to high conservatism and low confidence in the risk predictions.
- Risk to fish is unacceptable throughout OU-4, with predicted risk to predator and bottom fish higher than for forage fish.
- For all bird receptors, risk is highly unacceptable in Reach C1. For piscivorous and aquatic insectivorous birds, risk is highly unacceptable in Reach C2, and unacceptable throughout OU-4. For terrestrial avian receptors (aerial insectivores, insectivores, carnivores) risk is generally

unacceptable in Reaches C1 through C4, and indeterminate or acceptable in Reaches C5 through C10. For omnivorous birds with mixed terrestrial and aquatic diets, risk is unacceptable in Reaches C1 through C4 and indeterminate in Reaches C5 through C9.

- Risk to piscivorous mammals is highly unacceptable throughout OU-4. Risk to aerial insectivores and terrestrial insectivores and invertivores is unacceptable in Reaches C1 through C4, and indeterminate or acceptable in Reaches C5 through C10. Risk to herbivorous mammals is acceptable throughout OU-4. There is unacceptable calculated risk to carnivorous mammals feeding in Reach C1, indeterminate risk in Reaches C3 and C4, and acceptable risk in Reaches C2 and C5 through C9. For omnivorous mammals with mixed terrestrial and aquatic diets, risk is indeterminate throughout OU-4 when the raccoon is the surrogate receptor species, and highly unacceptable when the mink is used as the surrogate receptor species.

Risks were also evaluated for 7 additional secondary contaminants of potential concern (COPCs) (i.e., mercury, dioxin toxic equivalents [TEQs], barium, chromium, cobalt, lead, and vanadium), and are reported for completeness. Although unacceptable risks were identified in some areas of OU-4 for some of these COPCs, overall risks in OU4 are dominated by PCBs.

For most issues, the inclusion of conservative assumptions in the risk analysis was lower and the overall uncertainty was generally greater in the revised draft BERA for OU-4 (Arcadis 2016) as compared to the EPA analysis. As a consequence, EPA concludes the risks from PCBs and other COPCs to ecological receptors to be somewhat greater than estimated in the revised draft BERA for OU-4.

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Table ADES-1. Weight of Evidence Evaluation Summary for PCBs
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

[illegible]

Table AD1-1. Summary of Aquatic Receptors NOAEL Hazard Quotients by Exposure Unit (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1	C2	C3	C4	Upper AA	C5	C6 ¹	Middle AA	C7	C8 ¹	C9	C10	Lower AA
Exposure Subarea→		Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
Receptors↓														
Aquatic Birds		NOAEL HQs												
Tree Swallow	tPCB-mid	165.8	103.2	11.4	25.1	42.4	0.2	0.0	0.2	0.3	0.3	0.1	0.2	0.3
	tPCB-high	1785.6	1111.8	122.4	270.4	457.0	2.4	0.5	2.2	2.8	3.2	0.8	2.3	3.5
	Barium	0.1	0.1	0.1	0.0	0.1	0.2	0.2	0.2	0.0	0.0	0.1	0.1	0.1
	Chromium	4.6	1.6	2.1	1.8	1.7	5.4	5.4	5.4	1.3	1.3	2.3	2.8	2.4
	Cobalt	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
	Lead	0.3	0.2	0.0	0.0	0.1	0.2	0.2	0.2	0.0	0.0	0.1	0.1	0.1
	Mercury	2.0	95.7	3.4	3.4	15.6	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.5
	Vanadium	3.0	0.8	1.0	0.4	0.7	2.4	2.4	2.4	0.4	0.4	0.9	1.2	1.1
Spotted Sandpiper - 2	tPCB-mid	64.7	47.5	11.5	19.1	26.7	9.6	3.5	9.1	10.0	10.9	4.5	8.8	11.5
	tPCB-high	696.5	511.6	123.9	205.6	288.0	103.5	37.7	98.0	108.1	117.3	48.7	95.3	123.7
	Barium	2.1	1.6	0.8	0.4	1.0	2.3	2.3	2.3	0.3	0.3	0.8	1.0	0.9
	Chromium	1.6	0.6	0.7	0.6	0.6	2.0	2.0	2.0	0.5	0.5	0.8	1.0	0.9
	Cobalt	0.7	0.3	0.4	0.1	0.3	1.1	1.1	1.1	0.1	0.1	0.3	0.3	0.3
	Lead	11.7	5.4	1.5	1.4	3.2	7.6	7.6	7.6	1.0	1.0	2.6	2.8	2.4
	Mercury	4.1	149.8	6.4	6.4	25.9	5.5	5.5	5.7	5.5	5.5	5.6	5.6	7.0
	Vanadium	16.9	4.4	5.5	2.4	4.1	13.8	13.8	13.8	2.4	2.4	5.2	7.1	6.0

Table AD1-1. Summary of Aquatic Receptors NOAEL Hazard Quotients by Exposure Unit (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1	C2	C3	C4	Upper AA	C5	C6 ¹	Middle AA	C7	C8 ¹	C9	C10	Lower AA
Exposure Subarea→		Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
Receptors↓														
Kingfisher - 1	tPCB-mid	89.9	56.0	6.2	13.6	23.0	6.1	1.2	5.6	5.9	6.7	1.7	4.8	7.2
	tPCB-high	968.5	603.0	66.4	146.7	247.9	66.2	13.5	60.7	63.1	71.7	17.8	51.7	78.0
	Barium	1.6	1.2	0.6	0.3	0.7	1.8	1.8	1.8	0.2	0.2	0.6	0.8	0.7
	Chromium	1.7	0.6	0.8	0.7	0.6	2.0	2.0	2.0	0.5	0.5	0.8	1.0	0.9
	Cobalt	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
	Lead	0.4	0.2	0.1	0.1	0.1	0.3	0.3	0.3	0.0	0.0	0.1	0.1	0.1
	Mercury	0.6	30.5	1.1	1.1	5.0	2.6	2.6	2.7	2.7	2.7	2.7	2.7	3.6
	Vanadium	4.4	1.1	1.4	0.6	1.1	3.6	3.6	3.6	0.6	0.6	1.3	1.8	1.6
Kingfisher - 2	tPCB-mid	72.7	45.3	5.0	11.0	18.6	4.8	1.0	4.4	4.5	5.1	1.3	3.7	5.6
	tPCB-high	782.7	487.3	53.7	118.5	200.3	51.5	10.5	47.2	48.7	55.3	13.8	39.9	60.2
	Barium	3.1	2.4	1.2	0.7	1.5	3.6	3.6	3.6	0.4	0.4	1.3	1.6	1.3
	Chromium	1.5	0.5	0.7	0.6	0.5	1.7	1.7	1.7	0.4	0.4	0.7	0.9	0.8
	Cobalt	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
	Lead	0.9	0.4	0.1	0.1	0.2	0.6	0.6	0.6	0.1	0.1	0.2	0.2	0.2
	Mercury	0.9	25.5	1.3	1.3	4.7	2.5	2.5	2.5	2.5	2.5	2.5	2.5	3.2
	Vanadium	4.5	1.2	1.5	0.6	1.1	3.7	3.7	3.7	0.6	0.6	1.4	1.9	1.6
Great Blue Heron ²	tPCB-mid	128.4	80.0	8.8	19.5	32.9	7.0	1.4	6.4	7.2	8.2	2.0	5.9	8.9
	tPCB-high	1383.0	861.5	95.3	209.7	354.2	75.4	15.5	69.2	77.4	87.9	22.0	63.4	95.6
	Barium	0.8	0.6	0.3	0.2	0.4	0.9	0.9	0.9	0.1	0.1	0.3	0.4	0.3
	Chromium	0.7	0.2	0.3	0.3	0.3	0.8	0.8	0.8	0.2	0.2	0.4	0.4	0.4
	Cobalt	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
	Lead ⁷	0.7	0.3	0.1	0.1	0.2	0.5	0.5	0.5	0.1	0.1	0.2	0.2	0.2
	Mercury	1.4	57.7	2.2	2.2	9.7	3.1	3.1	3.2	3.6	3.7	3.6	3.7	4.7
	Vanadium	2.1	0.6	0.7	0.3	0.5	1.7	1.7	1.7	0.3	0.3	0.7	0.9	0.8
Osprey	tPCB-mid	53.8	33.5	3.7	8.1	13.8	3.0	0.6	2.7	3.0	3.5	0.9	2.5	3.8
	tPCB-high	579.5	360.8	39.7	87.8	148.3	31.9	6.5	29.3	32.8	37.3	9.3	26.9	40.6
	Barium	0.2	0.2	0.1	0.0	0.1	0.3	0.3	0.3	0.0	0.0	0.1	0.1	0.1
	Chromium	0.2	0.1	0.1	0.1	0.1	0.3	0.3	0.3	0.1	0.1	0.1	0.1	0.1
	Cobalt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
	Mercury	0.5	22.4	0.8	0.8	3.7	1.2	1.2	1.2	1.4	1.4	1.4	1.4	1.8
	Vanadium	0.5	0.1	0.2	0.1	0.1	0.4	0.4	0.4	0.1	0.1	0.2	0.2	0.2

Table AD1-1. Summary of Aquatic Receptors NOAEL Hazard Quotients by Exposure Unit (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1	C2	C3	C4	Upper AA	C5	C6 ¹	Middle AA	C7	C8 ¹	C9	C10	Lower AA
Exposure Subarea→		Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
Receptors↓														
Aquatic Mammals		NOAEL HQs												
Bat	tPCB	248.3	154.6	17.0	37.6	63.6	0.3	0.1	0.3	0.4	0.4	0.1	0.3	0.5
	Barium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Chromium	3.7	1.3	1.7	1.5	1.4	4.4	4.4	4.4	1.1	1.1	1.9	2.3	2.0
	Cobalt	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
	Lead	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
	Mercury	0.5	21.3	0.7	0.7	3.5	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3
	Vanadium	0.2	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.1
Mink - 2 ²	tPCB-mink	232.2	145.1	16.6	35.5	59.7	15.8	3.4	14.5	15.0	17.0	4.4	12.3	18.5
	Barium	0.2	0.2	0.1	0.1	0.1	0.3	0.3	0.3	0.0	0.0	0.1	0.1	0.1
	Chromium	0.5	0.2	0.2	0.2	0.2	0.6	0.6	0.6	0.2	0.2	0.3	0.3	0.3
	Cobalt	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Lead ⁷	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mercury	0.1	2.3	0.1	0.1	0.4	0.2	0.2	0.2	0.2	0.3	0.2	0.3	0.3
	Vanadium	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Otter	tPCB-mink	372.2	231.8	25.5	56.4	95.3	16.3	3.3	14.9	18.9	21.5	5.3	15.5	23.4
	Barium	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
	Chromium	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
	Cobalt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mercury	0.1	6.0	0.2	0.2	1.0	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.4
	Vanadium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Notes:

NOAEL HQ* ≤ 1
NOAEL HQ* > 1 and ≤ 10
NOAEL HQ* > 10

* All HQs rounded to the nearest whole number

¹ Sediment data unavailable for this reach for non-mercury metals. Non-mercury metal EPCs from the upstream reach were conservatively used to estimate exposure.

² Great blue heron and Mink-2 are exposed to sediment and riparian soil.

AA: assessment area

HQ: hazard quotient

mg/kg-day: milligrams per kilogram per day

NOAEL: no observed adverse effect level

PCB: polychlorinated biphenyl

tPCB: total polychlorinated biphenyl

--: not available

Exposure Units:

C1: Oxford Lake Park

C2: Backwater Area

C3: Friendship Road to Highway 21

C4: Hwy 21 to Silver Run Road

C5: Silver Run Road to Mitchell Matson Road

C6: Mitchell Matson Road to 2,000 feet upstream of Curry Station Road

C7: Upstream of Curry Station Road to Eastaboga Creek

C8: Eastaboga Creek to Jackson Shoals Dam

C9: Jackson Shoals Dam to Highway 77

C10: Highway 77 Bridge to Lake Logan Martin

Sediment: Instream Sediment

Table AD1-2. Summary of Aquatic Receptors LOAEL Hazard Quotients by Exposure Unit (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1	C2	C3	C4	Upper AA	C5	C6 ²	Middle AA	C7	C8 ²	C9	C10	Lower AA
Exposure Subarea→		Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
Receptors ⁵ ↓														
Aquatic Birds		LOAEL HQs												
Tree Swallow	tPCB-mid	55.3	34.4	3.8	8.4	14.1	0.1	0.0	0.1	0.1	0.1	0.0	0.1	0.1
	tPCB-high	595.2	370.6	40.8	90.1	152.3	0.8	0.2	0.7	0.9	1.1	0.3	0.8	1.2
	Barium	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
	Chromium	4.3	1.5	2.0	1.7	1.6	5.1	5.1	5.1	1.3	1.3	2.2	2.6	2.3
	Cobalt	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
	Lead	0.2	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
	Mercury	0.7	31.9	1.1	1.1	5.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5
	Vanadium	1.5	0.4	0.5	0.2	0.4	1.2	1.2	1.2	0.2	0.2	0.4	0.6	0.5
Spotted Sandpiper - 2	tPCB-mid	21.6	15.8	3.8	6.4	8.9	3.2	1.2	3.0	3.3	3.6	1.5	2.9	3.8
	tPCB-high	232.2	170.5	41.3	68.5	96.0	34.5	12.6	32.7	36.0	39.1	16.2	31.8	41.2
	Barium	1.0	0.8	0.4	0.2	0.5	1.2	1.2	1.2	0.1	0.1	0.4	0.5	0.4
	Chromium	1.6	0.5	0.7	0.6	0.6	1.9	1.9	1.9	0.5	0.5	0.8	1.0	0.8
	Cobalt	0.7	0.3	0.3	0.1	0.2	1.1	1.1	1.1	0.1	0.1	0.3	0.3	0.3
	Lead	5.9	2.7	0.7	0.7	1.6	3.8	3.8	3.8	0.5	0.5	1.3	1.4	1.2
	Mercury	1.4	49.9	2.1	2.1	8.6	1.8	1.8	1.9	1.8	1.8	1.9	1.9	2.3
	Vanadium	8.3	2.2	2.7	1.2	2.0	6.8	6.8	6.8	1.2	1.2	2.5	3.5	3.0
Kingfisher - 1	tPCB-mid	30.0	18.7	2.1	4.5	7.7	2.0	0.4	1.9	2.0	2.2	0.6	1.6	2.4
	tPCB-high	322.8	201.0	22.1	48.9	82.6	22.1	4.5	20.2	21.0	23.9	5.9	17.2	26.0
	Barium	0.8	0.6	0.3	0.2	0.4	0.9	0.9	0.9	0.1	0.1	0.3	0.4	0.3
	Chromium	1.6	0.6	0.7	0.6	0.6	1.9	1.9	1.9	0.5	0.5	0.8	1.0	0.8
	Cobalt	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
	Lead	0.2	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.0
	Mercury	0.2	10.2	0.4	0.4	1.7	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.2
	Vanadium	2.2	0.6	0.7	0.3	0.5	1.8	1.8	1.8	0.3	0.3	0.7	0.9	0.8
Kingfisher - 2	tPCB-mid	24.2	15.1	1.7	3.7	6.2	1.6	0.3	1.5	1.5	1.7	0.4	1.2	1.9
	tPCB-high	260.9	162.4	17.9	39.5	66.8	17.2	3.5	15.7	16.2	18.4	4.6	13.3	20.1
	Barium	1.6	1.2	0.6	0.3	0.7	1.8	1.8	1.8	0.2	0.2	0.6	0.8	0.7
	Chromium	1.4	0.5	0.6	0.5	0.5	1.7	1.7	1.7	0.4	0.4	0.7	0.9	0.7
	Cobalt	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
	Lead	0.4	0.2	0.1	0.1	0.1	0.3	0.3	0.3	0.0	0.0	0.1	0.1	0.1
	Mercury	0.3	8.5	0.4	0.4	1.6	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.1
	Vanadium	2.2	0.6	0.7	0.3	0.5	1.8	1.8	1.8	0.3	0.3	0.7	0.9	0.8
Great Blue Heron ³	tPCB-mid	42.8	26.7	2.9	6.5	11.0	2.3	0.5	2.1	2.4	2.7	0.7	2.0	3.0
	tPCB-high	461.0	287.2	31.8	69.9	118.1	25.1	5.2	23.1	25.8	29.3	7.3	21.1	31.9
	Barium	0.4	0.3	0.1	0.1	0.2	0.4	0.4	0.4	0.0	0.0	0.2	0.2	0.2
	Chromium	0.7	0.2	0.3	0.3	0.2	0.8	0.8	0.8	0.2	0.2	0.3	0.4	0.4
	Cobalt	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
	Lead	0.4	0.2	0.0	0.0	0.1	0.2	0.2	0.2	0.0	0.0	0.1	0.1	0.1
	Mercury	0.5	19.2	0.7	0.7	3.2	1.0	1.0	1.1	1.2	1.2	1.2	1.2	1.6
	Vanadium	1.0	0.3	0.3	0.2	0.3	0.8	0.8	0.8	0.2	0.2	0.3	0.4	0.4
Osprey	tPCB-mid	17.9	11.2	1.2	2.7	4.6	1.0	0.2	0.9	1.0	1.2	0.3	0.8	1.3
	tPCB-high	193.2	120.3	13.2	29.3	49.4	10.6	2.2	9.8	10.9	12.4	3.1	9.0	13.5
	Barium	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.0
	Chromium	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
	Cobalt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mercury	0.2	7.5	0.3	0.3	1.2	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.6
	Vanadium	0.3	0.1	0.1	0.0	0.1	0.2	0.2	0.2	0.0	0.0	0.1	0.1	0.1

Table AD1-2. Summary of Aquatic Receptors LOAEL Hazard Quotients by Exposure Unit (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1	C2	C3	C4	Upper AA	C5	C6 ²	Middle AA	C7	C8 ²	C9	C10	Lower AA
Exposure Subarea→		Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
Receptors ⁵ ↓														
Aquatic Mammals		LOAEL HQs												
Bat	tPCB	84.0	52.3	5.8	12.7	21.5	0.1	0.0	0.1	0.1	0.1	0.0	0.1	0.2
	Barium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Chromium	3.2	1.1	1.4	1.2	1.2	3.8	3.8	3.8	0.9	0.9	1.6	1.9	1.7
	Cobalt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mercury	0.2	10.7	0.4	0.4	1.7	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
	Vanadium	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Mink - 2 ³	tPCB-mink	116.1	72.5	8.3	17.8	29.9	7.9	1.7	7.2	7.5	8.5	2.2	6.2	9.3
Mink - 2 (Alternate TRV) ¹	tPCB-mink	232.2	145.1	16.6	35.5	59.7	15.8	3.4	14.5	15.0	17.0	4.4	12.3	18.5
	Barium	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
	Chromium	0.5	0.2	0.2	0.2	0.2	0.5	0.5	0.5	0.1	0.1	0.2	0.3	0.2
	Cobalt	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Lead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mercury	0.0	1.1	0.0	0.0	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
	Vanadium	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Otter	tPCB-mink	186.1	115.9	12.8	28.2	47.6	8.1	1.7	7.5	9.5	10.8	2.7	7.7	11.7
Otter (Alternate TRV) ¹	tPCB-mink	372.2	231.8	25.5	56.4	95.3	16.3	3.3	14.9	18.9	21.5	5.3	15.5	23.4
	Barium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Chromium	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.0	0.0	0.1	0.1	0.1
	Cobalt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mercury	0.1	3.0	0.1	0.1	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
	Vanadium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Notes:

NOAEL HQ* ≤ 1
LOAEL HQ* ≤ 1
LOAEL HQ* > 1 and ≤ 10
LOAEL HQ* > 10

* All HQs rounded to the nearest whole number

¹ Alternate TRVs were selected from Restum et al. (1998) based on growth. The LOAEL TRV is 0.05 mg/kg-day.

² Sediment data unavailable for this reach for non-mercury metals. Non-mercury metal EPCs from the upstream reach were conservatively used to estimate exposure.

³ Great blue heron and Mink-2 are exposed to riparian soil.

AA: assessment area

HQ: hazard quotient

LOAEL: lowest-observed adverse effect level

mg/kg-day: milligrams per kilogram per day

tPCB: total polychlorinated biphenyl

TRV: toxicity reference value

--: not available

Exposure Units:

C1: Oxford Lake Park

C2: Backwater Area

C3: Friendship Road to Highway 21

C4: Hwy 21 to Silver Run Road

C5: Silver Run Road to Mitchell Matson Road

C6: Mitchell Matson Road to 2,000 feet upstream of Curry Station Road

C7: Upstream of Curry Station Road to Eastaboga Creek

C8: Eastaboga Creek to Jackson Shoals Dam

C9: Jackson Shoals Dam to Highway 77

C10: Highway 77 Bridge to Lake Logan Martin

Sediment: Instream Sediment

References:

Restum, J., S. Bursian, J. Giesy, J. Render, W. Helferich, E. Shipp, D. Verbrugge, and R. Aulerich. 1998. Multigenerational study of the effects of consumption of PCB-contaminated carp from Saginaw Bay, Lake Huron, on mink: 1. Effects on mink reproduction, kit growth, and survival, and selected biological parameters. J. Toxicol. Environ. Health Part A 54: 343 375.

Table AD1-3. Summary of Terrestrial Receptors NOAEL-based Hazard Quotients by Exposure Unit (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1 ^{1,2}	C1 ^{1,2}	C2	C2	C2	C2	C3	C3	C3	C4	C4	C4	Upper AA	Upper AA	C5	C5	C5
Exposure Subarea→		East	West	North	South	Central	Riparian	North	South	Riparian	North	South	Riparian	Combined Soil	Riparian	North	South	Riparian
Receptors↓		NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ
Lower Trophic Receptors																		
Terrestrial Plants ³	PCB	0.3	5.2	0.1	0.0	0.0	0.8	0.3	0.7	0.6	0.2	0.2	0.2	0.2	0.3	0.0	0.0	0.1
	Chromium	--	--	34.4	11.2	13.4	13.4	17.9	55.2	16.2	43.8	26.2	46.0	28.2	27.5	19.9	25.0	41.9
	Lead	--	--	0.3	0.2	0.4	0.4	0.4	0.9	0.3	0.5	0.4	0.7	0.4	0.5	0.2	0.4	0.4
	Mercury	--	--	4.7	0.2	0.5	1.6	10.5	11.2	19.7	7.5	7.9	12.1	7.3	9.4	2.4	3.0	4.6
	Vanadium	--	--	11.5	11.4	9.7	11.4	9.8	12.4	7.9	11.6	11.3	11.1	10.1	10.1	14.0	16.0	7.9
Terrestrial Invertebrates ³	PCB	3.2	5.7	1.5	0.1	0.5	8.9	3.8	7.9	6.7	2.6	1.7	2.7	2.6	2.8	0.3	0.4	0.8
	Chromium	--	--	86.0	28.0	33.5	33.5	44.8	138.0	40.5	109.5	65.5	115.0	70.4	68.8	49.7	62.5	104.8
	Lead	--	--	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
	Mercury	--	--	14.2	0.7	1.6	4.9	31.6	33.6	59.1	22.4	23.8	36.3	21.9	28.1	7.3	9.1	13.8
	Vanadium	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Terrestrial Birds																		
Mourning Dove	tPCB-mid	2.2	39.6	1.1	0.1	0.4	--	2.6	5.5	--	1.8	1.2	--	1.9	--	0.2	0.3	--
	tPCB-high	23.9	426.5	11.8	1.2	4.0	--	28.3	58.8	--	19.7	13.3	--	20.0	--	2.5	3.4	--
	Mercury	--	--	1.7	0.1	0.2	--	3.7	4.0	--	2.6	2.8	--	2.6	--	0.9	1.1	--
	Chromium	--	--	0.4	0.1	0.2	--	0.2	0.7	--	0.5	0.3	--	0.3	--	0.2	0.3	--
	Lead	--	--	0.4	0.3	0.6	--	0.5	1.3	--	0.8	0.6	--	0.6	--	0.3	0.7	--
Blue Jay	Vanadium	--	--	1.4	1.4	1.2	--	1.2	1.5	--	1.4	1.4	--	1.2	--	1.7	1.9	--
	tPCB-mid	4.0	71.8	1.9	0.1	0.6	--	4.7	9.9	--	3.3	2.2	--	3.3	--	0.4	0.5	--
	tPCB-high	42.7	773.6	20.9	1.5	6.7	--	50.9	106.1	--	35.2	23.6	--	35.8	--	3.9	5.6	--
	Mercury	--	--	3.6	0.7	0.9	--	7.4	7.9	--	5.4	5.7	--	5.3	--	2.1	2.5	--
	Chromium	--	--	0.7	0.2	0.3	--	0.4	1.0	--	0.8	0.5	--	0.6	--	0.4	0.5	--
Carolina Wren - 1	Lead	--	--	0.6	0.5	0.9	--	0.9	2.1	--	1.3	1.0	--	0.9	--	0.4	1.1	--
	Vanadium	--	--	2.2	2.2	1.9	--	1.9	2.4	--	2.2	2.2	--	1.9	--	2.7	3.1	--
	tPCB-mid	14.3	261.3	6.9	0.3	2.1	--	17.0	35.7	--	11.7	7.8	--	11.9	--	1.1	1.7	--
	tPCB-high	153.8	2813.8	74.3	3.7	22.6	--	183.4	384.4	--	126.4	84.0	--	128.3	--	12.4	18.4	--
	Mercury	--	--	14.9	4.0	4.7	--	29.0	30.6	--	21.5	22.6	--	21.1	--	9.3	10.7	--
Hawk	Chromium	--	--	2.1	0.9	1.0	--	1.2	3.2	--	2.6	1.7	--	1.8	--	1.3	1.6	--
	Lead	--	--	2.0	1.5	3.0	--	2.9	7.1	--	4.2	3.3	--	3.0	--	1.5	3.6	--
	Vanadium	--	--	7.0	7.0	5.9	--	6.0	7.6	--	7.1	6.9	--	6.2	--	8.6	9.8	--
	tPCB-mid	31.2	37.5	19.4	18.8	19.0	--	3.5	4.2	--	5.7	5.4	--	8.8	--	1.5	1.6	--
	tPCB-high	335.5	404.3	209.4	202.3	205.1	--	37.3	45.6	--	61.0	58.4	--	94.7	--	16.0	16.8	--
Terrestrial Mammals	Chromium	--	--	0.4	0.2	0.2	--	0.2	0.6	--	0.5	0.3	--	0.3	--	0.3	0.4	--
	Lead	--	--	0.4	0.3	0.5	--	0.3	0.8	--	0.5	0.4	--	0.4	--	0.4	0.6	--
	Mercury	--	--	6.9	6.6	6.6	--	1.4	1.5	--	1.2	1.3	--	2.1	--	1.0	1.1	--
	Vanadium	--	--	2.0	2.0	2.0	--	2.0	2.1	--	1.9	1.9	--	2.0	--	2.5	2.5	--
Terrestrial Mammals																		
Shrew - 1	tPCB	19.2	352.3	9.3	0.5	2.8	--	22.9	48.1	--	15.8	10.5	--	16.1	--	1.5	2.3	--
	Mercury	--	--	2.8	0.8	1.0	--	5.3	5.6	--	4.0	4.2	--	3.9	--	1.8	2.1	--
	Chromium	--	--	1.2	0.5	0.5	--	0.7	1.9	--	1.5	1.0	--	1.0	--	0.8	0.9	--
	Lead	--	--	0.4	0.3	0.5	--	0.5	1.3	--	0.8	0.6	--	0.5	--	0.3	0.7	--
	Vanadium	--	--	0.3	0.3	0.3	--	0.3	0.3	--	0.3	0.3	--	0.3	--	0.4	0.4	--
Shrew - 2	tPCB	26.8	341.5	14.2	5.7	8.0	--	22.4	46.3	--	16.4	11.3	--	17.5	--	1.8	2.6	--
	Chromium	--	--	1.2	0.5	0.5	--	0.7	1.9	--	1.5	0.9	--	1.0	--	0.8	1.0	--
	Lead	--	--	0.4	0.3	0.6	--	0.5	1.2	--	0.7	0.6	--	0.6	--	0.3	0.7	--
	Mercury	--	--	4.1	2.3	2.4	--	5.1	5.4	--	3.8	4.0	--	4.0	--	1.8	2.0	--
	Vanadium	--	--	0.3	0.3	0.3	--	0.3	0.3	--	0.3	0.3	--	0.3	--	0.4	0.4	--

Table AD1-3. Summary of Terrestrial Receptors NOAEL-based Hazard Quotients by Exposure Unit (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1 ^{1,2}	C1 ^{1,2}	C2	C2	C2	C2	C3	C3	C3	C4	C4	C4	Upper AA	Upper AA	C5	C5	C5
Exposure Subarea→		East	West	North	South	Central	Riparian	North	South	Riparian	North	South	Riparian	Combined Soil	Riparian	North	South	Riparian
Receptors↓		NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ
Deer	tPCB	0.4	6.8	0.2	0.0	0.1	--	0.5	0.9	--	0.3	0.2	--	0.3	--	0.0	0.1	--
	Mercury	--	--	0.0	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	--	0.0	0.0	--
	Chromium	--	--	0.0	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	--	0.0	0.0	--
	Lead	--	--	0.0	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	--	0.0	0.0	--
	Vanadium	--	--	0.0	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	--	0.0	0.0	--
Weasel	tPCB	2.1	12.0	1.4	0.3	0.7	--	2.4	3.6	--	1.9	1.5	--	1.9	--	0.5	0.7	--
	Mercury	--	--	0.1	0.0	0.0	--	0.1	0.1	--	0.1	0.1	--	0.1	--	0.1	0.1	--
	Chromium	--	--	0.3	0.1	0.1	--	0.2	0.5	--	0.4	0.2	--	0.2	--	0.2	0.2	--
	Lead	--	--	0.1	0.0	0.1	--	0.1	0.2	--	0.1	0.1	--	0.1	--	0.0	0.1	--
	Vanadium	--	--	0.1	0.1	0.1	--	0.1	0.1	--	0.1	0.1	--	0.1	--	0.1	0.1	--
Fox - 1	tPCB	1.6	15.1	1.0	0.2	0.5	--	1.8	3.1	--	1.4	1.0	--	1.4	--	0.3	0.4	--
	Mercury	--	--	0.1	0.0	0.0	--	0.2	0.2	--	0.1	0.1	--	0.1	--	0.1	0.1	--
	Chromium	--	--	0.2	0.1	0.1	--	0.1	0.3	--	0.2	0.1	--	0.1	--	0.1	0.1	--
	Lead	--	--	0.0	0.0	0.0	--	0.0	0.1	--	0.1	0.1	--	0.0	--	0.0	0.1	--
	Vanadium	--	--	0.1	0.1	0.1	--	0.1	0.1	--	0.1	0.1	--	0.1	--	0.1	0.1	--
Fox - 2	tPCB	1.3	7.7	0.9	0.2	0.5	--	1.5	2.2	--	1.2	0.9	--	1.2	--	0.3	0.4	--
	Mercury	--	--	0.0	0.0	0.0	--	0.1	0.1	--	0.0	0.0	--	0.0	--	0.0	0.0	--
	Chromium	--	--	0.2	0.1	0.1	--	0.1	0.3	--	0.2	0.1	--	0.1	--	0.1	0.1	--
	Lead	--	--	0.0	0.0	0.0	--	0.0	0.1	--	0.1	0.0	--	0.0	--	0.0	0.1	--
	Vanadium	--	--	0.1	0.1	0.1	--	0.1	0.1	--	0.1	0.1	--	0.1	--	0.1	0.1	--

Table AD1-3. Summary of Terrestrial Receptors NOAEL-based Hazard Quotients by Exposure Unit (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C6	C6	C6	Middle AA	Middle AA	C7	C7	C7	C8	C8	C8	C9	C9	C9	C10 ²	Lower AA	Lower AA
Exposure Subarea→		North	South	Riparian	Combined Soil	Riparian	North	South	Riparian	North	South	Riparian	North	South	Riparian	Sediment	Combined Soil	Riparian
Receptors↓		NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ
Lower Trophic Receptors																		
Terrestrial Plants ³	PCB	0.0	0.1	0.1	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.1	--	0.0	0.0
	Chromium	18.4	10.0	18.4	19.0	41.9	22.2	29.5	27.8	23.7	18.8	23.7	14.4	14.1	14.4	--	20.2	19.6
	Lead	0.2	0.1	0.2	0.3	0.4	0.3	0.2	0.3	0.2	0.3	0.3	0.1	0.2	0.1	--	0.2	0.2
	Mercury	5.2	9.2	6.7	2.8	4.7	1.8	5.8	10.1	15.5	2.5	15.5	5.5	1.7	5.7	--	3.1	12.9
	Vanadium	13.6	6.5	6.7	12.6	7.9	14.4	14.9	7.7	11.4	14.2	14.2	6.1	13.5	4.9	--	11.9	10.3
Terrestrial Invertebrates ³	PCB	0.5	0.8	0.7	0.4	0.7	0.2	0.4	0.7	0.5	0.4	0.6	0.4	0.1	0.6	--	0.2	0.5
	Chromium	46.0	25.0	46.0	47.4	104.8	55.5	73.8	69.5	59.3	46.9	59.3	36.0	35.3	36.0	--	50.6	49.1
	Lead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	0.0	0.0
	Mercury	15.6	27.5	20.1	8.3	14.2	5.4	17.5	30.2	46.5	7.5	46.5	16.6	5.2	17.2	--	9.4	38.7
	Vanadium	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Terrestrial Birds																		
Mourning Dove	tPCB-mid	0.4	0.6	--	0.3	--	0.2	0.3	--	0.4	0.3	--	0.3	0.1	--	--	0.2	--
	tPCB-high	4.2	6.0	--	3.3	--	1.9	3.2	--	4.3	3.1	--	3.7	1.1	--	--	2.1	--
	Mercury	1.8	3.2	--	1.0	--	0.6	2.1	--	5.5	0.9	--	2.0	0.6	--	--	1.1	--
	Chromium	0.2	0.1	--	0.2	--	0.3	0.4	--	0.3	0.2	--	0.2	0.2	--	--	0.2	--
	Lead	0.3	0.2	--	0.5	--	0.5	0.3	--	0.4	0.4	--	0.2	0.2	--	--	0.3	--
Blue Jay	Vanadium	1.6	0.8	--	1.5	--	1.7	1.8	--	1.4	1.7	--	0.7	1.6	--	--	1.4	--
	tPCB-mid	0.6	1.0	--	0.5	--	0.3	0.5	--	0.7	0.5	--	0.6	0.1	--	--	0.3	--
	tPCB-high	7.0	10.3	--	5.4	--	2.9	5.1	--	7.3	4.9	--	6.2	1.3	--	--	3.2	--
	Mercury	3.9	6.5	--	2.3	--	1.7	4.4	--	10.8	2.2	--	4.2	1.7	--	--	2.6	--
	Chromium	0.4	0.2	--	0.4	--	0.4	0.6	--	0.5	0.4	--	0.3	0.3	--	--	0.4	--
Carolina Wren - 1	Lead	0.5	0.3	--	0.8	--	0.8	0.5	--	0.6	0.6	--	0.3	0.4	--	--	0.5	--
	Vanadium	2.6	1.2	--	2.4	--	2.8	2.9	--	2.2	2.7	--	1.2	2.6	--	--	2.3	--
	tPCB-mid	2.2	3.3	--	1.7	--	0.8	1.6	--	2.3	1.5	--	1.9	0.3	--	--	0.9	--
	tPCB-high	23.5	35.8	--	17.8	--	8.7	16.9	--	24.7	16.2	--	20.6	3.1	--	--	9.8	--
	Mercury	16.0	25.7	--	10.1	--	7.9	18.0	--	42.1	9.6	--	17.2	7.7	--	--	11.2	--
Hawk	Chromium	1.3	0.8	--	1.3	--	1.5	1.8	--	1.5	1.3	--	1.1	1.0	--	--	1.4	--
	Lead	1.7	1.0	--	2.8	--	2.6	1.7	--	2.0	2.0	--	1.0	1.2	--	--	1.6	--
	Vanadium	8.3	4.0	--	7.7	--	8.8	9.2	--	7.0	8.7	--	3.7	8.3	--	--	7.3	--
	tPCB-mid	0.7	0.8	--	1.5	--	0.8	0.9	--	1.0	0.9	--	0.6	0.3	--	--	0.9	--
	tPCB-high	7.4	8.6	--	15.7	--	8.3	9.4	--	11.1	10.1	--	6.0	3.4	--	--	9.7	--
Terrestrial Mammals	Chromium	0.3	0.2	--	0.3	--	0.3	0.3	--	0.3	0.2	--	0.2	0.2	--	--	0.3	--
	Lead	0.4	0.3	--	0.5	--	0.3	0.2	--	0.2	0.2	--	0.2	0.2	--	--	0.2	--
	Mercury	1.3	1.9	--	1.0	--	1.0	1.8	--	3.6	1.1	--	1.7	1.0	--	--	1.3	--
	Vanadium	2.5	2.3	--	2.4	--	2.0	2.0	--	1.9	2.0	--	1.9	2.1	--	--	2.1	--
Terrestrial Mammals																		
Shrew - 1	tPCB	2.9	4.5	--	2.2	--	1.1	2.1	--	3.1	2.0	--	2.6	0.4	--	--	1.2	--
	Mercury	3.0	4.7	--	1.9	--	1.5	3.3	--	7.6	1.8	--	3.2	1.5	--	--	2.1	--
	Chromium	0.7	0.4	--	0.7	--	0.8	1.1	--	0.9	0.7	--	0.6	0.6	--	--	0.8	--
	Lead	0.3	0.2	--	0.5	--	0.5	0.3	--	0.4	0.4	--	0.2	0.2	--	--	0.3	--
	Vanadium	0.4	0.2	--	0.3	--	0.4	0.4	--	0.3	0.4	--	0.2	0.4	--	--	0.3	--
Shrew - 2	tPCB	2.9	4.4	--	2.4	--	1.2	2.2	--	3.2	2.1	--	2.5	0.4	--	--	1.4	--
	Chromium	0.8	0.5	--	0.8	--	0.8	1.0	--	0.9	0.7	--	0.6	0.6	--	--	0.8	--
	Lead	0.4	0.2	--	0.5	--	0.5	0.3	--	0.3	0.4	--	0.2	0.2	--	--	0.3	--
	Mercury	2.9	4.5	--	1.9	--	1.5	3.2	--	7.2	1.8	--	3.1	1.5	--	--	2.1	--
	Vanadium	0.4	0.2	--	0.4	--	0.4	0.4	--	0.3	0.4	--	0.2	0.4	--	--	0.3	--

Table AD1-3. Summary of Terrestrial Receptors NOAEL-based Hazard Quotients by Exposure Unit (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C6	C6	C6	Middle AA	Middle AA	C7	C7	C7	C8	C8	C8	C9	C9	C9	C10 ²	Lower AA	Lower AA
Exposure Subarea→		North	South	Riparian	Combined Soil	Riparian	North	South	Riparian	North	South	Riparian	North	South	Riparian	Sediment	Combined Soil	Riparian
Receptors↓		NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ
Deer	tPCB	0.1	0.1	--	0.1	--	0.0	0.1	--	0.1	0.0	--	0.1	0.0	--	--	0.0	--
	Mercury	0.0	0.0	--	0.0	--	0.0	0.0	--	0.1	0.0	--	0.0	0.0	--	--	0.0	--
	Chromium	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	--	0.0	--
	Lead	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	--	0.0	--
	Vanadium	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	--	0.0	--
Weasel	tPCB	0.8	1.0	--	0.7	--	0.5	0.6	--	0.8	0.6	--	0.7	0.3	--	--	0.5	--
	Mercury	0.1	0.3	--	0.1	--	0.1	0.3	--	0.7	0.1	--	0.2	0.1	--	--	0.1	--
	Chromium	0.2	0.1	--	0.2	--	0.2	0.2	--	0.2	0.2	--	0.1	0.1	--	--	0.2	--
	Lead	0.0	0.0	--	0.1	--	0.1	0.0	--	0.1	0.1	--	0.0	0.0	--	--	0.0	--
	Vanadium	0.1	0.1	--	0.1	--	0.1	0.1	--	0.1	0.1	--	0.1	0.1	--	--	0.1	--
Fox - 1	tPCB	0.5	0.6	--	0.4	--	0.3	0.4	--	0.5	0.4	--	0.4	0.2	--	--	0.3	--
	Mercury	0.1	0.2	--	0.1	--	0.1	0.2	--	0.5	0.1	--	0.2	0.1	--	--	0.1	--
	Chromium	0.1	0.0	--	0.1	--	0.1	0.1	--	0.1	0.1	--	0.1	0.1	--	--	0.1	--
	Lead	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	--	0.0	--
	Vanadium	0.1	0.1	--	0.1	--	0.1	0.1	--	0.1	0.1	--	0.1	0.1	--	--	0.1	--
Fox - 2	tPCB	0.5	0.6	--	0.4	--	0.3	0.4	--	0.5	0.4	--	0.4	0.2	--	--	0.3	--
	Mercury	0.1	0.1	--	0.0	--	0.0	0.1	--	0.4	0.1	--	0.1	0.0	--	--	0.1	--
	Chromium	0.1	0.0	--	0.1	--	0.1	0.1	--	0.1	0.1	--	0.1	0.1	--	--	0.1	--
	Lead	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	--	0.0	--
	Vanadium	0.1	0.1	--	0.1	--	0.1	0.1	--	0.1	0.1	--	0.1	0.1	--	--	0.1	--

Notes:

NOAEL HQ* ≤ 1
NOAEL HQ* > 1 and ≤ 10
NOAEL HQ* > 10

* All HQs rounded to the nearest whole number

¹ Soil in C1 was not sampled for metals. Hawk and shrew-2 are exposed to both soil and sediment, therefore, the HQs presented for metals in C1 are based on exposures to sediment only.

² Riparian soil in reaches C1 and C10 is based on the applicable assessment area (i.e., Upper for C1 and Lower for C10). Reach C10 was not evaluated for terrestrial receptors due to lack of floodplain soil.

³ NOAEL TRV for terrestrial invertebrates and plants was not available for vanadium.

AA: assessment area

HQ: hazard quotient

NOAEL: no observed adverse effect level

tPCB: total polychlorinated biphenyl

TRV: toxicity reference value

--: not available

Exposure Units:

C1: Oxford Lake Park

C2: Backwater Area

C3: Friendship Road to Highway 21

C4: Hwy 21 to Silver Run Road

C5: Silver Run Road to Mitchell Matson Road

C6: Mitchell Matson Road to 2,000 feet upstream of Curry Station Road

C7: Upstream of Curry Station Road to Eastaboga Creek

C8: Eastaboga Creek to Jackson Shoals Dam

C9: Jackson Shoals Dam to Highway 77

C10: Hwy 77 Bridge to Lake Logan Martin

Exposure Subareas:

East: East Subarea Floodplain Soil

West: West Subarea Floodplain Soil

North: North Subarea Floodplain Soil

South: South Subarea Floodplain Soil

Central: Central Subarea Floodplain Soil

Table AD1-4. Summary of Terrestrial Receptors LOAEL-based Hazard Quotients by Exposure Unit (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1 ^{1,2}	C1 ^{1,2}	C2	C2	C2	C2	C3	C3	C3	C4	C4	C4	Upper AA
Exposure Subarea→		East	West	North	South	Central	Riparian	North	South	Riparian	North	South	Riparian	Combined Soil
Receptors↓ ³		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Lower Trophic Receptors														
Terrestrial Plants ³	PCB	--	--	--	--	--	--	--	--	--	--	--	--	--
	Chromium	--	--	--	--	--	--	--	--	--	--	--	--	--
	Lead	--	--	--	--	--	--	--	--	--	--	--	--	--
	Mercury	--	--	--	--	--	--	--	--	--	--	--	--	--
	Vanadium	--	--	--	--	--	--	--	--	--	--	--	--	--
Terrestrial Invertebrates ³	PCB	0.3	5.7	0.2	0.0	0.0	0.9	0.4	0.8	0.7	0.3	0.2	0.3	0.3
	Chromium	--	--	--	--	--	--	--	--	--	--	--	--	--
	Lead	--	--	--	--	--	--	--	--	--	--	--	--	--
	Mercury	--	--	6.2	0.3	0.7	2.1	13.8	14.6	25.7	9.7	10.3	15.8	9.5
	Vanadium	--	--	--	--	--	--	--	--	--	--	--	--	--
Terrestrial Birds														
Mourning Dove	tPCB-mid	0.7	13.2	0.4	0.0	0.1	--	0.9	1.8	--	0.6	0.4	--	0.6
	tPCB-high	8.0	142.2	3.9	0.4	1.3	--	9.4	19.6	--	6.6	4.4	--	6.7
	Mercury	--	--	0.6	0.0	0.1	--	1.2	1.3	--	0.9	0.9	--	0.9
	Chromium	--	--	0.4	0.1	0.2	--	0.2	0.6	--	0.5	0.3	--	0.3
	Lead	--	--	0.2	0.1	0.3	--	0.3	0.7	--	0.4	0.3	--	0.3
Blue Jay	Vanadium	--	--	0.7	0.7	0.6	--	0.6	0.7	--	0.7	0.7	--	0.6
	tPCB-mid	1.3	23.9	0.6	0.0	0.2	--	1.6	3.3	--	1.1	0.7	--	1.1
	tPCB-high	14.2	257.9	7.0	0.5	2.2	--	17.0	35.4	--	11.7	7.9	--	11.9
	Mercury	--	--	1.2	0.2	0.3	--	2.5	2.6	--	1.8	1.9	--	1.8
	Chromium	--	--	0.6	0.2	0.3	--	0.3	1.0	--	0.8	0.5	--	0.5
Carolina Wren	Lead	--	--	0.3	0.2	0.5	--	0.4	1.1	--	0.6	0.5	--	0.5
	Vanadium	--	--	1.1	1.1	0.9	--	0.9	1.2	--	1.1	1.1	--	1.0
	tPCB-mid	4.8	87.1	2.3	0.1	0.7	--	5.7	11.9	--	3.9	2.6	--	4.0
	tPCB-high	51.3	937.9	24.8	1.2	7.5	--	61.1	128.1	--	42.1	28.0	--	42.8
	Mercury	--	--	5.0	1.3	1.6	--	9.7	10.2	--	7.2	7.5	--	7.0
Hawk	Chromium	--	--	2.0	0.8	1.0	--	1.2	3.0	--	2.5	1.6	--	1.7
	Lead	--	--	1.0	0.8	1.5	--	1.4	3.6	--	2.1	1.7	--	1.5
	Vanadium	--	--	3.5	3.4	2.9	--	3.0	3.7	--	3.5	3.4	--	3.0
	tPCB-mid	10.4	12.5	6.5	6.3	6.3	--	1.2	1.4	--	1.9	1.8	--	2.9
	tPCB-high	111.8	134.8	69.8	67.4	68.4	--	12.4	15.2	--	20.3	19.5	--	31.6
	Chromium	--	--	0.4	0.2	0.2	--	0.2	0.6	--	0.5	0.3	--	0.3
	Lead	--	--	0.2	0.2	0.2	--	0.2	0.4	--	0.2	0.2	--	0.2
	Mercury	--	--	2.3	2.2	2.2	--	0.5	0.5	--	0.4	0.4	--	0.7
	Vanadium	--	--	1.0	1.0	1.0	--	1.0	1.0	--	1.0	1.0	--	1.0

Table AD1-4. Summary of Terrestrial Receptors LOAEL-based Hazard Quotients by Exposure Unit (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1 ^{1,2}	C1 ^{1,2}	C2	C2	C2	C2	C3	C3	C3	C4	C4	C4	Upper AA
Exposure Subarea→		East	West	North	South	Central	Riparian	North	South	Riparian	North	South	Riparian	Combined Soil
Receptors↓ ³		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Terrestrial Mammals														
Shrew - 1	tPCB	6.5	119.1	3.1	0.2	1.0	--	7.8	16.3	--	5.3	3.6	--	5.4
	Mercury	--	--	1.4	0.4	0.5	--	2.7	2.8	--	2.0	2.1	--	2.0
	Chromium	--	--	1.0	0.4	0.5	--	0.6	1.6	--	1.3	0.8	--	0.9
	Lead	--	--	0.2	0.1	0.3	--	0.3	0.7	--	0.4	0.3	--	0.3
	Vanadium	--	--	0.1	0.1	0.1	--	0.1	0.2	--	0.2	0.1	--	0.1
Shrew - 2	tPCB	9.1	115.5	4.8	1.9	2.7	--	7.6	15.7	--	5.5	3.8	--	5.9
	Chromium	--	--	1.0	0.4	0.5	--	0.6	1.6	--	1.3	0.8	--	0.9
	Lead	--	--	0.2	0.2	0.3	--	0.3	0.7	--	0.4	0.3	--	0.3
	Mercury	--	--	2.1	1.1	1.2	--	2.6	2.7	--	1.9	2.0	--	2.0
	Vanadium	--	--	0.2	0.2	0.1	--	0.1	0.2	--	0.2	0.1	--	0.1
Deer	tPCB	0.1	2.3	0.1	0.0	0.0	--	0.2	0.3	--	0.1	0.1	--	0.1
	Mercury	--	--	0.0	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0
	Chromium	--	--	0.0	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0
	Lead	--	--	0.0	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0
	Vanadium	--	--	0.0	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0
Weasel	tPCB	0.7	4.1	0.5	0.1	0.3	--	0.8	1.2	--	0.6	0.5	--	0.7
	Mercury	--	--	0.0	0.0	0.0	--	0.1	0.1	--	0.0	0.0	--	0.0
	Chromium	--	--	0.2	0.1	0.1	--	0.1	0.4	--	0.3	0.2	--	0.2
	Lead	--	--	0.0	0.0	0.0	--	0.0	0.1	--	0.1	0.0	--	0.0
	Vanadium	--	--	0.1	0.1	0.1	--	0.1	0.1	--	0.1	0.1	--	0.1
Fox - 1	tPCB	0.5	5.1	0.3	0.1	0.2	--	0.6	1.0	--	0.5	0.4	--	0.5
	Mercury	--	--	0.0	0.0	0.0	--	0.1	0.1	--	0.1	0.1	--	0.1
	Chromium	--	--	0.1	0.0	0.1	--	0.1	0.2	--	0.2	0.1	--	0.1
	Lead	--	--	0.0	0.0	0.0	--	0.0	0.1	--	0.0	0.0	--	0.0
	Vanadium	--	--	0.0	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0
Fox - 2	tPCB	0.4	2.6	0.3	0.1	0.2	--	0.5	0.8	--	0.4	0.3	--	0.4
	Mercury	--	--	0.0	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0
	Chromium	--	--	0.1	0.0	0.1	--	0.1	0.2	--	0.2	0.1	--	0.1
	Lead	--	--	0.0	0.0	0.0	--	0.0	0.1	--	0.0	0.0	--	0.0
	Vanadium	--	--	0.0	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0

Table AD1-4. Summary of Terrestrial Receptors LOAEL-based Hazard Quotients by Exposure Unit (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		Upper AA	C5	C5	C5	C6	C6	C6	Middle AA	Middle AA	C7	C7	C7	C8
Exposure Subarea→		Riparian	North	South	Riparian	North	South	Riparian	Combined Soil	Riparian	North	South	Riparian	North
Receptors↓ ³		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Lower Trophic Receptors														
Terrestrial Plants ³	PCB	--	--	--	--	--	--	--	--	--	--	--	--	--
	Chromium	--	--	--	--	--	--	--	--	--	--	--	--	--
	Lead	--	--	--	--	--	--	--	--	--	--	--	--	--
	Mercury	--	--	--	--	--	--	--	--	--	--	--	--	--
	Vanadium	--	--	--	--	--	--	--	--	--	--	--	--	--
Terrestrial Invertebrates ³	PCB	0.3	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.1	0.1
	Chromium	--	--	--	--	--	--	--	--	--	--	--	--	--
	Lead	--	--	--	--	--	--	--	--	--	--	--	--	--
	Mercury	12.2	3.2	3.9	6.0	6.8	12.0	8.7	3.6	6.2	2.3	7.6	13.1	20.2
	Vanadium	--	--	--	--	--	--	--	--	--	--	--	--	--
Terrestrial Birds														
Mourning Dove	tPCB-mid	--	0.1	0.1	--	0.1	0.2	--	0.1	--	0.1	0.1	--	0.1
	tPCB-high	--	0.8	1.1	--	1.4	2.0	--	1.1	--	0.6	1.1	--	1.4
	Mercury	--	0.3	0.4	--	0.6	1.1	--	0.3	--	0.2	0.7	--	1.8
	Chromium	--	0.2	0.3	--	0.2	0.1	--	0.2	--	0.3	0.3	--	0.3
	Lead	--	0.1	0.3	--	0.2	0.1	--	0.3	--	0.2	0.2	--	0.2
	Vanadium	--	0.8	0.9	--	0.8	0.4	--	0.7	--	0.8	0.9	--	0.7
Blue Jay	tPCB-mid	--	0.1	0.2	--	0.2	0.3	--	0.2	--	0.1	0.2	--	0.2
	tPCB-high	--	1.3	1.9	--	2.3	3.4	--	1.8	--	1.0	1.7	--	2.4
	Mercury	--	0.7	0.8	--	1.3	2.2	--	0.8	--	0.6	1.5	--	3.6
	Chromium	--	0.4	0.5	--	0.4	0.2	--	0.4	--	0.4	0.5	--	0.4
	Lead	--	0.2	0.5	--	0.3	0.1	--	0.4	--	0.4	0.3	--	0.3
	Vanadium	--	1.3	1.5	--	1.3	0.6	--	1.2	--	1.4	1.4	--	1.1
Carolina Wren	tPCB-mid	--	0.4	0.6	--	0.7	1.1	--	0.6	--	0.3	0.5	--	0.8
	tPCB-high	--	4.1	6.1	--	7.8	11.9	--	5.9	--	2.9	5.6	--	8.2
	Mercury	--	3.1	3.6	--	5.3	8.6	--	3.4	--	2.6	6.0	--	14.0
	Chromium	--	1.3	1.5	--	1.2	0.8	--	1.2	--	1.4	1.8	--	1.5
	Lead	--	0.7	1.8	--	0.9	0.5	--	1.4	--	1.3	0.8	--	1.0
	Vanadium	--	4.2	4.8	--	4.1	1.9	--	3.8	--	4.3	4.5	--	3.4
Hawk	tPCB-mid	--	0.5	0.5	--	0.2	0.3	--	0.5	--	0.3	0.3	--	0.3
	tPCB-high	--	5.3	5.6	--	2.5	2.9	--	5.2	--	2.8	3.1	--	3.7
	Chromium	--	0.3	0.3	--	0.3	0.2	--	0.3	--	0.3	0.3	--	0.3
	Lead	--	0.2	0.3	--	0.2	0.2	--	0.3	--	0.2	0.1	--	0.1
	Mercury	--	0.3	0.4	--	0.4	0.6	--	0.3	--	0.3	0.6	--	1.2
	Vanadium	--	1.2	1.2	--	1.2	1.1	--	1.2	--	1.0	1.0	--	1.0

Table AD1-4. Summary of Terrestrial Receptors LOAEL-based Hazard Quotients by Exposure Unit (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		Upper AA	C5	C5	C5	C6	C6	C6	Middle AA	Middle AA	C7	C7	C7	C8
Exposure Subarea→		Riparian	North	South	Riparian	North	South	Riparian	Combined Soil	Riparian	North	South	Riparian	North
Receptors↓ ³		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Terrestrial Mammals														
Shrew - 1	tPCB	--	0.5	0.8	--	1.0	1.5	--	0.7	--	0.4	0.7	--	1.0
	Mercury	--	0.9	1.0	--	1.5	2.4	--	1.0	--	0.8	1.7	--	3.8
	Chromium	--	0.6	0.8	--	0.6	0.4	--	0.6	--	0.7	0.9	--	0.7
	Lead	--	0.1	0.3	--	0.2	0.1	--	0.3	--	0.3	0.2	--	0.2
	Vanadium	--	0.2	0.2	--	0.2	0.1	--	0.2	--	0.2	0.2	--	0.1
Shrew - 2	tPCB	--	0.6	0.9	--	1.0	1.5	--	0.8	--	0.4	0.7	--	1.1
	Chromium	--	0.7	0.8	--	0.7	0.4	--	0.7	--	0.7	0.9	--	0.7
	Lead	--	0.2	0.4	--	0.2	0.1	--	0.3	--	0.2	0.2	--	0.2
	Mercury	--	0.9	1.0	--	1.5	2.3	--	1.0	--	0.8	1.6	--	3.6
	Vanadium	--	0.2	0.2	--	0.2	0.1	--	0.2	--	0.2	0.2	--	0.1
Deer	tPCB	--	0.0	0.0	--	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0
	Mercury	--	0.0	0.0	--	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0
	Chromium	--	0.0	0.0	--	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0
	Lead	--	0.0	0.0	--	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0
	Vanadium	--	0.0	0.0	--	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0
Weasel	tPCB	--	0.2	0.2	--	0.3	0.3	--	0.2	--	0.2	0.2	--	0.3
	Mercury	--	0.0	0.0	--	0.1	0.1	--	0.0	--	0.0	0.1	--	0.3
	Chromium	--	0.1	0.2	--	0.1	0.1	--	0.1	--	0.2	0.2	--	0.2
	Lead	--	0.0	0.1	--	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0
	Vanadium	--	0.1	0.1	--	0.1	0.0	--	0.1	--	0.1	0.1	--	0.1
Fox - 1	tPCB	--	0.1	0.1	--	0.2	0.2	--	0.1	--	0.1	0.1	--	0.2
	Mercury	--	0.0	0.0	--	0.1	0.1	--	0.0	--	0.0	0.1	--	0.2
	Chromium	--	0.1	0.1	--	0.1	0.0	--	0.1	--	0.1	0.1	--	0.1
	Lead	--	0.0	0.0	--	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0
	Vanadium	--	0.0	0.0	--	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0
Fox - 2	tPCB	--	0.1	0.1	--	0.2	0.2	--	0.1	--	0.1	0.1	--	0.2
	Mercury	--	0.0	0.0	--	0.0	0.1	--	0.0	--	0.0	0.1	--	0.2
	Chromium	--	0.1	0.1	--	0.1	0.0	--	0.1	--	0.1	0.1	--	0.1
	Lead	--	0.0	0.0	--	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0
	Vanadium	--	0.0	0.0	--	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0

Table AD1-4. Summary of Terrestrial Receptors LOAEL-based Hazard Quotients by Exposure Unit (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C8	C8	C9	C9	C9	C10 ¹	Lower AA	Lower AA
Exposure Subarea→		South	Riparian	North	South	Riparian	Sediment	Combined Soil	Riparian
Receptors↓ ³		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Lower Trophic Receptors									
Terrestrial Plants ³	PCB	--	--	--	--	--	--	--	--
	Chromium	--	--	--	--	--	--	--	--
	Lead	--	--	--	--	--	--	--	--
	Mercury	--	--	--	--	--	--	--	--
	Vanadium	--	--	--	--	--	--	--	--
Terrestrial Invertebrates ³	PCB	0.0	0.1	0.0	0.0	0.1	--	0.0	0.1
	Chromium	--	--	--	--	--	--	--	--
	Lead	--	--	--	--	--	--	--	--
	Mercury	3.3	20.2	7.2	2.3	7.5	--	4.1	16.8
	Vanadium	--	--	--	--	--	--	--	--
Terrestrial Birds									
Mourning Dove	tPCB-mid	0.1	--	0.1	0.0	--	--	0.1	--
	tPCB-high	1.0	--	1.2	0.4	--	--	0.7	--
	Mercury	0.3	--	0.7	0.2	--	--	0.4	--
	Chromium	0.2	--	0.2	0.2	--	--	0.2	--
	Lead	0.2	--	0.1	0.1	--	--	0.1	--
Blue Jay	Vanadium	0.8	--	0.4	0.8	--	--	0.7	--
	tPCB-mid	0.2	--	0.2	0.0	--	--	0.1	--
	tPCB-high	1.6	--	2.1	0.4	--	--	1.1	--
	Mercury	0.7	--	1.4	0.6	--	--	0.9	--
	Chromium	0.4	--	0.3	0.3	--	--	0.4	--
Carolina Wren	Lead	0.3	--	0.2	0.2	--	--	0.2	--
	Vanadium	1.3	--	0.6	1.3	--	--	1.1	--
	tPCB-mid	0.5	--	0.6	0.1	--	--	0.3	--
	tPCB-high	5.4	--	6.9	1.0	--	--	3.3	--
	Mercury	3.2	--	5.7	2.6	--	--	3.7	--
Hawk	Chromium	1.2	--	1.0	1.0	--	--	1.3	--
	Lead	1.0	--	0.5	0.6	--	--	0.8	--
	Vanadium	4.3	--	1.8	4.1	--	--	3.6	--
	tPCB-mid	0.3	--	0.2	0.1	--	--	0.3	--
	tPCB-high	3.4	--	2.0	1.1	--	--	3.2	--
	Chromium	0.2	--	0.2	0.2	--	--	0.3	--
	Lead	0.1	--	0.1	0.1	--	--	0.1	--
	Mercury	0.4	--	0.6	0.3	--	--	0.4	--
	Vanadium	1.0	--	0.9	1.0	--	--	1.0	--

Table AD1-4. Summary of Terrestrial Receptors LOAEL-based Hazard Quotients by Exposure Unit (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C8	C8	C9	C9	C9	C10 ¹	Lower AA	Lower AA
Exposure Subarea→		South	Riparian	North	South	Riparian	Sediment	Combined Soil	Riparian
Receptors↓ ³		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Terrestrial Mammals									
Shrew - 1	tPCB	0.7	--	0.9	0.1	--	--	0.4	--
	Mercury	0.9	--	1.6	0.8	--	--	1.1	--
	Chromium	0.6	--	0.5	0.5	--	--	0.6	--
	Lead	0.2	--	0.1	0.1	--	--	0.2	--
	Vanadium	0.2	--	0.1	0.2	--	--	0.2	--
Shrew - 2	tPCB	0.7	--	0.9	0.1	--	--	0.5	--
	Chromium	0.6	--	0.5	0.5	--	--	0.7	--
	Lead	0.2	--	0.1	0.1	--	--	0.2	--
	Mercury	0.9	--	1.5	0.7	--	--	1.0	--
	Vanadium	0.2	--	0.1	0.2	--	--	0.2	--
Deer	tPCB	0.0	--	0.0	0.0	--	--	0.0	--
	Mercury	0.0	--	0.0	0.0	--	--	0.0	--
	Chromium	0.0	--	0.0	0.0	--	--	0.0	--
	Lead	0.0	--	0.0	0.0	--	--	0.0	--
	Vanadium	0.0	--	0.0	0.0	--	--	0.0	--
Weasel	tPCB	0.2	--	0.2	0.1	--	--	0.2	--
	Mercury	0.1	--	0.1	0.0	--	--	0.1	--
	Chromium	0.1	--	0.1	0.1	--	--	0.1	--
	Lead	0.0	--	0.0	0.0	--	--	0.0	--
	Vanadium	0.1	--	0.0	0.1	--	--	0.1	--
Fox - 1	tPCB	0.1	--	0.1	0.1	--	--	0.1	--
	Mercury	0.0	--	0.1	0.0	--	--	0.1	--
	Chromium	0.1	--	0.1	0.1	--	--	0.1	--
	Lead	0.0	--	0.0	0.0	--	--	0.0	--
	Vanadium	0.0	--	0.0	0.0	--	--	0.0	--
Fox - 2	tPCB	0.1	--	0.1	0.1	--	--	0.1	--
	Mercury	0.0	--	0.1	0.0	--	--	0.0	--
	Chromium	0.1	--	0.1	0.1	--	--	0.1	--
	Lead	0.0	--	0.0	0.0	--	--	0.0	--
	Vanadium	0.0	--	0.0	0.0	--	--	0.0	--

Notes:

NOAEL HQ* ≤ 1
LOAEL HQ* ≤ 1
LOAEL HQ* > 1 and ≤ 10
LOAEL HQ* > 10

* All HQs rounded to the nearest whole number

¹ Riparian soil in reaches C1 and C10 is based on the applicable assessment area (i.e., Upper for C1 and Lower for C10). Reach C10 was not evaluated for terrestrial receptors due to lack of floodplain soil.

² Soil in C1 was not sampled for metals. Hawk and shrew-2 are exposed to both soil and sediment, therefore, the HQs presented for metals in C1 are based on exposures to sediment only.

³ LOAEL TRVs were only available for PCBs and mercury for terrestrial plants and invertebrates, therefore LOAEL-equivalent HQs could not be calculated for the remaining metals.

AA: assessment area

HQ: hazard quotient

LOAEL: lowest-observed adverse effect level

tPCB: total polychlorinated biphenyl

TRV: toxicity reference value

--: not available

Exposure Units:

C1: Oxford Lake Park

C2: Backwater Area

C3: Friendship Road to Highway 21

C4: Hwy 21 to Silver Run Road

C5: Silver Run Road to Mitchell Matson Road

C6: Mitchell Matson Road to 2,000 feet upstream of Curry Station Road

C7: Upstream of Curry Station Road to Eastaboga Creek

C8: Eastaboga Creek to Jackson Shoals Dam

C9: Jackson Shoals Dam to Highway 77

C10: Highway 77 Bridge to Lake Logan Martin

Exposure Subareas:

East: East Subarea Floodplain Soil

West: West Subarea Floodplain Soil

North: North Subarea Floodplain Soil

South: South Subarea Floodplain Soil

Central: Central Subarea Floodplain Soil

Table AD1-5. Summary of NOAEL Hazard Quotients by Exposure Unit for Receptors Exposed to Terrestrial + Aquatic Media (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1 ¹	C1 ¹	C1 ¹	C2	C2	C2	C2	C3	C3	C3	C4	C4	C4
Exposure Subarea→		East Floodplain Soil, Riparian Soil & Sediment	West Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Central Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment
Receptors↓		NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ
Aquatic+Terrestrial Birds														
Carolina Wren - 2	tPCB-mid	18.0	111.9	--	10.4	7.9	8.6	--	7.3	14.4	--	6.3	4.8	--
	tPCB-high	193.5	1205.1	--	111.9	85.1	92.3	--	78.1	154.6	--	67.7	51.6	--
	Barium ²	--	--	--	1.1	1.2	1.2	--	0.8	0.9	--	0.7	0.7	--
	Chromium	--	--	--	1.6	1.0	1.1	--	1.3	2.3	--	1.9	1.5	--
	Cobalt ²	--	--	--	0.5	0.5	0.5	--	0.5	0.6	--	0.5	0.5	--
	Lead	--	--	--	3.0	2.7	3.5	--	2.1	4.4	--	2.8	2.3	--
	Mercury	--	--	--	130.1	125.1	125.4	--	19.3	20.1	--	15.9	16.4	--
	Vanadium	--	--	--	6.0	6.0	5.4	--	6.0	6.9	--	5.1	5.0	--
Spotted Sandpiper - 1	tPCB-mid	--	--	13.4	--	--	--	32.2	--	--	22.5	--	--	9.6
	tPCB-high	--	--	144.5	--	--	--	346.7	--	--	242.0	--	--	103.7
	Barium ²	--	--	1.6	--	--	--	1.4	--	--	0.9	--	--	1.0
	Chromium	--	--	1.8	--	--	--	0.8	--	--	1.0	--	--	2.0
	Cobalt ²	--	--	0.5	--	--	--	0.3	--	--	0.3	--	--	0.2
	Lead	--	--	8.5	--	--	--	4.7	--	--	2.4	--	--	4.8
	Mercury	--	--	20.5	--	--	--	28.4	--	--	39.1	--	--	25.7
	Vanadium	--	--	12.7	--	--	--	6.9	--	--	6.0	--	--	5.8
Aquatic+Terrestrial Mammals														
Mink - 1	tPCB-mink	--	--	96.8	--	--	--	64.2	--	--	11.5	--	--	17.3
	Barium ²	--	--	0.2	--	--	--	0.2	--	--	0.1	--	--	0.1
	Chromium	--	--	0.5	--	--	--	0.2	--	--	0.2	--	--	0.3
	Cobalt ²	--	--	0.1	--	--	--	0.1	--	--	0.1	--	--	0.1
	Lead	--	--	0.2	--	--	--	0.1	--	--	0.0	--	--	0.1
	Mercury	--	--	0.1	--	--	--	1.0	--	--	0.1	--	--	0.1
	Vanadium	--	--	0.1	--	--	--	0.0	--	--	0.1	--	--	0.0
Raccoon - 1	tPCB	6.7	35.8	6.7	3.9	3.1	3.4	8.4	2.4	4.6	4.3	2.2	1.7	2.4
	Barium ²	--	--	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Chromium	--	--	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.2	0.1	0.2
	Cobalt ²	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	--	--	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Mercury	--	--	0.5	0.4	0.2	0.2	0.2	0.5	0.5	0.9	0.4	0.4	0.6
	Vanadium	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Raccoon - 2	tPCB	--	--	16.1	--	--	--	10.4	--	--	1.5	--	--	2.7
	Barium ²	--	--	0.2	--	--	--	0.1	--	--	0.1	--	--	0.0
	Chromium	--	--	0.3	--	--	--	0.1	--	--	0.1	--	--	0.1
	Cobalt ²	--	--	0.1	--	--	--	0.1	--	--	0.1	--	--	0.0
	Lead	--	--	0.3	--	--	--	0.1	--	--	0.0	--	--	0.0
	Mercury	--	--	0.1	--	--	--	2.5	--	--	0.1	--	--	0.1
	Vanadium	--	--	0.1	--	--	--	0.0	--	--	0.0	--	--	0.0

Table AD1-5. Summary of NOAEL Hazard Quotients by Exposure Unit for Receptors Exposed to Terrestrial + Aquatic Media (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		Upper AA	Upper AA	C5	C5	C5	C6	C6	C6	Middle AA	Middle AA
Exposure Subarea→		Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment
Receptors↓		NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	
Aquatic+Terrestrial Birds											
Carolina Wren - 2	tPCB-mid	7.7	--	1.0	1.2	--	0.9	1.3	--	1.1	--
	tPCB-high	82.7	--	10.7	13.0	--	9.4	14.1	--	12.2	--
	Barium ²	0.9	--	1.5	1.4	--	1.4	1.4	--	1.4	--
	Chromium	1.5	--	2.4	2.5	--	2.3	2.1	--	2.3	--
	Cobalt ²	0.5	--	0.7	0.7	--	0.7	0.7	--	0.7	--
	Lead	2.8	--	3.5	4.6	--	3.6	3.2	--	4.2	--
	Mercury	31.3	--	9.7	10.4	--	12.8	17.2	--	10.2	--
	Vanadium	5.4	--	11.6	12.2	--	11.4	9.0	--	11.1	--
Spotted Sandpiper - 1	tPCB-mid	--	10.4	--	--	2.8	--	--	2.3	--	2.4
	tPCB-high	--	112.4	--	--	30.0	--	--	25.3	--	25.7
	Barium ²	--	1.1	--	--	1.8	--	--	1.5	--	1.8
	Chromium	--	1.3	--	--	2.5	--	--	1.7	--	2.5
	Cobalt ²	--	0.3	--	--	0.7	--	--	0.7	--	0.7
	Lead	--	4.2	--	--	6.2	--	--	5.0	--	6.2
	Mercury	--	24.2	--	--	12.5	--	--	16.1	--	12.7
	Vanadium	--	6.3	--	--	10.2	--	--	9.7	--	10.2
Aquatic+Terrestrial Mammals											
Mink - 1	tPCB-mink	--	27.2	--	--	6.0	--	--	2.4	--	5.5
	Barium ²	--	0.1	--	--	0.3	--	--	0.2	--	0.3
	Chromium	--	0.2	--	--	0.6	--	--	0.5	--	0.6
	Cobalt ²	--	0.1	--	--	0.1	--	--	0.1	--	0.1
	Lead	--	0.1	--	--	0.1	--	--	0.1	--	0.1
	Mercury	--	0.3	--	--	0.2	--	--	0.2	--	0.2
	Vanadium	--	0.0	--	--	0.1	--	--	0.1	--	0.1
Raccoon - 1	tPCB	0.0	3.0	0.4	0.4	0.7	0.3	0.5	0.5	0.0	0.6
	Barium ²	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1
	Chromium	0.0	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.0	0.2
	Cobalt ²	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.1
	Mercury	0.0	0.5	0.2	0.2	0.3	0.3	0.5	0.3	0.0	0.3
	Vanadium	0.0	0.0	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0
Raccoon - 2	tPCB	--	4.4	--	--	0.9	--	--	0.3	--	0.8
	Barium ²	--	0.1	--	--	0.2	--	--	0.2	--	0.2
	Chromium	--	0.1	--	--	0.3	--	--	0.3	--	0.3
	Cobalt ²	--	0.1	--	--	0.1	--	--	0.1	--	0.1
	Lead	--	0.1	--	--	0.2	--	--	0.2	--	0.2
	Mercury	--	0.4	--	--	0.1	--	--	0.1	--	0.1
	Vanadium	--	0.0	--	--	0.1	--	--	0.1	--	0.1

Table AD1-5. Summary of NOAEL Hazard Quotients by Exposure Unit for Receptors Exposed to Terrestrial + Aquatic Media (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C7	C7	C7	C8	C8	C8	C9	C9	C9	C10 ¹	Lower AA	Lower AA
Exposure Subarea→		North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	Riparian Soil & Sediment	Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment
Receptors↓		NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ
Aquatic+Terrestrial Birds													
Carolina Wren - 2	tPCB-mid	0.9	1.2	--	1.6	1.3	--	0.8	0.2	--	--	1.1	--
	tPCB-high	9.9	13.0	--	17.0	13.8	--	9.0	2.4	--	--	12.1	--
	Barium ²	0.6	0.5	--	0.5	0.6	--	0.6	0.8	--	--	0.8	--
	Chromium	1.3	1.4	--	1.3	1.2	--	1.3	1.3	--	--	1.5	--
	Cobalt ²	0.6	0.5	--	0.5	0.5	--	0.5	0.5	--	--	0.5	--
	Lead	1.8	1.2	--	1.4	1.5	--	1.5	1.6	--	--	1.7	--
	Mercury	9.1	13.9	--	25.3	10.0	--	13.6	9.1	--	--	11.8	--
	Vanadium	6.1	6.2	--	5.0	6.0	--	4.6	7.1	--	--	7.0	--
Spotted Sandpiper - 1	tPCB-mid	--	--	2.5	--	--	2.1	--	--	2.0	1.7	--	1.8
	tPCB-high	--	--	26.5	--	--	23.1	--	--	22.1	18.3	--	18.9
	Barium ²	--	--	0.6	--	--	0.7	--	--	0.7	1.0	--	0.9
	Chromium	--	--	1.3	--	--	1.1	--	--	0.9	1.2	--	1.2
	Cobalt ²	--	--	0.2	--	--	0.2	--	--	0.2	0.3	--	0.3
	Lead	--	--	2.0	--	--	1.9	--	--	2.0	2.6	--	2.4
	Mercury	--	--	22.0	--	--	31.5	--	--	14.5	27.0	--	27.3
	Vanadium	--	--	4.4	--	--	7.1	--	--	4.6	7.8	--	7.3
Aquatic+Terrestrial Mammals													
Mink - 1	tPCB-mink	--	--	5.7	--	--	6.1	--	--	2.6	4.7	--	6.4
	Barium ²	--	--	0.0	--	--	0.0	--	--	0.1	0.1	--	0.1
	Chromium	--	--	0.2	--	--	0.2	--	--	0.2	0.3	--	0.3
	Cobalt ²	--	--	0.1	--	--	0.1	--	--	0.1	0.1	--	0.1
	Lead	--	--	0.0	--	--	0.0	--	--	0.0	0.0	--	0.0
	Mercury	--	--	0.3	--	--	0.3	--	--	0.2	0.3	--	0.3
	Vanadium	--	--	0.0	--	--	0.0	--	--	0.1	0.1	--	0.1
Raccoon - 1	tPCB	0.2	0.3	0.6	0.4	0.3	0.5	0.3	0.1	0.4	0.4	0.0	0.5
	Barium ²	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1
	Chromium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1
	Cobalt ²	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mercury	0.1	0.3	0.5	0.7	0.2	0.7	0.3	0.1	0.3	0.6	0.0	0.6
	Vanadium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Raccoon - 2	tPCB	--	--	0.9	--	--	1.1	--	--	0.3	0.8	--	1.1
	Barium ²	--	--	0.0	--	--	0.0	--	--	0.1	0.1	--	0.1
	Chromium	--	--	0.1	--	--	0.1	--	--	0.1	0.2	--	0.1
	Cobalt ²	--	--	0.0	--	--	0.0	--	--	0.1	0.1	--	0.1
	Lead	--	--	0.0	--	--	0.0	--	--	0.1	0.1	--	0.1
	Mercury	--	--	0.2	--	--	0.2	--	--	0.2	0.2	--	0.2
	Vanadium	--	--	0.0	--	--	0.0	--	--	0.0	0.0	--	0.0

Table AD1-5. Summary of NOAEL Hazard Quotients by Exposure Unit for Receptors Exposed to Terrestrial + Aquatic Media (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Notes:

NOAEL HQ* ≤ 1
NOAEL HQ* > 1 and ≤ 10
NOAEL HQ* > 10

* All HQs rounded to the nearest whole number

¹ Riparian soil in reaches C1 and C10 is based on the applicable assessment area (i.e., Upper for C1 and Lower for C10). Reach C10 was not evaluated for terrestrial receptors due to lack of floodplain soil

² Barium and cobalt are COPCs in sediment only. Soil exposures were estimated for these metals so that the complete aquatic + terrestrial dose could be estimated.

AA: assessment area

COPCs: constituent of potential concern

HQ: hazard quotient

mg/kg-day: milligrams per kilogram per day

NOAEL: no observed adverse effect level

tPCB: total polychlorinated biphenyl

TRV: toxicity reference value

--: not available

Exposure Units:

C1: Oxford Lake Park

C2: Backwater Area

C3: Friendship Road to Highway 21

C4: Hwy 21 to Silver Run Road

C5: Silver Run Road to Mitchell Matson Road

C6: Mitchell Matson Road to 2,000 feet upstream of Curry Station Road

C7: Upstream of Curry Station Road to Eastaboga Creek

C8: Eastaboga Creek to Jackson Shoals Dam

C9: Jackson Shoals Dam to Highway 77

C10: Highway 77 Bridge to Lake Logan Martin

Exposure Subareas:

East: East Subarea Floodplain Soil

West: West Subarea Floodplain Soil

North: North Subarea Floodplain Soil

South: South Subarea Floodplain Soil

Central: Central Subarea Floodplain Soil

Table AD1-6. Summary of LOAEL Hazard Quotients by Exposure Unit for Aquatic and Terrestrial Mixed Diet Receptors (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1 ¹	C1 ¹	C1 ¹	C2	C2	C2	C2	C3	C3	C3	C4	C4	C4	Upper AA
Exposure Subarea→		East Floodplain Soil, Riparian Soil & Sediment	West Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Central Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	Floodplain Soil, Riparian Soil & Sediment
Receptors↓		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Aquatic+Terrestrial Birds															
Carolina Wren - 2	tPCB-mid	6.0	37.3	--	3.5	2.6	2.9	--	2.4	4.8	--	2.1	1.6	--	2.6
	tPCB-high	64.5	401.7	--	37.3	28.4	30.8	--	26.0	51.5	--	22.6	17.2	--	27.6
	Barium ³	--	--	--	0.5	0.6	0.6	--	0.4	0.5	--	0.4	0.3	--	0.4
	Chromium	--	--	--	1.6	1.0	1.0	--	1.3	2.2	--	1.8	1.4	--	1.4
	Cobalt ³	--	--	--	0.5	0.5	0.5	--	0.5	0.6	--	0.5	0.5	--	0.5
	Lead	--	--	--	1.5	1.4	1.8	--	1.0	2.2	--	1.4	1.1	--	1.4
	Mercury	--	--	--	43.4	41.7	41.8	--	6.4	6.7	--	5.3	5.5	--	10.4
	Vanadium	--	--	--	3.0	3.0	2.7	--	3.0	3.4	--	2.5	2.4	--	2.7
Spotted Sandpiper - 1	tPCB-mid	--	--	4.5	--	--	--	10.7	--	--	7.5	--	--	3.2	--
	tPCB-high	--	--	48.2	--	--	--	115.6	--	--	80.7	--	--	34.6	--
	Barium ³	--	--	0.8	--	--	--	0.7	--	--	0.4	--	--	0.5	--
	Chromium	--	--	1.7	--	--	--	0.7	--	--	0.9	--	--	1.9	--
	Cobalt ³	--	--	0.5	--	--	--	0.3	--	--	0.3	--	--	0.2	--
	Lead	--	--	4.2	--	--	--	2.4	--	--	1.2	--	--	2.4	--
	Mercury	--	--	6.8	--	--	--	9.5	--	--	13.0	--	--	8.6	--
	Vanadium	--	--	6.2	--	--	--	3.4	--	--	3.0	--	--	2.9	--
Aquatic+Terrestrial Mammals															
Mink - 1	tPCB-mink	--	--	48.4	--	--	--	32.1	--	--	5.8	--	--	8.7	--
Mink - 1 (Alternate TRV) ²	tPCB-mink	--	--	96.8	--	--	--	64.2	--	--	11.5	--	--	17.3	--
	Barium ³	--	--	0.1	--	--	--	0.1	--	--	0.0	--	--	0.0	--
	Chromium	--	--	0.4	--	--	--	0.1	--	--	0.2	--	--	0.2	--
	Cobalt ³	--	--	0.1	--	--	--	0.1	--	--	0.1	--	--	0.1	--
	Lead	--	--	0.1	--	--	--	0.0	--	--	0.0	--	--	0.0	--
	Mercury	--	--	0.1	--	--	--	0.5	--	--	0.1	--	--	0.1	--
	Vanadium	--	--	0.0	--	--	--	0.0	--	--	0.0	--	--	0.0	--
Raccoon - 1	tPCB	0.0	0.0	2.3	1.3	1.1	1.1	2.8	0.8	1.6	1.5	0.7	0.6	0.8	0.0
	Barium ³	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Chromium	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.2	0.1	0.2	0.0
	Cobalt ³	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0
	Mercury	0.0	0.0	0.2	0.2	0.1	0.1	0.1	0.3	0.3	0.4	0.2	0.2	0.3	0.0
	Vanadium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Raccoon - 2	tPCB	--	--	5.5	--	--	--	3.5	--	--	0.5	--	--	0.9	--
	Barium ³	--	--	0.1	--	--	--	0.1	--	--	0.0	--	--	0.0	--
	Chromium	--	--	0.2	--	--	--	0.1	--	--	0.1	--	--	0.1	--
	Cobalt ³	--	--	0.1	--	--	--	0.0	--	--	0.0	--	--	0.0	--
	Lead	--	--	0.1	--	--	--	0.1	--	--	0.0	--	--	0.0	--
	Mercury	--	--	0.0	--	--	--	1.2	--	--	0.1	--	--	0.1	--
	Vanadium	--	--	0.1	--	--	--	0.0	--	--	0.0	--	--	0.0	--

Table AD1-6. Summary of LOAEL Hazard Quotients by Exposure Unit for Aquatic and Terrestrial Mixed Diet Receptors (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		Upper AA	C5	C5	C5	C6	C6	C6	Middle AA	Middle AA	C7	C7	C7	C8	C8	C8
Exposure Subarea→		Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment
Receptors↓		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Aquatic+Terrestrial Birds																
Carolina Wren - 2	tPCB-mid	--	0.3	0.4	--	0.3	0.4	--	0.4	--	0.3	0.4	--	0.5	0.4	--
	tPCB-high	--	3.6	4.3	--	3.1	4.7	--	4.1	--	3.3	4.3	--	5.7	4.6	--
	Barium ³	--	0.7	0.7	--	0.7	0.7	--	0.7	--	0.3	0.2	--	0.3	0.3	--
	Chromium	--	2.2	2.4	--	2.2	2.0	--	2.2	--	1.2	1.4	--	1.2	1.1	--
	Cobalt ³	--	0.7	0.7	--	0.7	0.7	--	0.7	--	0.6	0.5	--	0.5	0.5	--
	Lead	--	1.7	2.3	--	1.8	1.6	--	2.1	--	0.9	0.6	--	0.7	0.7	--
	Mercury	--	3.2	3.5	--	4.3	5.7	--	3.4	--	3.0	4.6	--	8.4	3.3	--
	Vanadium	--	5.7	6.0	--	5.6	4.4	--	5.4	--	3.0	3.1	--	2.5	2.9	--
Spotted Sandpiper - 1	tPCB-mid	3.5	--	--	0.9	--	--	0.8	--	0.8	--	--	0.8	--	--	0.7
	tPCB-high	37.5	--	--	10.0	--	--	8.4	--	8.6	--	--	8.8	--	--	7.7
	Barium ³	0.6	--	--	0.9	--	--	0.7	--	0.9	--	--	0.3	--	--	0.4
	Chromium	1.2	--	--	2.4	--	--	1.6	--	2.4	--	--	1.2	--	--	1.1
	Cobalt ³	0.2	--	--	0.7	--	--	0.6	--	0.7	--	--	0.2	--	--	0.2
	Lead	2.1	--	--	3.1	--	--	2.5	--	3.1	--	--	1.0	--	--	0.9
	Mercury	8.1	--	--	4.2	--	--	5.4	--	4.2	--	--	7.3	--	--	10.5
	Vanadium	3.1	--	--	5.0	--	--	4.7	--	5.0	--	--	2.2	--	--	3.5
Aquatic+Terrestrial Mammals																
Mink - 1	tPCB-mink	13.6	--	--	3.0	--	--	1.2	--	2.8	--	--	2.8	--	--	3.1
Mink - 1 (Alternate TRV) ²	tPCB-mink	27.2	--	--	6.0	--	--	2.4	--	5.5	--	--	5.7	--	--	6.1
	Barium ³	0.0	--	--	0.1	--	--	0.1	--	0.1	--	--	0.0	--	--	0.0
	Chromium	0.2	--	--	0.5	--	--	0.4	--	0.5	--	--	0.2	--	--	0.2
	Cobalt ³	0.1	--	--	0.1	--	--	0.1	--	0.1	--	--	0.1	--	--	0.1
	Lead	0.0	--	--	0.1	--	--	0.1	--	0.1	--	--	0.0	--	--	0.0
	Mercury	0.2	--	--	0.1	--	--	0.1	--	0.1	--	--	0.1	--	--	0.2
	Vanadium	0.0	--	--	0.0	--	--	0.0	--	0.0	--	--	0.0	--	--	0.0
Raccoon - 1	tPCB	1.0	0.1	0.1	0.2	0.1	0.2	0.2	0.0	0.2	0.1	0.1	0.2	0.1	0.1	0.2
	Barium ³	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
	Chromium	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.0	0.2	0.1	0.1	0.1	0.1	0.1	0.1
	Cobalt ³	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mercury	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.0	0.1	0.1	0.2	0.2	0.4	0.1	0.4
	Vanadium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Raccoon - 2	tPCB	1.5	--	--	0.3	--	--	0.1	--	0.3	--	--	0.3	--	--	0.4
	Barium ³	0.0	--	--	0.1	--	--	0.1	--	0.1	--	--	0.0	--	--	0.0
	Chromium	0.1	--	--	0.3	--	--	0.3	--	0.3	--	--	0.1	--	--	0.1
	Cobalt ³	0.0	--	--	0.1	--	--	0.1	--	0.1	--	--	0.0	--	--	0.0
	Lead	0.0	--	--	0.1	--	--	0.1	--	0.1	--	--	0.0	--	--	0.0
	Mercury	0.2	--	--	0.1	--	--	0.1	--	0.1	--	--	0.1	--	--	0.1
	Vanadium	0.0	--	--	0.0	--	--	0.0	--	0.0	--	--	0.0	--	--	0.0

Table AD1-6. Summary of LOAEL Hazard Quotients by Exposure Unit for Aquatic and Terrestrial Mixed Diet Receptors (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C9	C9	C9	C10 ¹	Lower AA	Lower AA
Exposure Subarea→		North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	Riparian Soil & Sediment	Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment
Receptors↓		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Aquatic+Terrestrial Birds							
Carolina Wren - 2	tPCB-mid	0.3	0.1	--	--	0.4	--
	tPCB-high	3.0	0.8	--	--	4.0	--
	Barium ³	0.3	0.4	--	--	0.4	--
	Chromium	1.3	1.3	--	--	1.4	--
	Cobalt ³	0.5	0.5	--	--	0.5	--
	Lead	0.7	0.8	--	--	0.9	--
	Mercury	4.5	3.0	--	--	3.9	--
	Vanadium	2.3	3.5	--	--	3.4	--
Spotted Sandpiper - 1	tPCB-mid	--	--	0.7	0.6	--	0.6
	tPCB-high	--	--	7.4	6.1	--	6.3
	Barium ³	--	--	0.3	0.5	--	0.4
	Chromium	--	--	0.9	1.2	--	1.1
	Cobalt ³	--	--	0.2	0.3	--	0.3
	Lead	--	--	1.0	1.3	--	1.2
	Mercury	--	--	4.8	9.0	--	9.1
	Vanadium	--	--	2.3	3.9	--	3.6
Aquatic+Terrestrial Mammals							
Mink - 1	tPCB-mink	--	--	1.3	2.3	--	3.2
Mink - 1 (Alternate TRV) ²	tPCB-mink	--	--	2.6	4.7	--	6.4
	Barium ³	--	--	0.0	0.0	--	0.0
	Chromium	--	--	0.2	0.3	--	0.2
	Cobalt ³	--	--	0.1	0.1	--	0.1
	Lead	--	--	0.0	0.0	--	0.0
	Mercury	--	--	0.1	0.2	--	0.2
	Vanadium	--	--	0.0	0.0	--	0.0
Raccoon - 1	tPCB	0.1	0.0	0.1	0.1	0.0	0.2
	Barium ³	0.0	0.0	0.0	0.0	0.0	0.0
	Chromium	0.1	0.1	0.1	0.1	0.0	0.1
	Cobalt ³	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.0	0.0	0.0	0.0	0.0	0.0
	Mercury	0.2	0.1	0.2	0.3	0.0	0.3
	Vanadium	0.0	0.0	0.0	0.0	0.0	0.0
Raccoon - 2	tPCB	--	--	0.1	0.3	--	0.4
	Barium ³	--	--	0.0	0.0	--	0.0
	Chromium	--	--	0.1	0.1	--	0.1
	Cobalt ³	--	--	0.0	0.0	--	0.0
	Lead	--	--	0.0	0.0	--	0.0
	Mercury	--	--	0.1	0.1	--	0.1
	Vanadium	--	--	0.0	0.0	--	0.0

Table AD1-6. Summary of LOAEL Hazard Quotients by Exposure Unit for Aquatic and Terrestrial Mixed Diet Receptors (Modeled Tissue)
Anniston PCB Site, Anniston, Alabama

Notes:

NOAEL HQ* ≤ 1
LOAEL HQ* ≤ 1
LOAEL HQ* > 1 and ≤ 10
LOAEL HQ* > 10

* All HQs rounded to the nearest whole number

¹ Riparian soil in reaches C1 and C10 is based on the applicable assessment area (i.e., Upper for C1 and Lower for C10). Reach C10 was not evaluated for terrestrial receptors due to lack of floodplain soil.

² Alternate TRVs were selected from Restum et al. (1998) based on growth. The LOAEL TRV is 0.05 mg/kg-day.

³ Barium and cobalt are COPCs in sediment only. Soil exposures were estimated for these metals so that the complete aquatic + terrestrial dose could be estimated.

AA: assessment area

COPCs: constituent of potential concern

HQ: hazard quotient

mg/kg-day: milligrams per kilogram per day

NOAEL: no observed adverse effect level

tPCB: total polychlorinated biphenyl

TRV: toxicity reference value

--: not available

Exposure Units:

C1: Oxford Lake Park

C2: Backwater Area

C3: Friendship Road to Highway 21

C4: Hwy 21 to Silver Run Road

C5: Silver Run Road to Mitchell Matson Road

C6: Mitchell Matson Road to 2,000 feet upstream of Curry Station Road

C7: Upstream of Curry Station Road to Eastaboga Creek

C8: Eastaboga Creek to Jackson Shoals Dam

C9: Jackson Shoals Dam to Highway 77

C10: Highway 77 Bridge to Lake Logan Martin

Exposure Subareas:

East: East Subarea Floodplain Soil

West: West Subarea Floodplain Soil

North: North Subarea Floodplain Soil

South: South Subarea Floodplain Soil

Central: Central Subarea Floodplain Soil

References:

Restum, J., S. Bursian, J. Giesy, J. Render, W. Helferich, E. Shipp, D. Verbrugge, and R. Aulerich. 1998. Multigenerational study of the effects of consumption of PCB-contaminated carp from Saginaw Bay, Lake Huron, on mink: 1. Effects on mink reproduction, kit growth, and survival, and selected biological parameters. J. Toxicol. Environ. Health Part A 54: 343 375.

Table AD1-7. Summary of Terrestrial and Aquatic Bird Egg Tissue NOAEL Hazard Quotients by Exposure Unit
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1 ¹	C1 ¹	C1 ¹	C2	C2	C2	C2	C3	C3	C3	C4	C4	C4	Upper AA	Upper AA	C5	C5
Exposure Subarea→		East	West	Riparian/ Aquatic	North	South	Central	Riparian/ Aquatic	North	South	Riparian/ Aquatic	North	South	Riparian/ Aquatic	Soil Combined	Riparian/ Aquatic	North	South
Receptors↓		NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ
Terrestrial Birds																		
Mourning Dove - mid	tPCB-med	0.2	3.2	--	0.1	0.0	0.0	--	0.2	0.4	--	0.1	0.1	--	0.1	--	0.0	0.0
Mourning Dove - high	tPCB-high	2.4	42.2	--	1.2	0.1	0.4	--	2.8	5.8	--	2.0	1.3	--	2.0	--	0.2	0.3
	Mercury	--	--	--	0.0	0.0	0.0	--	0.1	0.1	--	0.1	0.1	--	0.1	--	0.0	0.0
Blue Jay - mid	tPCB-med	0.2	4.2	--	0.1	0.0	0.0	--	0.3	0.6	--	0.2	0.1	--	0.2	--	0.0	0.0
Blue Jay - high	tPCB-high	3.1	55.6	--	1.5	0.1	0.5	--	3.7	7.6	--	2.5	1.7	--	2.6	--	0.3	0.4
	Mercury	--	--	--	0.1	0.0	0.0	--	0.1	0.1	--	0.1	0.1	--	0.1	--	0.0	0.0
Carolina Wren - 1 - mid	tPCB-med	0.2	3.5	--	0.1	0.0	0.0	--	0.2	0.5	--	0.2	0.1	--	0.2	--	0.0	0.0
Carolina Wren - 1 - high	tPCB-high	2.5	46.4	--	1.2	0.1	0.4	--	3.0	6.3	--	2.1	1.4	--	2.1	--	0.2	0.3
	Mercury	--	--	--	0.0	0.0	0.0	--	0.1	0.1	--	0.1	0.1	--	0.1	--	0.0	0.0
Carolina Wren - 2 - mid	tPCB-med	0.2	1.5	--	0.1	0.1	0.1	--	0.1	0.2	--	0.1	0.1	--	0.1	--	0.0	0.0
Carolina Wren - 2 - high	tPCB-high	3.2	19.9	--	1.8	1.4	1.5	--	1.3	2.6	--	1.1	0.9	--	1.4	--	0.2	0.2
	Mercury	--	--	--	0.4	0.4	0.4	--	0.1	0.1	--	0.1	0.1	--	0.1	--	0.0	0.0
Hawk - mid	tPCB-med	22.8	27.5	--	14.3	13.8	14.0	--	2.5	3.1	--	4.2	4.0	--	6.5	--	1.1	1.1
Hawk - high	tPCB-high	304.6	367.1	--	190.1	183.7	186.2	--	33.8	41.4	--	55.4	53.1	--	86.0	--	14.5	15.2
	Mercury	--	--	--	1.3	1.2	1.2	--	0.3	0.3	--	0.2	0.2	--	0.4	--	0.2	0.2
Aquatic Birds																		
Tree Swallow	tPCB-med	--	--	2.3	--	--	--	1.4	--	--	0.2	--	--	0.4	--	0.6	--	--
	tPCB-high	--	--	31.0	--	--	--	19.3	--	--	2.1	--	--	4.7	--	7.9	--	--
	Mercury	--	--	0.0	--	--	--	0.3	--	--	0.0	--	--	0.0	--	0.1	--	--
Spotted Sandpiper - 1	tPCB-med	--	--	0.4	--	--	--	0.9	--	--	0.6	--	--	0.3	--	0.3	--	--
	tPCB-high	--	--	5.1	--	--	--	12.3	--	--	8.6	--	--	3.7	--	4.0	--	--
	Mercury	--	--	0.1	--	--	--	0.2	--	--	0.3	--	--	0.2	--	0.2	--	--
Spotted Sandpiper - 2	tPCB-med	--	--	1.9	--	--	--	1.4	--	--	0.3	--	--	0.5	--	0.8	--	--
	tPCB-high	--	--	24.7	--	--	--	18.2	--	--	4.4	--	--	7.3	--	10.2	--	--
	Mercury	--	--	0.0	--	--	--	1.1	--	--	0.0	--	--	0.0	--	0.2	--	--
Kingfisher - 1	tPCB-med	--	--	8.9	--	--	--	5.5	--	--	0.6	--	--	1.3	--	2.3	--	--
	tPCB-high	--	--	118.3	--	--	--	73.7	--	--	8.1	--	--	17.9	--	30.3	--	--
	Mercury	--	--	0.0	--	--	--	0.7	--	--	0.0	--	--	0.0	--	0.1	--	--
Kingfisher - 2	tPCB-med	--	--	7.2	--	--	--	4.5	--	--	0.5	--	--	1.1	--	1.8	--	--
	tPCB-high	--	--	95.6	--	--	--	59.5	--	--	6.6	--	--	14.5	--	24.5	--	--
	Mercury	--	--	0.0	--	--	--	0.6	--	--	0.0	--	--	0.0	--	0.1	--	--
Great Blue Heron	tPCB-med	--	--	196.9	--	--	--	122.7	--	--	13.6	--	--	29.9	--	50.4	--	--
	tPCB-high	--	--	2625.5	--	--	--	1635.5	--	--	180.9	--	--	398.1	--	672.4	--	--
	Mercury	--	--	0.5	--	--	--	21.9	--	--	0.8	--	--	0.8	--	3.7	--	--
Osprey	tPCB-med	--	--	57.4	--	--	--	35.7	--	--	3.9	--	--	8.7	--	14.7	--	--
	tPCB-high	--	--	765.3	--	--	--	476.5	--	--	52.5	--	--	115.9	--	195.9	--	--
	Mercury	--	--	0.1	--	--	--	5.9	--	--	0.2	--	--	0.2	--	1.0	--	--

Table AD1-7. Summary of Terrestrial and Aquatic Bird Egg Tissue NOAEL Hazard Quotients by Exposure Unit
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C5	C6	C6	C6	Middle AA	Middle AA	C7	C7	C7	C8	C8	C8	C9	C9	C9	C10 ¹	Lower AA	Lower AA
Exposure Subarea→		Riparian/ Aquatic	North	South	Riparian/ Aquatic	Soil Combined	Riparian/ Aquatic	North	South	Riparian/ Aquatic	North	South	Riparian/ Aquatic	North	South	Riparian/ Aquatic	Riparian/ Aquatic	Soil Combined	Riparian/ Aquatic
Receptors↓		NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ
Terrestrial Birds																			
Mourning Dove - mid	tPCB-med	--	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	--	0.0	--
Mourning Dove - high	tPCB-high	--	0.4	0.6	--	0.3	--	0.2	0.3	--	0.4	0.3	--	0.4	0.1	--	--	0.2	--
	Mercury	--	0.0	0.1	--	0.0	--	0.0	0.0	--	0.1	0.0	--	0.0	0.0	--	--	0.0	--
Blue Jay - mid	tPCB-med	--	0.0	0.1	--	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	--	0.0	--
Blue Jay - high	tPCB-high	--	0.5	0.7	--	0.4	--	0.2	0.4	--	0.5	0.4	--	0.4	0.1	--	--	0.2	--
	Mercury	--	0.1	0.1	--	0.0	--	0.0	0.1	--	0.2	0.0	--	0.1	0.0	--	--	0.0	--
Carolina Wren - 1 - mid	tPCB-med	--	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	--	0.0	--
Carolina Wren - 1 - high	tPCB-high	--	0.4	0.6	--	0.3	--	0.1	0.3	--	0.4	0.3	--	0.3	0.1	--	--	0.2	--
	Mercury	--	0.1	0.1	--	0.0	--	0.0	0.1	--	0.1	0.0	--	0.1	0.0	--	--	0.0	--
Carolina Wren - 2 - mid	tPCB-med	--	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	--	0.0	--
Carolina Wren - 2 - high	tPCB-high	--	0.2	0.2	--	0.2	--	0.2	0.2	--	0.3	0.2	--	0.1	0.0	--	--	0.2	--
	Mercury	--	0.0	0.1	--	0.0	--	0.0	0.0	--	0.1	0.0	--	0.0	0.0	--	--	0.0	--
Hawk - mid	tPCB-med	--	0.5	0.6	--	1.1	--	0.6	0.6	--	0.8	0.7	--	0.4	0.2	--	--	0.7	--
Hawk - high	tPCB-high	--	6.7	7.8	--	14.2	--	7.5	8.6	--	10.1	9.2	--	5.5	3.1	--	--	8.9	--
	Mercury	--	0.2	0.3	--	0.2	--	0.2	0.3	--	0.6	0.2	--	0.3	0.2	--	--	0.2	--
Aquatic Birds																			
Tree Swallow	tPCB-mid	0.0	--	--	0.0	--	0.0	--	--	0.0	--	--	0.0	--	--	0.0	0.0	--	0.0
	tPCB-high	0.0	--	--	0.0	--	0.0	--	--	0.0	--	--	0.1	--	--	0.0	0.0	--	0.1
	Mercury	0.0	--	--	0.0	--	0.0	--	--	0.0	--	--	0.0	--	--	0.0	0.0	--	0.0
Spotted Sandpiper - 1	tPCB-mid	0.1	--	--	0.1	--	0.1	--	--	0.1	--	--	0.1	--	--	0.1	0.0	--	0.1
	tPCB-high	1.1	--	--	0.9	--	0.9	--	--	0.9	--	--	0.8	--	--	0.8	0.7	--	0.7
	Mercury	0.1	--	--	0.1	--	0.1	--	--	0.2	--	--	0.2	--	--	0.1	0.2	--	0.2
Spotted Sandpiper - 2	tPCB-mid	0.3	--	--	0.1	--	0.3	--	--	0.3	--	--	0.3	--	--	0.1	0.3	--	0.3
	tPCB-high	3.7	--	--	1.3	--	3.5	--	--	3.8	--	--	4.2	--	--	1.7	3.4	--	4.4
	Mercury	0.0	--	--	0.0	--	0.0	--	--	0.0	--	--	0.0	--	--	0.0	0.0	--	0.0
Kingfisher - 1	tPCB-mid	0.6	--	--	0.1	--	0.6	--	--	0.6	--	--	0.7	--	--	0.2	0.5	--	0.7
	tPCB-high	8.1	--	--	1.6	--	7.4	--	--	7.7	--	--	8.8	--	--	2.2	6.3	--	9.5
	Mercury	0.1	--	--	0.1	--	0.1	--	--	0.1	--	--	0.1	--	--	0.1	0.1	--	0.1
Kingfisher - 2	tPCB-mid	0.5	--	--	0.1	--	0.4	--	--	0.4	--	--	0.5	--	--	0.1	0.4	--	0.6
	tPCB-high	6.3	--	--	1.3	--	5.8	--	--	5.9	--	--	6.8	--	--	1.7	4.9	--	7.4
	Mercury	0.1	--	--	0.1	--	0.1	--	--	0.1	--	--	0.1	--	--	0.1	0.1	--	0.1
Great Blue Heron	tPCB-mid	10.7	--	--	2.2	--	9.9	--	--	11.0	--	--	12.5	--	--	3.1	9.0	--	13.6
	tPCB-high	143.2	--	--	29.3	--	131.4	--	--	146.8	--	--	166.9	--	--	41.7	120.4	--	181.6
	Mercury	1.2	--	--	1.2	--	1.2	--	--	1.4	--	--	1.4	--	--	1.4	1.4	--	1.8
Osprey	tPCB-mid	3.2	--	--	0.6	--	2.9	--	--	3.2	--	--	3.7	--	--	0.9	2.7	--	4.0
	tPCB-high	42.2	--	--	8.6	--	38.7	--	--	43.3	--	--	49.2	--	--	12.2	35.5	--	53.6
	Mercury	0.3	--	--	0.3	--	0.3	--	--	0.4	--	--	0.4	--	--	0.4	0.4	--	0.5

Table AD1-7. Summary of Terrestrial and Aquatic Bird Egg Tissue NOAEL Hazard Quotients by Exposure Unit
Anniston PCB Site, Anniston, Alabama

Notes:

NOAEL HQ* ≤ 1
NOAEL HQ* > 1 and ≤ 10
NOAEL HQ* > 10

* All HQs rounded to the nearest whole number

¹ Riparian soil in reaches C1 and C10 is based on the applicable assessment area (i.e., Upper for C1 and Lower for C10). Reach C10 was not evaluated for terrestrial receptors due to lack of floodplain soil.

HQ: hazard quotient

NOAEL: no observed adverse effect level

tPCB: total polychlorinated biphenyl

TRV: toxicity reference value

--: not available

Exposure Units:

C1: Oxford Lake Park

C2: Backwater Area

C3: Friendship Road to Highway 21

C4: Hwy 21 to Silver Run Road

C5: Silver Run Road to Mitchell Matson Road

C6: Mitchell Matson Road to 2,000 feet upstream of Curry Station Road

C7: Upstream of Curry Station Road to Eastaboga Creek

C8: Eastaboga Creek to Jackson Shoals Dam

C9: Jackson Shoals Dam to Highway 77

C10: Highway 77 Bridge to Lake Logan Martin

Exposure Subareas:

East: East Subarea Floodplain Soil

West: West Subarea Floodplain Soil

North: North Subarea Floodplain Soil

South: South Subarea Floodplain Soil

Central: Central Subarea Floodplain Soil

Table AD1-8. Summary of Terrestrial and Aquatic Bird Egg Tissue LOAEL Hazard Quotients by Exposure Unit
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1 ¹	C1 ¹	C1 ¹	C2	C2	C2	C2	C3	C3	C3	C4	C4	C4	Upper	Upper	C5	C5	C5
Exposure Subarea→		East	West	Riparian/ Aquatic	North	South	Central	Riparian/ Aquatic	North	South	Riparian/ Aquatic	North	South	Riparian/ Aquatic	Soil Combined	Riparian/ Aquatic	North	South	Riparian/ Aquatic
Receptors↓		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Terrestrial Birds																			
Mourning Dove - mid	tPCB-med	0.1	1.3	--	0.0	0.0	0.0	--	0.1	0.2	--	0.1	0.0	--	0.1	--	0.0	0.0	--
Mourning Dove - high	tPCB-high	1.1	19.7	--	0.5	0.1	0.2	--	1.3	2.7	--	0.9	0.6	--	0.9	--	0.1	0.2	--
	Mercury	--	--	--	0.0	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	--	0.0	0.0	--
Blue Jay - mid	tPCB-med	0.1	1.8	--	0.0	0.0	0.0	--	0.1	0.2	--	0.1	0.1	--	0.1	--	0.0	0.0	--
Blue Jay - high	tPCB-high	1.4	25.9	--	0.7	0.1	0.2	--	1.7	3.6	--	1.2	0.8	--	1.2	--	0.1	0.2	--
	Mercury	--	--	--	0.0	0.0	0.0	--	0.1	0.1	--	0.0	0.0	--	0.0	--	0.0	0.0	--
Carolina Wren - 1 - mid	tPCB-med	0.1	1.5	--	0.0	0.0	0.0	--	0.1	0.2	--	0.1	0.0	--	0.1	--	0.0	0.0	--
Carolina Wren - 1 - high	tPCB-high	1.2	21.7	--	0.6	0.0	0.2	--	1.4	3.0	--	1.0	0.6	--	1.0	--	0.1	0.1	--
	Mercury	--	--	--	0.0	0.0	0.0	--	0.1	0.1	--	0.0	0.0	--	0.0	--	0.0	0.0	--
Carolina Wren - 2 - mid	tPCB-med	0.1	0.6	--	0.1	0.0	0.0	--	0.0	0.1	--	0.0	0.0	--	0.0	--	0.0	0.0	--
Carolina Wren - 2 - high	tPCB-high	1.5	9.3	--	0.9	0.7	0.7	--	0.6	1.2	--	0.5	0.4	--	0.6	--	0.1	0.1	--
	Mercury	--	--	--	0.2	0.2	0.2	--	0.0	0.0	--	0.0	0.0	--	0.1	--	0.0	0.0	--
Hawk - mid	tPCB-med	9.7	11.7	--	6.0	5.8	5.9	--	1.1	1.3	--	1.8	1.7	--	2.7	--	0.5	0.5	--
Hawk - high	tPCB-high	142.2	171.3	--	88.7	85.7	86.9	--	15.8	19.3	--	25.8	24.8	--	40.1	--	6.8	7.1	--
	Mercury	--	--	--	0.7	0.7	0.7	--	0.1	0.1	--	0.1	0.1	--	0.2	--	0.1	0.1	--
Aquatic Birds																			
Tree Swallow	tPCB-mid	--	--	1.0	--	--	--	0.6	--	--	0.1	--	--	0.1	--	0.3	--	--	0.0
	tPCB-high	--	--	14.4	--	--	--	9.0	--	--	1.0	--	--	2.2	--	3.7	--	--	0.0
	Mercury	--	--	0.0	--	--	--	0.2	--	--	0.0	--	--	0.0	--	0.0	--	--	0.0
Spotted Sandpiper - 1	tPCB-mid	--	--	0.2	--	--	--	0.4	--	--	0.3	--	--	0.1	--	0.1	--	--	0.0
	tPCB-high	--	--	2.4	--	--	--	5.7	--	--	4.0	--	--	1.7	--	1.9	--	--	0.5
	Mercury	--	--	0.1	--	--	--	0.1	--	--	0.2	--	--	0.1	--	0.1	--	--	0.0
Spotted Sandpiper - 2	tPCB-mid	--	--	0.8	--	--	--	0.6	--	--	0.1	--	--	0.2	--	0.3	--	--	0.1
	tPCB-high	--	--	11.5	--	--	--	8.5	--	--	2.1	--	--	3.4	--	4.8	--	--	1.7
	Mercury	--	--	0.0	--	--	--	0.6	--	--	0.0	--	--	0.0	--	0.1	--	--	0.0
Kingfisher - 1	tPCB-mid	--	--	3.8	--	--	--	2.3	--	--	0.3	--	--	0.6	--	1.0	--	--	0.3
	tPCB-high	--	--	55.2	--	--	--	34.4	--	--	3.8	--	--	8.4	--	14.1	--	--	3.8
	Mercury	--	--	0.0	--	--	--	0.4	--	--	0.0	--	--	0.0	--	0.1	--	--	0.0
Kingfisher - 2	tPCB-mid	--	--	3.0	--	--	--	1.9	--	--	0.2	--	--	0.5	--	0.8	--	--	0.2
	tPCB-high	--	--	44.6	--	--	--	27.8	--	--	3.1	--	--	6.8	--	11.4	--	--	2.9
	Mercury	--	--	0.0	--	--	--	0.3	--	--	0.0	--	--	0.0	--	0.1	--	--	0.0
Great Blue Heron	tPCB-mid	--	--	83.5	--	--	--	52.0	--	--	5.8	--	--	12.7	--	21.4	--	--	4.6
	tPCB-high	--	--	1225.2	--	--	--	763.2	--	--	84.4	--	--	185.8	--	313.8	--	--	66.8
	Mercury	--	--	0.3	--	--	--	12.0	--	--	0.5	--	--	0.5	--	2.0	--	--	0.6
Osprey	tPCB-mid	--	--	24.4	--	--	--	15.2	--	--	1.7	--	--	3.7	--	6.2	--	--	1.3
	tPCB-high	--	--	357.2	--	--	--	222.4	--	--	24.5	--	--	54.1	--	91.4	--	--	19.7
	Mercury	--	--	0.1	--	--	--	3.3	--	--	0.1	--	--	0.1	--	0.5	--	--	0.2

Table AD1-8. Summary of Terrestrial and Aquatic Bird Egg Tissue LOAEL Hazard Quotients by Exposure Unit
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C6	C6	C6	Middle	Middle	C7	C7	C7	C8	C8	C8	C9	C9	C9	C10 ¹	Lower	Lower
Exposure Subarea→		North	South	Riparian/ Aquatic	Soil Combined	Riparian/ Aquatic	North	South	Riparian/ Aquatic	North	South	Riparian/ Aquatic	North	South	Riparian/ Aquatic	Riparian/ Aquatic	Soil Combined	Riparian/ Aquatic
Receptors↓		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Terrestrial Birds																		
Mourning Dove - mid	tPCB-med	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	--	0.0	--
Mourning Dove - high	tPCB-high	0.2	0.3	--	0.2	--	0.1	0.1	--	0.2	0.1	--	0.2	0.0	--	--	0.1	--
	Mercury	0.0	0.0	--	0.0	--	0.0	0.0	--	0.1	0.0	--	0.0	0.0	--	--	0.0	--
Blue Jay - mid	tPCB-med	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	--	0.0	--
Blue Jay - high	tPCB-high	0.2	0.3	--	0.2	--	0.1	0.2	--	0.2	0.2	--	0.2	0.0	--	--	0.1	--
	Mercury	0.0	0.1	--	0.0	--	0.0	0.0	--	0.1	0.0	--	0.0	0.0	--	--	0.0	--
Carolina Wren - 1 - mid	tPCB-med	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	--	0.0	--
Carolina Wren - 1 - high	tPCB-high	0.2	0.3	--	0.1	--	0.1	0.1	--	0.2	0.1	--	0.2	0.0	--	--	0.1	--
	Mercury	0.0	0.0	--	0.0	--	0.0	0.0	--	0.1	0.0	--	0.0	0.0	--	--	0.0	--
Carolina Wren - 2 - mid	tPCB-med	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	--	0.0	--
Carolina Wren - 2 - high	tPCB-high	0.1	0.1	--	0.1	--	0.1	0.1	--	0.1	0.1	--	0.1	0.0	--	--	0.1	--
	Mercury	0.0	0.0	--	0.0	--	0.0	0.0	--	0.0	0.0	--	0.0	0.0	--	--	0.0	--
Hawk - mid	tPCB-med	0.2	0.2	--	0.5	--	0.2	0.3	--	0.3	0.3	--	0.2	0.1	--	--	0.3	--
Hawk - high	tPCB-high	3.1	3.6	--	6.6	--	3.5	4.0	--	4.7	4.3	--	2.6	1.4	--	--	4.1	--
	Mercury	0.1	0.2	--	0.1	--	0.1	0.2	--	0.4	0.1	--	0.2	0.1	--	--	0.1	--
Aquatic Birds																		
Tree Swallow	tPCB-mid	--	--	0.0	--	0.0	--	--	0.0	--	--	0.0	--	--	0.0	0.0	--	0.0
	tPCB-high	--	--	0.0	--	0.0	--	--	0.0	--	--	0.0	--	--	0.0	0.0	--	0.0
	Mercury	--	--	0.0	--	0.0	--	--	0.0	--	--	0.0	--	--	0.0	0.0	--	0.0
Spotted Sandpiper - 1	tPCB-mid	--	--	0.0	--	0.0	--	--	0.0	--	--	0.0	--	--	0.0	0.0	--	0.0
	tPCB-high	--	--	0.4	--	0.4	--	--	0.4	--	--	0.4	--	--	0.4	0.3	--	0.3
	Mercury	--	--	0.1	--	0.0	--	--	0.1	--	--	0.1	--	--	0.1	0.1	--	0.1
Spotted Sandpiper - 2	tPCB-mid	--	--	0.0	--	0.1	--	--	0.1	--	--	0.1	--	--	0.1	0.1	--	0.1
	tPCB-high	--	--	0.6	--	1.6	--	--	1.8	--	--	1.9	--	--	0.8	1.6	--	2.0
	Mercury	--	--	0.0	--	0.0	--	--	0.0	--	--	0.0	--	--	0.0	0.0	--	0.0
Kingfisher - 1	tPCB-mid	--	--	0.1	--	0.2	--	--	0.2	--	--	0.3	--	--	0.1	0.2	--	0.3
	tPCB-high	--	--	0.8	--	3.5	--	--	3.6	--	--	4.1	--	--	1.0	2.9	--	4.4
	Mercury	--	--	0.0	--	0.0	--	--	0.0	--	--	0.0	--	--	0.0	0.0	--	0.0
Kingfisher - 2	tPCB-mid	--	--	0.0	--	0.2	--	--	0.2	--	--	0.2	--	--	0.1	0.2	--	0.2
	tPCB-high	--	--	0.6	--	2.7	--	--	2.8	--	--	3.2	--	--	0.8	2.3	--	3.4
	Mercury	--	--	0.0	--	0.0	--	--	0.0	--	--	0.0	--	--	0.0	0.0	--	0.0
Great Blue Heron	tPCB-mid	--	--	0.9	--	4.2	--	--	4.7	--	--	5.3	--	--	1.3	3.8	--	5.8
	tPCB-high	--	--	13.7	--	61.3	--	--	68.5	--	--	77.9	--	--	19.5	56.2	--	84.7
	Mercury	--	--	0.6	--	0.7	--	--	0.8	--	--	0.8	--	--	0.8	0.8	--	1.0
Osprey	tPCB-mid	--	--	0.3	--	1.2	--	--	1.4	--	--	1.6	--	--	0.4	1.1	--	1.7
	tPCB-high	--	--	4.0	--	18.1	--	--	20.2	--	--	23.0	--	--	5.7	16.6	--	25.0
	Mercury	--	--	0.2	--	0.2	--	--	0.2	--	--	0.2	--	--	0.2	0.2	--	0.3

Table AD1-8. Summary of Terrestrial and Aquatic Bird Egg Tissue LOAEL Hazard Quotients by Exposure Unit
Anniston PCB Site, Anniston, Alabama

Notes:

NOAEL HQ* ≤ 1
LOAEL HQ* ≤ 1
LOAEL HQ* > 1 and ≤ 10
LOAEL HQ* > 10

* All HQs rounded to the nearest whole number
¹ Riparian soil in reaches C1 and C10 is based on the applicable assessment area (i.e., Upper for C1 and Lower for C10). Reach C10 was not evaluated for terrestrial receptors due to lack of floodplain soil.
HQ: hazard quotient
LOAEL: lowest observed adverse effect level
tPCB: total polychlorinated biphenyls
TRV: toxicity reference value
"-": not available
Exposure Units:
C1: Oxford Lake Park
C2: Backwater Area
C3: Friendship Road to Highway 21
C4: Hwy 21 to Silver Run Road
C5: Silver Run Road to Mitchell Matson Road
C6: Mitchell Matson Road to 2,000 feet upstream of Curry Station Road
C7: Upstream of Curry Station Road to Eastaboga Creek
C8: Eastaboga Creek to Jackson Shoals Dam

C9: Jackson Shoals Dam to Highway 77
C10: Highway 77 Bridge to Lake Logan Martin
Exposure Subareas:
East: East Subarea Floodplain Soil
West: West Subarea Floodplain Soil
North: North Subarea Floodplain Soil
South: South Subarea Floodplain Soil
Central: Central Subarea Floodplain Soil

Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1	C2	C3	C4	Upper AA	C5	C6 ¹	Middle AA	C7	C8 ¹	C9	C10	Lower AA
Exposure Subarea→		Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
Receptors↓														
Aquatic Birds		NOAEL HQs												
Tree Swallow	tPCB-mid	11.6	11.6	11.6	11.6	11.6	0.4	0.4	0.4	0.6	0.6	0.6	0.6	0.6
	tPCB-high	125.1	125.1	125.1	125.1	125.1	4.5	4.5	4.5	6.1	6.1	6.1	6.1	6.1
	Barium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Chromium	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
	Cobalt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Mercury	3.4	3.4	3.4	3.4	3.4	2.0	2.0	2.0	2.2	2.2	2.2	2.2	2.2
	Vanadium	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Spotted Sandpiper - 2	tPCB-mid	2.1	1.7	1.1	1.2	1.3	0.8	0.7	0.7	0.5	0.5	0.4	0.5	0.5
	tPCB-high	22.7	18.3	11.7	12.7	13.9	8.1	7.6	8.1	5.1	5.2	4.7	5.0	5.3
	Barium	0.9	0.8	0.6	0.6	0.7	0.9	0.9	0.9	0.6	0.6	0.7	0.7	0.7
	Chromium	0.8	0.5	0.5	0.5	0.5	0.9	0.9	0.9	0.4	0.4	0.5	0.6	0.6
	Cobalt	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
	Lead	2.8	1.6	0.9	0.9	1.3	2.1	2.1	2.1	0.8	0.8	1.1	1.2	1.1
	Mercury	2.6	40.6	3.2	3.2	8.2	3.9	3.9	3.9	4.9	4.9	4.9	4.9	5.3
	Vanadium	6.3	2.6	2.9	2.0	2.5	5.3	5.3	5.3	2.0	2.0	2.8	3.4	3.1
Kingfisher - 1	tPCB-mid	8.1	8.1	8.0	8.0	8.0	12.2	12.2	12.2	11.3	11.3	11.3	11.3	11.3
	tPCB-high	87.5	87.1	86.5	86.5	86.7	131.0	131.0	131.0	121.9	121.9	121.9	121.9	121.9
	Barium	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
	Chromium	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
	Cobalt	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
	Lead	0.4	0.3	0.2	0.2	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.3	0.2
	Mercury	1.3	5.1	1.4	1.4	1.9	3.7	3.7	3.7	4.6	4.6	4.6	4.6	4.6
	Vanadium	1.0	0.7	0.7	0.6	0.7	0.9	0.9	0.9	0.6	0.6	0.7	0.7	0.7
Kingfisher - 2	tPCB-mid	7.1	7.1	7.0	7.0	7.0	9.5	9.5	9.5	8.8	8.8	8.8	8.8	8.8
	tPCB-high	76.4	76.0	75.3	75.4	75.6	102.2	102.2	102.2	94.4	94.4	94.3	94.4	94.4
	Barium	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	Chromium	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Cobalt	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
	Lead	0.4	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3
	Mercury	1.7	5.4	1.7	1.7	2.2	3.7	3.7	3.7	4.0	4.0	4.0	4.0	4.1
	Vanadium	1.1	0.7	0.7	0.6	0.7	1.0	1.0	1.0	0.6	0.6	0.7	0.8	0.7
Great Blue Heron ⁵	tPCB-mid	18.5	18.5	18.4	18.4	18.4	16.5	16.4	16.5	18.9	18.9	18.9	18.9	18.9
	tPCB-high	199.4	198.9	198.1	198.3	198.4	177.2	177.1	177.2	203.4	203.4	203.4	203.4	203.4
	Barium	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	Chromium	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
	Cobalt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead ⁷	0.3	0.2	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
	Mercury	5.8	10.0	5.9	5.9	6.4	6.1	6.1	6.1	8.1	8.1	8.1	8.1	8.2
	Vanadium	1.2	0.8	0.8	0.7	0.8	1.1	1.1	1.1	0.7	0.7	0.8	0.9	0.8
Osprey	tPCB-mid	7.6	7.6	7.6	7.6	7.6	7.0	7.0	7.0	8.0	8.0	8.0	8.0	8.0
	tPCB-high	81.7	81.7	81.7	81.7	81.7	75.0	75.0	75.0	86.1	86.1	86.1	86.1	86.1
	Barium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Chromium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Cobalt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mercury	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	3.3	3.3	3.3	3.3	3.3
	Vanadium	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2

Table AD1-9. Summary of Aquatic Receptors NOAEL Hazard Quotients by Exposure Unit (Measured Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1	C2	C3	C4	Upper AA	C5	C6 ¹	Middle AA	C7	C8 ¹	C9	C10	Lower AA
Exposure Subarea→		Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
Receptors↓														
Aquatic Mammals		NOAEL HQs												
Bat	tPCB	17.4	17.4	17.4	17.4	17.4	0.6	0.6	0.6	0.9	0.9	0.9	0.9	0.9
	Barium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Chromium	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	Cobalt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mercury	0.8	0.8	0.8	0.8	0.8	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5
	Vanadium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mink - 2⁵	tPCB-mink	21.9	21.9	21.9	21.9	21.9	31.8	31.8	31.8	29.6	29.6	29.6	29.6	29.6
	Barium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Chromium	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	Cobalt	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Lead⁷	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mercury	0.1	0.1	0.1	0.1	0.1	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4
	Vanadium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Otter	tPCB-mink	38.8	38.8	38.8	38.8	38.8	37.6	37.6	37.6	40.3	40.3	40.3	40.3	40.3
	Barium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Chromium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Cobalt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mercury	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.6	0.6	0.6	0.6	0.6
	Vanadium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Notes:

NOAEL HQ* ≤ 1

NOAEL HQ* > 1 and ≤ 10

NOAEL HQ* > 10

* All HQs rounded to the nearest whole number

¹ Sediment data unavailable for this reach for non-mercury metals. Non-mercury metal EPCs from the upstream reach were conservatively used to estimate exposure.

² Great blue heron and Mink-2 are exposed to riparian soil.

AA: assessment area

HQ: hazard quotient

mg/kg-day: milligrams per kilogram per day

NOAEL: no observed adverse effect level

tPCB: total polychlorinated biphenyl

--: not available

Exposure Units:

C1: Oxford Lake Park

C2: Backwater Area

C3: Friendship Road to Highway 21

C4: Hwy 21 to Silver Run Road

C5: Silver Run Road to Mitchell Matson Road

C6: Mitchell Matson Road to 2,000 feet upstream of Curry Station Road

C7: Upstream of Curry Station Road to Eastaboga Creek

C8: Eastaboga Creek to Jackson Shoals Dam

C9: Jackson Shoals Dam to Highway 77

C10: Highway 77 Bridge to Lake Logan Martin

Sediment: Instream Sediment

Table AD1-10. Summary of Aquatic Receptors LOAEL Hazard Quotients by Exposure Unit (Measured Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1	C2	C3	C4	Upper AA	C5	C6 ²	Middle AA	C7	C8 ²	C9	C10	Lower AA
Exposure Subarea→		Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
Receptors ⁵ ↓														
Aquatic Birds		LOAEL HQs												
Tree Swallow	tPCB-mid	3.9	3.9	3.9	3.9	3.9	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2
	tPCB-high	41.7	41.7	41.7	41.7	41.7	1.5	1.5	1.5	2.0	2.0	2.0	2.0	2.0
	Barium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Chromium	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
	Cobalt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mercury	1.1	1.1	1.1	1.1	1.1	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
	Vanadium	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Spotted Sandpiper - 2	tPCB-mid	0.7	0.6	0.4	0.4	0.4	0.3	0.2	0.2	0.2	0.2	0.1	0.2	0.2
	tPCB-high	7.6	6.1	3.9	4.2	4.6	2.7	2.5	2.7	1.7	1.7	1.6	1.7	1.8
	Barium	0.4	0.4	0.3	0.3	0.3	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3
	Chromium	0.8	0.4	0.5	0.5	0.4	0.9	0.9	0.9	0.4	0.4	0.5	0.6	0.5
	Cobalt	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
	Lead	1.4	0.8	0.5	0.5	0.6	1.0	1.0	1.0	0.4	0.4	0.6	0.6	0.6
	Mercury	0.9	13.5	1.1	1.1	2.7	1.3	1.3	1.3	1.6	1.6	1.6	1.6	1.8
	Vanadium	3.1	1.3	1.4	1.0	1.2	2.6	2.6	2.6	1.0	1.0	1.4	1.7	1.5
Kingfisher - 1	tPCB-mid	2.7	2.7	2.7	2.7	2.7	4.1	4.1	4.1	3.8	3.8	3.8	3.8	3.8
	tPCB-high	29.2	29.0	28.8	28.8	28.9	43.7	43.7	43.7	40.6	40.6	40.6	40.6	40.6
	Barium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Chromium	0.7	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.6	0.6	0.7	0.7	0.7
	Cobalt	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
	Lead	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
	Mercury	0.4	1.7	0.5	0.5	0.6	1.2	1.2	1.2	1.5	1.5	1.5	1.5	1.5
	Vanadium	0.5	0.3	0.3	0.3	0.3	0.5	0.5	0.5	0.3	0.3	0.3	0.4	0.4
Kingfisher - 2	tPCB-mid	2.4	2.4	2.3	2.3	2.3	3.2	3.2	3.2	2.9	2.9	2.9	2.9	2.9
	tPCB-high	25.5	25.3	25.1	25.1	25.2	34.1	34.1	34.1	31.5	31.5	31.4	31.5	31.5
	Barium	0.3	0.3	0.3	0.2	0.3	0.3	0.3	0.3	0.2	0.2	0.3	0.3	0.3
	Chromium	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Cobalt	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
	Lead	0.2	0.2	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
	Mercury	0.6	1.8	0.6	0.6	0.7	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.4
	Vanadium	0.5	0.3	0.4	0.3	0.3	0.5	0.5	0.5	0.3	0.3	0.4	0.4	0.4

**Table AD1-10. Summary of Aquatic Receptors LOAEL Hazard Quotients by Exposure Unit (Measured Tissue)
Anniston PCB Site, Anniston, Alabama**

[illegible]

**Table AD1-10. Summary of Aquatic Receptors LOAEL Hazard Quotients by Exposure Unit (Measured Tissue)
Anniston PCB Site, Anniston, Alabama**

Exposure Unit→		C1	C2	C3	C4	Upper AA	C5	C6 ²	Middle AA	C7	C8 ²	C9	C10	Lower AA
Exposure Subarea→		Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
Receptors ⁵ ↓														
Otter	tPCB-mink	19.4	19.4	19.4	19.4	19.4	18.8	18.8	18.8	20.2	20.2	20.2	20.2	20.2
Otter (Alternate TRV) ¹	tPCB-mink	38.8	38.8	38.8	38.8	38.8	37.6	37.6	37.6	40.3	40.3	40.3	40.3	40.3
	Barium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Chromium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Cobalt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mercury	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3
	Vanadium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Notes:

NOAEL HQ* ≤ 1

LOAEL HQ* ≤ 1

LOAEL HQ* > 1 and ≤ 10

LOAEL HQ* > 10

* All HQs rounded to the nearest whole number

¹ Alternate TRVs were selected from Restum et al. (1998) based on growth. The LOAEL TRV is 0.05 mg/kg-day.

² Sediment data unavailable for this reach for non-mercury metals. Non-mercury metal EPCs from AA used to estimate incidental sediment ingestion.

³ Great blue heron and Mink-2 are exposed to riparian soil.

AA: assessment area

LOAEL: lowest-observed adverse effect level

tPCB: total polychlorinated biphenyl

--: not available

HQ: hazard quotient

mg/kg-day: milligrams per kilogram per day

TRV: toxicity reference value

Exposure Units:

C1: Oxford Lake Park

C4: Hwy 21 to Silver Run Road

C7: Upstream of Curry Station Road to Eastaboga Creek

C2: Backwater Area

C5: Silver Run Road to Mitchell Matson Road

C8: Eastaboga Creek to Jackson Shoals Dam

C3: Friendship Road to Highway 21

C6: Mitchell Matson Road to 2,000 feet upstream of Curry Station Road

C9: Jackson Shoals Dam to Highway 77

C10: Highway 77 Bridge to Lake Logan Martin

References:

Restum, J., S. Bursian, J. Giesy, J. Render, W. Helferich, E. Shipp, D. Verbrugge, and R. Aulerich. 1998. Multigenerational study of the effects of consumption of PCB-contaminated carp from Saginaw Bay, Lake

Table AD1-11. Summary of Terrestrial Receptors NOAEL-based Hazard Quotients by Exposure Unit (Measured Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1 ¹	C1 ¹	C2	C2	C2	C3	C3	C4	C4	Upper AA	C5	C5
Exposure Subarea→		East	West	North	South	Central	North	South	North	South	Combined Soil	North	South
Receptors↓		NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ
Terrestrial Birds													
Mourning Dove	tPCB-mid	0.6	8.8	0.3	0.1	0.2	0.6	1.3	0.5	0.3	0.5	0.2	0.2
	tPCB-high	6.0	94.4	3.4	1.0	1.6	7.0	13.7	5.1	3.7	5.1	1.9	2.1
	Mercury	--	--	1.6	0.4	0.5	3.1	3.3	2.3	2.4	2.3	1.0	1.2
	Chromium	--	--	0.4	0.2	0.2	0.3	0.5	0.5	0.3	0.3	0.3	0.3
	Lead	--	--	0.4	0.3	0.5	0.5	1.3	0.8	0.6	0.6	0.3	0.7
	Vanadium	--	--	1.4	1.4	1.2	1.2	1.5	1.4	1.3	1.2	1.7	1.9
Blue Jay	tPCB-mid	2.2	11.2	2.0	1.7	1.8	2.3	3.0	2.1	2.0	2.1	0.3	0.3
	tPCB-high	23.9	120.3	21.0	18.5	19.1	25.0	32.3	22.9	21.4	23.0	3.5	3.8
	Mercury	--	--	5.8	4.6	4.6	7.5	7.7	6.6	6.7	6.6	3.4	3.5
	Chromium	--	--	0.6	0.4	0.4	0.4	0.7	0.6	0.5	0.5	0.4	0.5
	Lead	--	--	1.6	1.5	1.8	1.8	2.6	2.0	1.9	1.8	1.5	1.9
	Vanadium	--	--	1.9	1.9	1.7	1.7	2.1	2.0	1.9	1.8	2.3	2.5
Carolina Wren - 1	tPCB-mid	11.7	26.0	11.3	10.9	11.0	11.9	13.0	11.6	11.3	11.6	1.2	1.3
	tPCB-high	126.2	279.8	121.6	117.5	118.6	127.9	139.5	124.6	122.1	124.7	13.3	13.6
	Mercury	--	--	30.0	28.0	28.1	32.6	32.9	31.2	31.4	31.1	16.9	17.2
	Chromium	--	--	1.6	1.3	1.3	1.4	1.9	1.7	1.5	1.5	1.4	1.5
	Lead	--	--	8.6	8.5	8.9	8.9	10.2	9.3	9.0	8.9	8.4	9.1
	Vanadium	--	--	5.4	5.4	5.1	5.1	5.6	5.5	5.4	5.1	5.9	6.3
Hawk	tPCB-mid	4.9	6.8	4.8	4.8	4.8	4.8	5.0	4.8	4.8	4.8	5.0	5.0
	tPCB-high	53.2	73.7	51.9	51.4	51.5	51.8	53.4	51.5	51.2	51.7	53.6	53.6
	Chromium	--	--	0.2	0.2	0.2	0.2	0.3	0.3	0.2	0.2	0.3	0.3
	Lead	--	--	0.5	0.4	0.5	0.4	0.6	0.4	0.4	0.4	0.5	0.6
	Mercury	--	--	6.4	6.1	6.1	1.4	1.4	1.2	1.2	1.9	1.5	1.5
	Vanadium	--	--	2.0	2.0	2.0	2.0	2.1	1.9	1.9	2.0	2.5	2.5
Terrestrial Mammals													
Shrew - 1	tPCB	15.9	19.2	15.8	15.7	15.7	15.9	16.2	15.9	15.8	15.9	1.7	1.7
	Mercury	--	--	6.0	6.0	6.0	6.1	6.1	6.1	6.1	6.1	3.4	3.4
	Chromium	--	--	0.8	0.8	0.8	0.8	0.9	0.8	0.8	0.8	0.8	0.8
	Lead	--	--	2.0	2.0	2.0	2.0	2.1	2.0	2.0	2.0	2.0	2.0
	Vanadium	--	--	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Shrew - 2	tPCB	16.5	19.7	16.3	16.2	16.2	16.3	16.5	16.2	16.2	16.3	2.7	2.7
	Chromium	--	--	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9
	Lead	--	--	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	2.0
	Mercury	--	--	7.1	7.0	7.0	5.8	5.9	5.8	5.8	6.0	3.3	3.3
	Vanadium	--	--	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3
Deer	tPCB	0.0	0.3	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
	Mercury	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Chromium	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vanadium	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table AD1-11. Summary of Terrestrial Receptors NOAEL-based Hazard Quotients by Exposure Unit (Measured Tissue)
Anniston PCB Site, Anniston, Alabama

[illegible]

Table AD1-11. Summary of Terrestrial Receptors NOAEL-based Hazard Quotients by Exposure Unit (Measured Tissue)
Anniston PCB Site, Anniston, Alabama

[illegible]

Table AD1-11. Summary of Terrestrial Receptors NOAEL-based Hazard Quotients by Exposure Unit (Measured Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C6	C6	Middle AA	C7	C7	C8	C8	C9	C9	C10 ²	Lower AA
Exposure Subarea→		North	South	Combined Soil	North	South	North	South	North	South	Sediment	Combined Soil
Receptors↓		NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ
Weasel	tPCB	3.9	3.9	3.9	4.0	4.0	4.0	4.0	4.0	4.0	--	4.0
	Mercury	0.1	0.2	0.1	0.1	0.2	0.3	0.2	0.2	0.1	--	0.2
	Chromium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	--	0.1
	Lead	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	--	0.1
	Vanadium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	--	0.1
Fox - 1	tPCB	2.0	2.0	2.0	2.0	2.1	2.1	2.1	2.1	2.0	--	2.0
	Mercury	0.1	0.2	0.1	0.1	0.1	0.2	0.1	0.1	0.1	--	0.1
	Chromium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	--	0.1
	Lead	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	--	0.1
	Vanadium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	--	0.1
Fox - 2	tPCB	2.3	2.3	2.3	2.4	2.4	2.4	2.4	2.4	2.4	--	2.4
	Mercury	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	--	0.1
	Chromium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	--	0.1
	Lead	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	--	0.0
	Vanadium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	--	0.1

Notes:

NOAEL HQ* ≤ 1
NOAEL HQ* > 1 and ≤ 10
NOAEL HQ* > 10

* All HQs rounded to the nearest whole number

¹ Soil in C1 was not sampled for metals. Hawk and shrew-2 are exposed to both soil and sediment, therefore, the HQs presented for metals in C1 are based on exposures to sediment only.

² Reach C10 was not evaluated for terrestrial receptors due to lack of floodplain soil.

AA = assessment area

HQ: hazard quotient

NOAEL: no observed adverse effect level

tPCB: total polychlorinated biphenyl

TRV: toxicity reference value

--: not available

Exposure Units:

C1: Oxford Lake Park

C2: Backwater Area

C3: Friendship Road to Highway 21

C4: Hwy 21 to Silver Run Road

C5: Silver Run Road to Mitchell Matson Road

C6: Mitchell Matson Road to 2,000 feet upstream of Curry Station North: North Subarea Floodplain Soil

C7: Upstream of Curry Station Road to Eastaboga Creek South: South Subarea Floodplain Soil

C8: Eastaboga Creek to Jackson Shoals Dam Central: Central Subarea Floodplain Soil

C9: Jackson Shoals Dam to Highway 77

C10: Hwy 77 Bridge to Lake Logan Martin

Exposure Subareas:

East: East Subarea Floodplain Soil

West: West Subarea Floodplain Soil

North: North Subarea Floodplain Soil

South: South Subarea Floodplain Soil

Central: Central Subarea Floodplain Soil

Table AD1-12. Summary of Terrestrial Receptors LOAEL-based Hazard Quotients by Exposure Unit (Measured Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1 ^{1,2}	C1 ^{1,2}	C2	C2	C2	C3	C3	C4	C4	Upper AA	C5	C5	C6	C6	Middle AA	C7	C7	C8	C8	C9	C9	Lower AA
Exposure Subarea→		East	West	North	South	Central	North	South	North	South	Combined Soil	North	South	North	South	Combined Soil	North	South	North	South	North	South	Combined Soil
Terrestrial Birds																							
Mourning Dove	tPCB-mid	0.2	2.9	0.1	0.0	0.1	0.2	0.4	0.2	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1
	tPCB-high	2.0	31.5	1.1	0.3	0.5	2.3	4.6	1.7	1.2	1.7	0.6	0.7	0.8	0.9	0.7	0.6	0.7	0.8	0.7	0.7	0.5	0.6
	Mercury	--	--	0.5	0.1	0.2	1.0	1.1	0.8	0.8	0.8	0.3	0.4	0.6	0.9	0.4	0.3	0.6	1.5	0.3	0.6	0.3	0.4
	Chromium	--	--	0.4	0.2	0.2	0.2	0.5	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.3
	Lead	--	--	0.2	0.1	0.3	0.3	0.6	0.4	0.3	0.3	0.1	0.3	0.2	0.1	0.3	0.2	0.2	0.2	0.2	0.1	0.1	0.1
	Vanadium	--	--	0.7	0.7	0.6	0.6	0.7	0.7	0.7	0.6	0.8	0.9	0.8	0.4	0.7	0.8	0.9	0.7	0.8	0.4	0.8	0.7
Blue Jay	tPCB-mid	0.7	3.7	0.7	0.6	0.6	0.8	1.0	0.7	0.7	0.7	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	tPCB-high	8.0	40.1	7.0	6.2	6.4	8.3	10.8	7.6	7.1	7.7	1.2	1.3	1.3	1.5	1.2	1.2	1.3	1.4	1.3	1.4	1.1	1.2
	Mercury	--	--	1.9	1.5	1.5	2.5	2.6	2.2	2.2	2.2	1.1	1.2	1.4	1.8	1.2	0.9	1.3	2.2	0.9	1.2	0.9	1.0
	Chromium	--	--	0.5	0.3	0.4	0.4	0.7	0.6	0.5	0.5	0.4	0.5	0.4	0.3	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.4
	Lead	--	--	0.8	0.8	0.9	0.9	1.3	1.0	0.9	0.9	0.7	1.0	0.8	0.7	0.9	0.9	0.8	0.8	0.8	0.7	0.7	0.8
	Vanadium	--	--	1.0	0.9	0.8	0.9	1.0	1.0	0.9	0.9	1.1	1.2	1.1	0.6	1.0	1.1	1.2	0.9	1.1	0.6	1.1	1.0
Carolina Wren	tPCB-mid	3.9	8.7	3.8	3.6	3.7	4.0	4.3	3.9	3.8	3.9	0.4	0.4	0.4	0.5	0.4	0.5	0.5	0.5	0.5	0.5	0.4	0.5
	tPCB-high	42.1	93.3	40.5	39.2	39.5	42.6	46.5	41.5	40.7	41.6	4.4	4.5	4.6	4.9	4.5	4.9	5.0	5.2	5.0	5.1	4.7	4.9
	Mercury	--	--	10.0	9.3	9.4	10.9	11.0	10.4	10.5	10.4	5.6	5.7	6.1	6.7	5.7	4.3	4.9	6.4	4.4	4.9	4.3	4.5
	Chromium	--	--	1.5	1.2	1.2	1.3	1.8	1.6	1.4	1.4	1.3	1.4	1.3	1.2	1.3	1.4	1.4	1.4	1.3	1.3	1.3	1.3
	Lead	--	--	4.3	4.2	4.5	4.4	5.1	4.6	4.5	4.5	4.2	4.6	4.3	4.1	4.4	4.4	4.2	4.3	4.3	4.2	4.2	4.2
	Vanadium	--	--	2.7	2.7	2.5	2.5	2.8	2.7	2.6	2.5	2.9	3.1	2.9	2.2	2.8	2.9	3.0	2.7	2.9	2.1	2.9	2.7
Hawk	tPCB-mid	1.6	2.3	1.6	1.6	1.6	1.6	1.7	1.6	1.6	1.6	1.7	1.7	1.7	1.7	1.7	1.2	1.2	1.2	1.2	1.2	1.2	1.2
	tPCB-high	17.7	24.6	17.3	17.1	17.2	17.3	17.8	17.2	17.1	17.2	17.9	17.9	17.9	17.9	17.9	12.7	12.7	12.8	12.7	12.7	12.7	12.7
	Chromium	--	--	0.2	0.2	0.2	0.2	0.3	0.3	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	Lead	--	--	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.3	0.3	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	Mercury	--	--	2.1	2.0	2.0	0.5	0.5	0.4	0.4	0.6	0.5	0.5	0.5	0.6	0.5	0.6	0.7	0.9	0.6	0.7	0.6	0.6
	Vanadium	--	--	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.2	1.2	1.2	1.1	1.2	1.0	1.0	1.0	1.0	0.9	1.0	1.0
Terrestrial Mammals																							
Shrew - 1	tPCB	5.4	6.5	5.3	5.3	5.3	5.4	5.5	5.4	5.4	5.4	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Mercury	--	--	3.0	3.0	3.0	3.1	3.1	3.0	3.0	3.0	1.7	1.7	1.7	1.8	1.7	1.3	1.3	1.4	1.3	1.3	1.3	1.3
	Chromium	--	--	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
	Lead	--	--	1.1	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.1	1.1	1.0	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0
	Vanadium	--	--	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Shrew - 2	tPCB	5.6	6.7	5.5	5.5	5.5	5.5	5.6	5.5	5.5	5.5	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
	Chromium	--	--	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
	Lead	--	--	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	Mercury	--	--	3.6	3.5	3.5	2.9	2.9	2.9	2.9	3.0	1.7	1.7	1.7	1.7	1.7	1.3	1.3	1.4	1.3	1.3	1.3	1.3
	Vanadium	--	--	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Deer	tPCB	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mercury	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Chromium	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vanadium	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Weasel	tPCB	0.6	1.3	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.6	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
	Mercury	--	--	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Chromium	--	--	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Lead	--	--	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vanadium	--	--	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1
Fox - 1	tPCB	0.4	0.7	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
	Mercury	--	--	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Chromium	--	--	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Lead	--	--	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vanadium	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fox - 2	tPCB	0.4	0.7	0.3	0.3	0.3	0.4	0.4	0.4	0.3	0.4	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
	Mercury	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.0	0.0
	Chromium	--	--	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Lead	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vanadium	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table AD1-12. Summary of Terrestrial Receptors LOAEL-based Hazard Quotients by Exposure Unit (Measured Tissue)
Anniston PCB Site, Anniston, Alabama

Notes:

NOAEL HQ* ≤ 1
LOAEL HQ* ≤ 1
LOAEL HQ* > 1 and ≤ 10
LOAEL HQ* > 10

* All HQs rounded to the nearest whole number

¹ Riparian soil in reaches C1 and C10 is based on the applicable assessment area (i.e., Upper for C1 and Lower for C10). Reach C10 was not evaluated for terrestrial receptors due to lack of floodplain soil.

² Soil in C1 was not sampled for metals. Hawk and shrew-2 are exposed to both soil and sediment, therefore, the HQs presented for metals in C1 are based on exposures to sediment only.

AA = assessment area

HQ: hazard quotient

tPCB: total polychlorinated biphenyl

TRV: toxicity reference value

--: not available

Exposure Units:

C1: Oxford Lake Park

C2: Backwater Area

C3: Friendship Road to Highway 21

C4: Hwy 21 to Silver Run Road

C5: Silver Run Road to Mitchell Matson Road

C6: Mitchell Matson Road to 2,000 feet upstream of Curry Station Road

C7: Upstream of Curry Station Road to Eastaboga Creek

C8: Eastaboga Creek to Jackson Shoals Dam

C9: Jackson Shoals Dam to Highway 77

C10: Hwy 77 Bridge to Lake Logan Martin

Exposure Subareas:

East: East Subarea Floodplain Soil

West: West Subarea Floodplain Soil

North: North Subarea Floodplain Soil

South: South Subarea Floodplain Soil

Central: Central Subarea Floodplain Soil

Table AD1-13. Summary of NOAEL Hazard Quotients by Exposure Unit for Receptors Exposed to Terrestrial + Aquatic Media (Measured Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1 ¹	C1 ¹	C1 ¹	C2	C2	C2	C2	C3	C3	C3	C4	C4	C4
Exposure Subarea→		East Floodplain Soil, Riparian Soil & Sediment	West Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Central Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment
Receptors↓		NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ
Aquatic+Terrestrial Birds														
Carolina Wren - 2	tPCB-mid	11.7	26.0	--	11.3	10.9	11.0	--	11.9	13.0	--	11.6	11.4	--
	tPCB-high	126.5	280.2	--	121.9	117.9	118.9	--	128.2	139.8	--	124.9	122.5	--
	Barium ²	--	--	--	1.5	1.6	1.6	--	1.6	1.6	--	1.6	1.6	--
	Chromium	--	--	--	1.6	1.3	1.3	--	1.4	1.9	--	1.7	1.5	--
	Cobalt ²	--	--	--	0.5	0.5	0.5	--	0.5	0.5	--	0.5	0.5	--
	Lead	--	--	--	8.7	8.5	9.0	--	9.0	10.3	--	9.4	9.1	--
	Mercury	--	--	--	30.0	28.0	28.1	--	32.6	32.9	--	31.3	31.5	--
	Vanadium	--	--	--	5.5	5.5	5.2	--	5.2	5.7	--	5.6	5.5	--
Spotted Sandpiper - 1	tPCB-mid	--	--	10.0	--	--	--	10.6	--	--	10.0	--	--	9.5
	tPCB-high	--	--	107.9	--	--	--	113.7	--	--	107.5	--	--	102.7
	Barium ²	--	--	1.5	--	--	--	1.5	--	--	1.4	--	--	1.4
	Chromium	--	--	1.2	--	--	--	1.0	--	--	1.0	--	--	1.2
	Cobalt ²	--	--	0.2	--	--	--	0.2	--	--	0.2	--	--	0.2
	Lead	--	--	8.3	--	--	--	7.6	--	--	7.1	--	--	7.6
	Mercury	--	--	25.2	--	--	--	42.6	--	--	27.7	--	--	26.1
	Vanadium	--	--	6.5	--	--	--	4.8	--	--	4.6	--	--	4.5
Aquatic+Terrestrial Mammals														
Mink - 1	tPCB-mink	--	--	17.9	--	--	--	17.9	--	--	17.9	--	--	17.9
	Barium ²	--	--	0.1	--	--	--	0.1	--	--	0.1	--	--	0.1
	Chromium	--	--	0.2	--	--	--	0.2	--	--	0.2	--	--	0.2
	Cobalt ²	--	--	0.1	--	--	--	0.1	--	--	0.1	--	--	0.1
	Lead	--	--	0.0	--	--	--	0.0	--	--	0.0	--	--	0.0
	Mercury	--	--	0.2	--	--	--	0.2	--	--	0.2	--	--	0.2
	Vanadium	--	--	0.0	--	--	--	0.0	--	--	0.0	--	--	0.0
Raccoon - 1	tPCB	1.9	4.1	1.9	1.9	1.8	1.8	2.2	2.0	2.1	2.1	1.9	1.9	1.9
	Barium ²	--	--	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Chromium	--	--	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Cobalt ²	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	--	--	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	Mercury	--	--	0.5	0.5	0.4	0.4	0.5	0.5	0.6	0.6	0.5	0.5	0.6
	Vanadium	--	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Raccoon - 2	tPCB	--	--	2.5	--	--	--	2.4	--	--	2.3	--	--	2.4
	Barium ²	--	--	0.0	--	--	--	0.0	--	--	0.0	--	--	0.0
	Chromium	--	--	0.1	--	--	--	0.1	--	--	0.1	--	--	0.1
	Cobalt ²	--	--	0.1	--	--	--	0.0	--	--	0.0	--	--	0.0
	Lead	--	--	0.1	--	--	--	0.0	--	--	0.0	--	--	0.0
	Mercury	--	--	0.2	--	--	--	1.1	--	--	0.2	--	--	0.2
	Vanadium	--	--	0.0	--	--	--	0.0	--	--	0.0	--	--	0.0

Table AD1-13. Summary of NOAEL Hazard Quotients by Exposure Unit for Receptors Exposed to Terrestrial + Aquatic Media (Measured Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		Upper AA	Upper AA	C5	C5	C5	C6	C6	C6	Middle AA	Middle AA	C7	C7	C7
Exposure Subarea→		Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment
Receptors↓		NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ		NOAEL HQ	NOAEL HQ	NOAEL HQ
Aquatic+Terrestrial Birds														
Carolina Wren - 2	tPCB-mid	11.6	--	1.3	1.3	--	1.3	1.4	--	1.3	--	1.4	1.4	--
	tPCB-high	125.0	--	13.5	13.9	--	14.2	14.9	--	13.9	--	14.6	15.0	--
	Barium ²	1.6	--	1.5	1.5	--	1.5	1.5	--	1.5	--	1.6	1.5	--
	Chromium	1.5	--	1.4	1.5	--	1.4	1.3	--	1.4	--	1.4	1.5	--
	Cobalt ²	0.5	--	0.5	0.5	--	0.5	0.5	--	0.5	--	0.6	0.5	--
	Lead	9.0	--	8.5	9.2	--	8.6	8.4	--	8.9	--	8.9	8.6	--
	Mercury	31.2	--	17.1	17.4	--	18.4	20.2	--	17.3	--	13.0	14.8	--
	Vanadium	5.3	--	6.0	6.4	--	6.0	4.5	--	5.8	--	6.1	6.2	--
Spotted Sandpiper - 1	tPCB-mid	--	9.6	--	--	1.4	--	--	1.3	--	1.3	--	--	1.3
	tPCB-high	--	103.5	--	--	14.7	--	--	14.3	--	14.5	--	--	14.3
	Barium ²	--	1.4	--	--	1.5	--	--	1.5	--	1.5	--	--	1.3
	Chromium	--	1.0	--	--	1.4	--	--	1.2	--	1.4	--	--	1.0
	Cobalt ²	--	0.2	--	--	0.2	--	--	0.2	--	0.2	--	--	0.1
	Lead	--	7.5	--	--	7.9	--	--	7.6	--	7.9	--	--	7.1
	Mercury	--	28.0	--	--	15.3	--	--	15.8	--	15.4	--	--	13.9
	Vanadium	--	4.6	--	--	5.8	--	--	5.7	--	5.8	--	--	4.2
Aquatic+Terrestrial Mammals														
Mink - 1	tPCB-mink	--	17.9	--	--	15.4	--	--	15.4	--	15.4	--	--	15.1
	Barium ²	--	0.1	--	--	0.1	--	--	0.1	--	0.1	--	--	0.1
	Chromium	--	0.2	--	--	0.2	--	--	0.2	--	0.2	--	--	0.2
	Cobalt ²	--	0.1	--	--	0.1	--	--	0.1	--	0.1	--	--	0.1
	Lead	--	0.0	--	--	0.0	--	--	0.0	--	0.0	--	--	0.0
	Mercury	--	0.2	--	--	0.4	--	--	0.4	--	0.4	--	--	0.2
	Vanadium	--	0.0	--	--	0.0	--	--	0.0	--	0.0	--	--	0.0
Raccoon - 1	tPCB	0.0	1.9	0.7	0.7	0.7	0.7	0.7	0.7	0.0	0.7	0.5	0.6	0.6
	Barium ²	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1
	Chromium	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1
	Cobalt ²	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.0	0.2	0.1	0.2	0.2	0.2	0.1	0.2	0.0	0.2	0.2	0.2	0.2
	Mercury	0.0	0.5	0.3	0.3	0.3	0.3	0.4	0.4	0.0	0.3	0.2	0.3	0.3
	Vanadium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Raccoon - 2	tPCB	--	2.4	--	--	1.8	--	--	1.8	--	1.8	--	--	2.1
	Barium ²	--	0.0	--	--	0.0	--	--	0.0	--	0.0	--	--	0.0
	Chromium	--	0.1	--	--	0.1	--	--	0.1	--	0.1	--	--	0.1
	Cobalt ²	--	0.0	--	--	0.1	--	--	0.1	--	0.1	--	--	0.0
	Lead	--	0.0	--	--	0.1	--	--	0.1	--	0.1	--	--	0.0
	Mercury	--	0.3	--	--	0.2	--	--	0.2	--	0.2	--	--	0.2
	Vanadium	--	0.0	--	--	0.0	--	--	0.0	--	0.0	--	--	0.0

Table AD1-13. Summary of NOAEL Hazard Quotients by Exposure Unit for Receptors Exposed to Terrestrial + Aquatic Media (Measured Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C8	C8	C8	C9	C9	C9	C10 ^a	Lower AA	Lower AA
Exposure Subarea→		North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	Riparian Soil & Sediment	Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment
Receptors↓		NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ	NOAEL HQ
Aquatic+Terrestrial Birds										
Carolina Wren - 2	tPCB-mid	1.4	1.4	--	1.4	1.3	--	--	1.4	--
	tPCB-high	15.5	15.0	--	15.2	14.2	--	--	14.6	--
	Barium ²	1.6	1.6	--	1.4	1.5	--	--	1.5	--
	Chromium	1.5	1.4	--	1.3	1.3	--	--	1.4	--
	Cobalt ²	0.5	0.5	--	0.5	0.5	--	--	0.5	--
	Lead	8.7	8.7	--	8.4	8.5	--	--	8.6	--
	Mercury	19.2	13.3	--	14.7	12.9	--	--	13.6	--
	Vanadium	5.5	6.1	--	4.5	5.9	--	--	5.6	--
Spotted Sandpiper - 1	tPCB-mid	--	--	1.3	--	--	1.3	1.3	--	1.3
	tPCB-high	--	--	14.2	--	--	13.9	13.9	--	14.1
	Barium ²	--	--	1.4	--	--	1.3	1.4	--	1.4
	Chromium	--	--	1.0	--	--	1.0	1.1	--	1.0
	Cobalt ²	--	--	0.2	--	--	0.1	0.2	--	0.2
	Lead	--	--	7.0	--	--	7.0	7.2	--	7.1
	Mercury	--	--	15.1	--	--	13.0	14.6	--	14.7
	Vanadium	--	--	4.8	--	--	4.3	5.1	--	4.9
Aquatic+Terrestrial Mammals										
Mink - 1	tPCB-mink	--	--	15.1	--	--	15.1	15.1	--	15.1
	Barium ²	--	--	0.1	--	--	0.1	0.1	--	0.1
	Chromium	--	--	0.2	--	--	0.2	0.2	--	0.2
	Cobalt ²	--	--	0.1	--	--	0.1	0.1	--	0.1
	Lead	--	--	0.0	--	--	0.0	0.0	--	0.0
	Mercury	--	--	0.2	--	--	0.2	0.2	--	0.2
	Vanadium	--	--	0.0	--	--	0.0	0.0	--	0.0
Raccoon - 1	tPCB	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.0	0.6
	Barium ²	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1
	Chromium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1
	Cobalt ²	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.2	0.2	0.2	0.1	0.1	0.1	0.2	0.0	0.2
	Mercury	0.4	0.3	0.4	0.3	0.2	0.3	0.4	0.0	0.4
	Vanadium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Raccoon - 2	tPCB	--	--	2.1	--	--	2.0	2.1	--	2.1
	Barium ²	--	--	0.0	--	--	0.0	0.0	--	0.0
	Chromium	--	--	0.1	--	--	0.1	0.1	--	0.1
	Cobalt ²	--	--	0.0	--	--	0.0	0.0	--	0.0
	Lead	--	--	0.0	--	--	0.0	0.0	--	0.0
	Mercury	--	--	0.2	--	--	0.2	0.2	--	0.2
	Vanadium	--	--	0.0	--	--	0.0	0.0	--	0.0

Table AD1-13. Summary of NOAEL Hazard Quotients by Exposure Unit for Receptors Exposed to Terrestrial + Aquatic Media (Measured Tissue)
Anniston PCB Site, Anniston, Alabama

Notes:

NOAEL HQ* ≤ 1
NOAEL HQ* > 1 and ≤ 10
NOAEL HQ* > 10

* All HQs rounded to the nearest whole number

¹ Riparian soil in reaches C1 and

² Barium and cobalt are

AA: assessment area

COPCs: constituent of potential concern

HQ: hazard quotient

mg/kg-day: milligrams per kilogram per day

NOAEL: no observed adverse effect level

tPCB: total polychlorinated biphenyl

TRV: toxicity reference value

--: not available

Exposure Units:

C1: Oxford Lake Park

C2: Backwater Area

C3: Friendship Road to Highway 21

C4: Hwy 21 to Silver Run Road

C5: Silver Run Road to Mitchell Matson Road

C6: Mitchell Matson Road to 2,000 feet upstream of Curry Station Road

C7: Upstream of Curry Station Road to Eastaboga Creek

C8: Eastaboga Creek to Jackson Shoals Dam

C9: Jackson Shoals Dam to Highway 77

C10: Highway 77 Bridge to Lake Logan Martin

Exposure Subareas:

East: East Subarea Floodplain Soil

West: West Subarea Floodplain Soil

North: North Subarea Floodplain Soil

South: South Subarea Floodplain Soil

Central: Central Subarea Floodplain Soil

Table AD1-14. Summary of LOAEL Hazard Quotients by Exposure Unit for Aquatic and Terrestrial Mixed Diet Receptors (Measured Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1 ¹	C1 ¹	C1 ¹	C2	C2	C2	C2	C3	C3	C3	C4	C4	C4
Exposure Subarea→		East Floodplain Soil, Riparian Soil & Sediment	West Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Central Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment
Receptors↓		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Aquatic+Terrestrial Birds														
Carolina Wren - 2	tPCB-mid	3.9	8.7	--	3.8	3.6	3.7	--	4.0	4.3	--	3.9	3.8	--
	tPCB-high	42.2	93.4	--	40.6	39.3	39.6	--	42.7	46.6	--	41.6	40.8	--
	Barium ³	--	--	--	0.7	0.8	0.8	--	0.8	0.8	--	0.8	0.8	--
	Chromium	--	--	--	1.5	1.2	1.3	--	1.3	1.8	--	1.6	1.4	--
	Cobalt ³	--	--	--	0.5	0.5	0.5	--	0.5	0.5	--	0.5	0.5	--
	Lead	--	--	--	4.3	4.3	4.5	--	4.5	5.1	--	4.7	4.6	--
	Mercury	--	--	--	10.0	9.3	9.4	--	10.9	11.0	--	10.4	10.5	--
	Vanadium	--	--	--	2.7	2.7	2.5	--	2.6	2.8	--	2.7	2.7	--
Spotted Sandpiper - 1	tPCB-mid	--	--	3.3	--	--	--	3.5	--	--	3.3	--	--	3.2
	tPCB-high	--	--	36.0	--	--	--	37.9	--	--	35.8	--	--	34.2
	Barium ³	--	--	0.8	--	--	--	0.7	--	--	0.7	--	--	0.7
	Chromium	--	--	1.2	--	--	--	0.9	--	--	1.0	--	--	1.1
	Cobalt ³	--	--	0.2	--	--	--	0.2	--	--	0.2	--	--	0.1
	Lead	--	--	4.1	--	--	--	3.8	--	--	3.6	--	--	3.8
	Mercury	--	--	8.4	--	--	--	14.2	--	--	9.2	--	--	8.7
	Vanadium	--	--	3.2	--	--	--	2.4	--	--	2.3	--	--	2.2
Aquatic+Terrestrial Mammals														
Mink - 1	tPCB-mink	--	--	9.0	--	--	--	9.0	--	--	9.0	--	--	9.0
Mink - 1 (Alternate TRV) ²	tPCB-mink	--	--	17.9	--	--	--	17.9	--	--	17.9	--	--	17.9
	Barium ³	--	--	0.0	--	--	--	0.0	--	--	0.0	--	--	0.0
	Chromium	--	--	0.2	--	--	--	0.2	--	--	0.2	--	--	0.2
	Cobalt ³	--	--	0.1	--	--	--	0.1	--	--	0.1	--	--	0.1
	Lead	--	--	0.0	--	--	--	0.0	--	--	0.0	--	--	0.0
	Mercury	--	--	0.1	--	--	--	0.1	--	--	0.1	--	--	0.1
	Vanadium	--	--	0.0	--	--	--	0.0	--	--	0.0	--	--	0.0
Raccoon - 1	tPCB	0.0	0.0	0.7	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.6	0.6	0.7
	Barium ³	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Chromium	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Cobalt ³	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Mercury	0.0	0.0	0.3	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3
	Vanadium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Raccoon - 2	tPCB	--	--	0.8	--	--	--	0.8	--	--	0.8	--	--	0.8
	Barium ³	--	--	0.0	--	--	--	0.0	--	--	0.0	--	--	0.0
	Chromium	--	--	0.1	--	--	--	0.1	--	--	0.1	--	--	0.1
	Cobalt ³	--	--	0.0	--	--	--	0.0	--	--	0.0	--	--	0.0
	Lead	--	--	0.0	--	--	--	0.0	--	--	0.0	--	--	0.0
	Mercury	--	--	0.1	--	--	--	0.5	--	--	0.1	--	--	0.1
	Vanadium	--	--	0.0	--	--	--	0.0	--	--	0.0	--	--	0.0

Table AD1-14. Summary of LOAEL Hazard Quotients by Exposure Unit for Aquatic and Terrestrial Mixed Diet Receptors (Measured Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		Upper AA	Upper AA	C5	C5	C5	C6	C6	C6	Middle AA	Middle AA	C7	C7	C7	C8
Exposure Subarea→		Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment
Receptors↓		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Aquatic+Terrestrial Birds															
Carolina Wren - 2	tPCB-mid	3.9	--	0.4	0.4	--	0.4	0.5	--	0.4	--	0.5	0.5	--	0.5
	tPCB-high	41.7	--	4.5	4.6	--	4.7	5.0	--	4.6	--	4.9	5.0	--	5.2
	Barium ³	0.8	--	0.8	0.8	--	0.7	0.7	--	0.7	--	0.8	0.8	--	0.8
	Chromium	1.4	--	1.3	1.4	--	1.3	1.2	--	1.3	--	1.4	1.5	--	1.4
	Cobalt ³	0.5	--	0.5	0.5	--	0.5	0.5	--	0.5	--	0.5	0.5	--	0.5
	Lead	4.5	--	4.3	4.6	--	4.3	4.2	--	4.5	--	4.4	4.3	--	4.3
	Mercury	10.4	--	5.7	5.8	--	6.1	6.7	--	5.8	--	4.3	4.9	--	6.4
	Vanadium	2.6	--	3.0	3.2	--	2.9	2.2	--	2.8	--	3.0	3.1	--	2.7
Spotted Sandpiper - 1	tPCB-mid	--	3.2	--	--	0.5	--	--	0.4	--	0.4	--	--	0.4	--
	tPCB-high	--	34.5	--	--	4.9	--	--	4.8	--	4.8	--	--	4.8	--
	Barium ³	--	0.7	--	--	0.8	--	--	0.7	--	0.8	--	--	0.7	--
	Chromium	--	1.0	--	--	1.3	--	--	1.2	--	1.3	--	--	1.0	--
	Cobalt ³	--	0.2	--	--	0.2	--	--	0.2	--	0.2	--	--	0.1	--
	Lead	--	3.7	--	--	3.9	--	--	3.8	--	3.9	--	--	3.5	--
	Mercury	--	9.3	--	--	5.1	--	--	5.3	--	5.1	--	--	4.6	--
	Vanadium	--	2.3	--	--	2.9	--	--	2.8	--	2.9	--	--	2.0	--
Aquatic+Terrestrial Mammals															
Mink - 1	tPCB-mink	--	9.0	--	--	7.7	--	--	7.7	--	7.7	--	--	7.6	--
Mink - 1 (Alternate TRV) ²	tPCB-mink	--	17.9	--	--	15.4	--	--	15.4	--	15.4	--	--	15.1	--
	Barium ³	--	0.0	--	--	0.0	--	--	0.0	--	0.0	--	--	0.0	--
	Chromium	--	0.2	--	--	0.2	--	--	0.2	--	0.2	--	--	0.2	--
	Cobalt ³	--	0.1	--	--	0.1	--	--	0.1	--	0.1	--	--	0.1	--
	Lead	--	0.0	--	--	0.0	--	--	0.0	--	0.0	--	--	0.0	--
	Mercury	--	0.1	--	--	0.2	--	--	0.2	--	0.2	--	--	0.1	--
	Vanadium	--	0.0	--	--	0.0	--	--	0.0	--	0.0	--	--	0.0	--
Raccoon - 1	tPCB	0.0	0.7	0.2	0.2	0.2	0.2	0.2	0.2	0.0	0.2	0.2	0.2	0.2	0.2
	Barium ³	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Chromium	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1
	Cobalt ³	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lead	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1
	Mercury	0.0	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.0	0.2	0.1	0.1	0.2	0.2
	Vanadium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Raccoon - 2	tPCB	--	0.8	--	--	0.6	--	--	0.6	--	0.6	--	--	0.7	--
	Barium ³	--	0.0	--	--	0.0	--	--	0.0	--	0.0	--	--	0.0	--
	Chromium	--	0.1	--	--	0.1	--	--	0.1	--	0.1	--	--	0.1	--
	Cobalt ³	--	0.0	--	--	0.0	--	--	0.0	--	0.0	--	--	0.0	--
	Lead	--	0.0	--	--	0.0	--	--	0.0	--	0.0	--	--	0.0	--
	Mercury	--	0.1	--	--	0.1	--	--	0.1	--	0.1	--	--	0.1	--
	Vanadium	--	0.0	--	--	0.0	--	--	0.0	--	0.0	--	--	0.0	--

Table AD1-14. Summary of LOAEL Hazard Quotients by Exposure Unit for Aquatic and Terrestrial Mixed Diet Receptors (Measured Tissue)
Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C8	C8	C9	C9	C9	C9	C10 ¹	Upper AA	Upper AA
		South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	Riparian Soil & Sediment	Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	
Exposure Subarea→		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Receptors↓		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Aquatic+Terrestrial Birds										
Carolina Wren - 2	tPCB-mid	0.5	--	0.5	0.4	--	--	0.5	--	
	tPCB-high	5.0	--	5.1	4.7	--	--	4.9	--	
	Barium ³	0.8	--	0.7	0.8	--	--	0.8	--	
	Chromium	1.3	--	1.3	1.3	--	--	1.3	--	
	Cobalt ³	0.5	--	0.5	0.5	--	--	0.5	--	
	Lead	4.4	--	4.2	4.2	--	--	4.3	--	
	Mercury	4.4	--	4.9	4.3	--	--	4.5	--	
	Vanadium	3.0	--	2.2	2.9	--	--	2.8	--	
Spotted Sandpiper - 1	tPCB-mid	--	0.4	--	--	0.4	0.4	--	0.4	
	tPCB-high	--	4.7	--	--	4.6	4.6	--	4.7	
	Barium ³	--	0.7	--	--	0.7	0.7	--	0.7	
	Chromium	--	1.0	--	--	1.0	1.0	--	1.0	
	Cobalt ³	--	0.2	--	--	0.1	0.2	--	0.2	
	Lead	--	3.5	--	--	3.5	3.6	--	3.6	
	Mercury	--	5.0	--	--	4.3	4.9	--	4.9	
	Vanadium	--	2.3	--	--	2.1	2.5	--	2.4	
Aquatic+Terrestrial Mammals										
Mink - 1	tPCB-mink	--	7.6	--	--	7.6	7.6	--	7.6	
Mink - 1 (Alternate TRV) ²	tPCB-mink	--	15.1	--	--	15.1	15.1	--	15.1	
	Barium ³	--	0.0	--	--	0.0	0.0	--	0.0	
	Chromium	--	0.2	--	--	0.2	0.2	--	0.2	
	Cobalt ³	--	0.1	--	--	0.1	0.1	--	0.1	
	Lead	--	0.0	--	--	0.0	0.0	--	0.0	
	Mercury	--	0.1	--	--	0.1	0.1	--	0.1	
	Vanadium	--	0.0	--	--	0.0	0.0	--	0.0	
Raccoon - 1	tPCB	0.2	0.2	0.2	0.2	0.2	0.2	0.0	0.2	
	Barium ³	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	Chromium	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	
	Cobalt ³	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	Lead	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	
	Mercury	0.1	0.2	0.1	0.1	0.1	0.2	0.0	0.2	
	Vanadium	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Raccoon - 2	tPCB	--	0.7	--	--	0.7	0.7	--	0.7	
	Barium ³	--	0.0	--	--	0.0	0.0	--	0.0	
	Chromium	--	0.1	--	--	0.1	0.1	--	0.1	
	Cobalt ³	--	0.0	--	--	0.0	0.0	--	0.0	
	Lead	--	0.0	--	--	0.0	0.0	--	0.0	
	Mercury	--	0.1	--	--	0.1	0.1	--	0.1	
	Vanadium	--	0.0	--	--	0.0	0.0	--	0.0	

Table AD1-14. Summary of LOAEL Hazard Quotients by Exposure Unit for Aquatic and Terrestrial Mixed Diet Receptors (Measured Tissue)
Anniston PCB Site, Anniston, Alabama

Notes:

NOAEL HQ* ≤ 1
LOAEL HQ* ≤ 1
LOAEL HQ* > 1 and ≤ 10
LOAEL HQ* > 10

* All HQs rounded to the nearest whole number

¹ Riparian soil in reaches C1 and C10 is based on the applicable assessment area (i.e., Upper for C1 and Lower for C10). Reach C10 was not evaluated for terrestrial receptors due to lack of floodplain soil.

² Alternate TRVs were selected from Restum et al. (1998) based on growth. The LOAEL TRV is 0.05 mg/kg-day.

³ Barium and cobalt are COPCs in sediment only. Soil exposures were estimated for these metals so that the complete aquatic + terrestrial dose could be estimated.

AA = assessment area

COPCs: constituent of potential concern

HQ: hazard quotient

mg/kg-day: milligrams per kilogram per day

NOAEL: no observed adverse effect level

tPCB: total polychlorinated biphenyl

TRV: toxicity reference value

--: not available

Exposure Units:

C1: Oxford Lake Park

C2: Backwater Area

C3: Friendship Road to Highway 21

C4: Hwy 21 to Silver Run Road

C5: Silver Run Road to Mitchell Matson Road

C6: Mitchell Matson Road to 2,000 feet upstream of Curry Station Road

C7: Upstream of Curry Station Road to Eastaboga Creek

C8: Eastaboga Creek to Jackson Shoals Dam

C9: Jackson Shoals Dam to Highway 77

C10: Highway 77 Bridge to Lake Logan Martin

Exposure Subareas:

East: East Subarea Floodplain Soil

West: West Subarea Floodplain Soil

North: North Subarea Floodplain Soil

South: South Subarea Floodplain Soil

Central: Central Subarea Floodplain Soil

References:

Restum, J., S. Bursian, J. Giesy, J. Render, W. Helferich, E. Shipp, D. Verbrugge, and R. Aulerich. 1998. Multigenerational study of the effects of consumption of PCB-contaminated carp from Saginaw Bay, Lake Huron, on mink: 1. Effects on mink reproduction, kit growth, and survival, and selected biological parameters. J. Toxicol. Environ. Health Part A 54: 343 375.

Table AD1-15. Hazard Quotients Based on Measured Tissue and Critical Tissue Concentrations
Anniston PCB Site, Anniston, Alabama

Assessment Area	Matrix	Detects	Total Samples	Minimum	Maximum	Mean	95% UCL	EPC	Critical Tissue Concentration		Hazard Quotients	
									NOAEL CTC	LOAEL CTC	NOAEL HQ	LOAEL HQ
PCBs												
Upper Assessment Area	Aquatic											
	aquatic plants	9	9	0.414	1.194	0.823	0.978	0.978	NA	NA	NA	NA
	benthic invertebrates	9	9	0.864	3.51	1.70	2.65	2.65	158	422	0.0	0.0
	crayfish	7	7	1.288	3.80	2.46	--	3.80 m	21	57	0.2	0.1
	emergent insects	9	9	0.305	27	16	23	23	21	NA	1.1	NA
	frogs	7	7	2.531	38	15	--	38 m	NA	NA	NA	NA
	mollusks	9	9	5.905	17	12	14	14	1263	1875	0.0	0.0
	snake	2	2	26	167	96	--	167 m	NA	NA	NA	NA
	bottom fish	9	9	34	68	53	61	61	7.0	34	8.7	1.8
	forage fish	27	27	6.77	44	21	24	24	7.0	34	3.4	0.7
	predator fish	9	9	22	175	84	111	111	7.0	34	15.9	3.2
	all fish	45	45	6.77	175	40	50	50	7.0	34	7.2	1.5
	Terrestrial											
	small mammals	14	16	0.319	13.53	3.22	6.36	6.36	10	23	0.6	0.3
	terrestrial insects	0	6	N/A	N/A	N/A	--	N/A m	307	480	NA	NA
	terrestrial plants	18	18	0.033	0.257	0.108	0.145	0.145	NA	NA	NA	NA
	worm	6	9	14	85	40	45	45	78	83	0.6	0.5
Middle Assessment Area	Aquatic											
	aquatic plants	6	9	0.39	1.69	0.867	0.978	0.978	NA	NA	NA	NA
	benthic invertebrates	9	9	1.18	1.99	1.62	1.83	1.83	158	422	0.0	0.0
	crayfish	7	7	0.892	2.62	1.81	--	2.62 m	21	57	0.1	0.0
	emergent insects	9	9	0.31	1.011	0.685	0.806	0.806	21	NA	0.0	NA
	frogs	7	7	2.42	4.58	3.39	--	4.58 m	NA	NA	NA	NA
	mollusks	9	9	4.60	11.88	7.74	9.48	9.48	1263	1875	0.0	0.0
	snake	2	2	19	122	71	--	122 m	NA	NA	NA	NA
	bottom fish	9	9	18	51	32	39	39	7.0	34	5.6	1.1
	forage fish	27	27	18	51	33	36	36	7.0	34	5.1	1.0
	predator fish	9	9	37	127	74	95	95	7.0	34	13.6	2.8
	all fish	45	45	18	127	41	46	46	7.0	34	6.6	1.3
	Terrestrial											
	small mammals	8	11	0.13	20	4	15	15	10	23	1.4	0.7
	terrestrial insects	0	6	N/A	N/A	N/A	--	N/A m	307	480	NA	NA
	terrestrial plants	5	18	0.0344	0.437	0.182	0.13	0.13	NA	NA	NA	NA
	worm	5	9	0.913	11.08	3.95	4.64	4.64	78	83	0.1	0.1
Lower Assessment Area	Aquatic											
	aquatic plants	6	9	0.244	0.631	0.402	0.427	0.427	NA	NA	NA	NA
	benthic invertebrates	9	9	0.614	1.57	0.922	1.09	1.09	158	422	0.0	0.0
	crayfish	9	9	0.235	1.28	0.833	1.05	1.05	21	57	0.0	0.0
	emergent insects	9	9	0.67	1.38	0.957	1.11	1.11	21	NA	0.1	NA
	frogs	2	2	5.29	5.43	5.36	--	5.43 m	NA	NA	NA	NA
	mollusks	9	9	6.076	14	11	12	12	1263	1875	0.0	0.0
	snake	7	7	26	55	39	--	55 m	NA	NA	NA	NA
	bottom fish	9	9	22	84	53	66	66	7.0	34	9.5	1.9
	forage fish	27	27	16	47	31	34	34	7.0	34	4.8	1.0
	predator fish	9	9	42	127	83	102	102	7.0	34	14.5	3.0
	all fish	45	45	16	127	46	53	53	7.0	34	7.5	1.5
	Terrestrial											
	small mammals	8	17	0.195	38	8	15	15	10	23	1.5	0.7
	terrestrial insects	0	6	N/A	N/A	N/A	--	N/A m	307	480	NA	NA
	terrestrial plants	0	18	N/A	N/A	N/A	--	N/A m	NA	NA	NA	NA
	worm	5	9	3.30	7.90	5.59	5.23	5.23	78	83	0.1	0.1

Table AD1-15. Hazard Quotients Based on Measured Tissue and Critical Tissue Concentrations
Anniston PCB Site, Anniston, Alabama

Assessment Area	Matrix	Detects	Total Samples	Minimum	Maximum	Mean	95% UCL	EPC	Critical Tissue Concentration		Hazard Quotients	
									NOAEL CTC	LOAEL CTC	NOAEL HQ	LOAEL HQ
Mercury												
Upper Assessment Area	Aquatic											
	aquatic plants	7	9	0.0457	0.113	0.0787	0.0859	0.0859	NA	NA	NA	NA
	benthic invertebrates	9	9	0.128	0.311	0.192	0.232	0.232	56	90	0.0	0.0
	crayfish	6	7	0.115	0.19	0.136	--	0.19 m	0.92	16	0.2	0.0
	emergent insects	9	9	0.105	0.417	0.25	0.321	0.321	24	NA	0.0	NA
	frogs	7	7	0.122	1.03	0.646	--	1.03 m	NA	NA	NA	NA
	mollusks	9	9	0.14	0.377	0.24	0.292	0.292	7.5	150	0.0	0.0
	snake	2	2	0.609	0.875	0.742	--	0.875 m	NA	NA	NA	NA
	bottom fish	9	9	0.262	0.75	0.463	0.567	0.567	0.85	0.93	0.7	0.6
	forage fish	26	27	0.0607	0.277	0.165	0.182	0.182	0.85	0.93	0.2	0.2
	predator fish	9	9	0.856	1.95	1.24	1.47	1.47	0.85	0.93	1.7	1.6
	all fish	44	45	0.0607	1.949	0.446	0.736	0.736	0.85	0.93	0.9	0.8
	Terrestrial											
	small mammals	8	16	0.0203	0.0906	0.0526	0.0468	0.0468	NA	NA	NA	NA
	terrestrial insects	4	6	0.0207	0.0377	0.0314	--	0.0377 m	NA	NA	NA	NA
	terrestrial plants	0	18	N/A	N/A	N/A	--	N/A m	NA	NA	NA	NA
	worm	9	9	0.11	7.36	3.76	5.58	5.58	15	NA	0.4	NA
Middle Assessment Area	Aquatic											
	aquatic plants	5	9	0.0625	0.376	0.134	0.258	0.258	NA	NA	NA	NA
	benthic invertebrates	9	9	0.22	0.444	0.301	0.35	0.35	56	90	0.0	0.0
	crayfish	7	7	0.119	0.206	0.167	--	0.206 m	0.92	16	0.2	0.0
	emergent insects	9	9	0.0337	0.318	0.134	0.188	0.188	24	NA	0.0	NA
	frogs	7	7	0.235	1.76	0.566	--	1.76 m	NA	NA	NA	NA
	mollusks	9	9	0.136	0.424	0.3	0.36	0.36	7.5	150	0.0	0.0
	snake	2	2	0.54	1.71	1.12	--	1.71 m	NA	NA	NA	NA
	bottom fish	9	9	0.157	0.466	0.326	0.399	0.399	0.85	0.93	0.5	0.4
	forage fish	27	27	0.239	0.761	0.471	0.512	0.512	0.85	0.93	0.6	0.6
	predator fish	9	9	0.97	1.97	1.40	1.59	1.59	0.85	0.93	1.9	1.7
	all fish	45	45	0.16	1.97	0.63	0.74	0.74	0.85	0.93	0.9	0.8
	Terrestrial											
	small mammals	5	11	0.02	0.28	0.13	0.12	0.12	NA	NA	NA	NA
	terrestrial insects	0	6	N/A	N/A	N/A	--	N/A m	NA	NA	NA	NA
	terrestrial plants	2	18	0.02	0.06	0.04	--	0.06 m	NA	NA	NA	NA
	worm	9	9	0.53	4.40	1.31	3.16	3.16	15	NA	0.2	NA
Lower Assessment Area	Aquatic											
	aquatic plants	7	9	0.03	0.09	0.06	0.07	0.07	NA	NA	NA	NA
	benthic invertebrates	9	9	0.25	0.70	0.38	0.48	0.48	56	90	0.0	0.0
	crayfish	8	9	0.11	0.29	0.19	0.23	0.23	0.92	16	0.3	0.0
	emergent insects	9	9	0.08	0.25	0.17	0.21	0.21	24	NA	0.0	NA
	frogs	2	2	0.32	0.56	0.44	--	0.56 m	NA	NA	NA	NA
	mollusks	9	9	0.52	1.01	0.77	0.86	0.86	7.5	150	0.1	0.0
	snake	7	7	0.42	2.12	1.24	--	2.12 m	NA	NA	NA	NA
	bottom fish	9	9	0.35	1.41	0.68	0.90	0.90	0.85	0.93	1.1	1.0
	forage fish	27	27	0.21	1.09	0.57	0.65	0.65	0.85	0.93	0.8	0.7
	predator fish	9	9	1.47	3.04	2.04	2.35	2.35	0.85	0.93	2.8	2.5
	all fish	45	45	0.21	3.04	0.89	1.07	1.07	0.85	0.93	1.3	1.2
	Terrestrial											
	small mammals	5	17	0.05	0.75	0.24	0.17	0.17	NA	NA	NA	NA
	terrestrial insects	0	6	N/A	N/A	N/A	--	N/A m	NA	NA	NA	NA
	terrestrial plants	0	18	N/A	N/A	N/A	--	N/A m	NA	NA	NA	NA
	worm	9	9	0.14	3.71	1.58	2.39	2.39	15	NA	0.2	NA

Table AD1-15. Hazard Quotients Based on Measured Tissue and Critical Tissue Concentrations
Anniston PCB Site, Anniston, Alabama

Assessment Area	Matrix	Detects	Total Samples	Minimum	Maximum	Mean	95% UCL	EPC	Critical Tissue Concentration		Hazard Quotients	
									NOAEL CTC	LOAEL CTC	NOAEL HQ	LOAEL HQ
Lead												
Upper Assessment Area	Aquatic											
	bottom fish	1	1	0.375	0.375	0.375	--	0.375 m	9.3	15	0.0	0.0
	forage fish	2	4	0.195	2.07	1.13	--	2.07 m	9.3	15	0.2	0.1
	predator fish	--	--	--	--	--	--	-- m	9.3	15	NA	NA
	all fish	3	5	0.195	2.07	0.88	--	2.07 m	9.3	15	0.2	0.1
Middle Assessment Area	Aquatic											
	bottom fish	1	1	0.265	0.265	0.265	--	0.265 m	9.3	15	0.0	0.0
	forage fish	--	--	--	--	--	--	-- m	9.3	15	NA	NA
	predator fish	1	1	0.0959	0.0959	0.0959	--	0.0959 m	9.3	15	0.0	0.0
	all fish	2	2	0.0959	0.265	0.18	--	0.265 m	9.3	15	0.0	0.0
Lower Assessment Area	Aquatic											
	bottom fish	1	2	0.216	0.216	0.216	--	0.216 m	9.3	15	0.0	0.0
	forage fish	2	2	0.155	0.177	0.166	--	0.177 m	9.3	15	0.0	0.0
	predator fish	1	3	0.214	0.214	0.214	--	0.214 m	9.3	15	0.0	0.0
	all fish	4	7	0.155	0.216	0.191	--	0.216 m	9.3	15	0.0	0.0
Vanadium												
Upper Assessment Area	Aquatic											
	bottom fish	0	1	N/A	N/A	N/A	--	N/A m	0.09	2.1	NA	NA
	forage fish	1	4	1.188	1.19	1.19	--	1.19 m	0.09	2.1	13.2	0.6
	predator fish	--	--	--	--	--	--	-- m	0.09	2.1	NA	NA
	all fish	1	5	1.188	1.19	1.19	--	1.19 m	0.09	2.1	13.2	0.6
Middle Assessment Area	Aquatic											
	bottom fish	0	1	N/A	N/A	N/A	--	N/A m	0.09	2.1	NA	NA
	forage fish	--	--	--	--	--	--	-- m	0.09	2.1	NA	NA
	predator fish	0	1	N/A	N/A	N/A	--	N/A m	0.09	2.1	NA	NA
	all fish	0	2	N/A	N/A	N/A	--	N/A m	0.09	2.1	NA	NA
Lower Assessment Area	Aquatic											
	bottom fish	1	2	0.258	0.258	0.258	--	0.258 m	0.09	2.1	2.9	0.1
	forage fish	0	2	N/A	N/A	N/A	--	N/A m	0.09	2.1	NA	NA
	predator fish	1	3	0.148	0.148	0.148	--	0.148 m	0.09	2.1	1.6	0.1
	all fish	2	7	0.148	0.258	0.203	--	0.258 m	0.09	2.1	2.9	0.1

Notes:

All units in mg/kg dw

CTC: critical tissue concentration

EPC: exposure point concentration

HQ: hazard quotient

LOAEL: lowest observed adverse effect level

m: maximum

N/A: Measured tissue concentrations were not detected

NA: CTC not available

NOAEL: no observed adverse effect level

PCB: polychlorinated biphenyl

UCL: upper confidence limit on arithmetic mean

0 values indicated HQ is <1

Tissue CTCs are presented in Table 5-2b.

NOAEL and LOAEL HQ < 1*

NOAEL HQ > 1 and LOAEL HQ < 1*

NOAEL or LOAEL HQ > 1 and < 10*

LOAEL HQ > 10*

* All HQs rounded to the nearest whole number

Table AD2b-1. Percentage of Surface Sediment Samples Exceeding Site-Specific Toxicity Thresholds by Reach
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

Exposure Unit	Total Number of Samples in Reach	Percentage of Surface Sediment Samples Exceeding Toxicity Threshold Values										
		Total PCBs (mg/kg dw)										
		H. azteca 42-day young/female (normalized to survival)				C. dilutus Percent Emergence				C. dilutus survival		
		< EC0* (1.4)	≥ EC0*, < EC10* (2.6)	≥ EC10*, < EC20* (4.4)	≥ EC20 (4.4)	< EC0* (2.0)	≥ EC0*, < EC10* (6.8)	≥ EC10*, < EC20* (14.3)	≥ EC20 (14.3)	< EC0* (14)	≥ EC0*, < EC10* (75.7)	≥ EC10*, < EC20* (123)
C1	16	31	25	13	31	44	44	6	6	94	6	0
C2	39	72	5	10	13	77	13	0	10	90	8	3
C3	14	57	36	7	0	86	14	0	0	100	0	0
C4	25	84	8	0	8	88	4	4	4	100	4	0
C5	48	83	10	4	2	87	13	0	0	100	0	0
C6	4	100	0	0	0	100	0	0	0	100	0	0
C7	36	70	11	19	0	72	28	0	0	100	0	0
C8	32	75	22	3	0	94	6	0	0	100	0	0
C9	17	100	0	0	0	100	0	0	0	100	0	0
C10	36	89	8	3	0	97	3	0	0	100	0	0
Total	267	75	12	7	5	84	12	1	2	98	2	0.4

**Table AD2b-2 Percentage of Surface Sediment Samples Exceeding Toxicity Thresholds by
Reach Anniston PCB Site, Anniston, Alabama**

EU	Total Number of Samples in Reach	Percentage of Surface Sediment Samples Exceeding Sediment Toxicity Threshold Values ^a									
		Total PCBs (mg/kg dw)					Total PCBs (mg/kg-OC)				
		<i>H. azteca</i> 42-day young/female (normalized to survival)				<i>C. dilutis</i> Survival	<i>H. azteca</i> 42-day young/female (normalized to survival)				<i>C. dilutis</i> Survival
		< EC0* (1.4)	>EC0*; ≤ EC10* (2.6)	>EC10*; ≤ EC20* (4.4)	> EC20*	> EC0* (14)	< EC0* (72.8)	>EC0*; ≤ EC10* (120)	>EC10*; ≤ EC20* (195)	> EC20*	> EC0* (1000)
C1	16	31%	25%	25%	19%	6%	25%	0%	6%	69%	25%
C2	39	72%	5%	10%	13%	10%	74%	0%	5%	21%	8%
C3	14	57%	36%	7%	0%	0%	43%	14%	14%	29%	0%
C4	25	84%	8%	0%	8%	4%	52%	12%	8%	28%	0%
C5	48	83%	10%	4%	2%	0%	54%	15%	17%	15%	0%
C6	4	100%	0%	0%	0%	0%	75%	25%	0%	0%	0%
C7	36	69%	11%	19%	0%	0%	50%	14%	17%	19%	3%
C8	32	78%	19%	3%	0%	0%	94%	6%	0%	0%	0%
C9	17	100%	0%	0%	0%	0%	100%	0%	0%	0%	0%
C10	37	89%	8%	3%	0%	0%	92%	8%	0%	0%	0%
Total	268	77%	12%	7%	4%	2%	67%	9%	8%	16%	3%

**Table AD2b-2 Percentage of Surface Sediment Samples Exceeding Toxicity Thresholds by
Reach Anniston PCB Site, Anniston, Alabama**

EU	Percentage of Surface Sediment Samples Exceeding Sediment Toxicity Threshold Values ^a					
	Mercury (mg/kg dw)					
	Total Number of Samples in Reach	<i>H. azteca</i> 42-day young/female (normalized to survival)				<i>C. dilutis</i> Survival
		< EC0*	>EC0*; ≤ EC10*	>EC10*; ≤ EC20*	> EC20*	
C1	2	0%	100%	0%	0%	0%
C2	7	43%	0%	14%	43%	14%
C3	10	40%	20%	30%	10%	0%
C4	7	29%	0%	57%	14%	0%
C5	25	8%	44%	32%	16%	0%
C6	0	--	--	--	--	--
C7	21	38%	33%	14%	14%	5%
C8	3	33%	0%	33%	33%	0%
C9	1	0%	0%	100%	0%	0%
C10	15	47%	7%	13%	33%	0%
Total	91	30%	25%	25%	20%	2%

Notes

^a EC0*, EC10*, and EC20* are the regression-predicted PCB or mercury concentrations that would cause an additional 0%, 10%, or 20% effect beyond the lowest response measured in the reference sediments (i.e., 1×, 0.9×, and 0.8× the response at the “bottom” of the reference envelope).
H. azteca 42-day young/female (normalized to survival) is the most sensitive endpoint.
 -- : Not calculated since there were no samples collected for mercury from this EU.

EU: exposure unit

OC: organic carbon

PCBs: polychlorinated biphenyls

Negligible risk when concentration is below EC0* for most sensitive reproduction endpoint

Low risk based on exceedance of EC0* for most sensitive reproduction endpoint

Moderate risk based on exceedance of EC10* for most sensitive reproduction endpoint

High risk based on exceedance of EC20* for most sensitive reproduction endpoint

Risk Based based on EC0* for most sensitive survival endpoint.

Table AD3-1. Summary of LOAEL Hazard Quotients by Exposure Unit for Aquatic and Terrestrial Mixed Diet Receptors (Modeled Tissue) Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C1 ¹	C1 ¹	C1 ¹	C2	C2	C2	C2	C3	C3	C3	C4	C4	C4	Upper AA
Exposure Subarea→		East Floodplain Soil, Riparian Soil & Sediment	West Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Central Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	Floodplain Soil, Riparian Soil & Sediment
Receptors↓		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Aquatic+Terrestrial Birds															
Carolina Wren - 2	tPCB-mid	6	37	--	3	3	3	--	2	5	--	2	2	--	3
	tPCB-high	64	402	--	37	28	31	--	26	52	--	23	17	--	28
	Barium ³	--	--	--	1	1	1	--	0	0	--	0	0	--	0
	Chromium	--	--	--	2	1	1	--	1	2	--	2	1	--	1
	Cobalt ³	--	--	--	0	1	1	--	1	1	--	0	0	--	0
	Lead	--	--	--	1	1	2	--	1	2	--	1	1	--	1
	Mercury	--	--	--	43	42	42	--	6	7	--	5	5	--	10
	Vanadium	--	--	--	3	3	3	--	3	3	--	3	2	--	3
Spotted Sandpiper - 1	tPCB-mid	--	--	4	--	--	--	11	--	--	7	--	--	3	--
	tPCB-high	--	--	48	--	--	--	116	--	--	81	--	--	35	--
	Barium ³	--	--	1	--	--	--	1	--	--	0	--	--	1	--
	Chromium	--	--	2	--	--	--	1	--	--	1	--	--	2	--
	Cobalt ³	--	--	0	--	--	--	0	--	--	0	--	--	0	--
	Lead	--	--	4	--	--	--	2	--	--	1	--	--	2	--
	Mercury	--	--	7	--	--	--	9	--	--	13	--	--	9	--
	Vanadium	--	--	6	--	--	--	3	--	--	3	--	--	3	--
Aquatic+Terrestrial Mammals															
Mink - 1	tPCB-mink	--	--	48	--	--	--	32	--	--	6	--	--	9	--
Mink - 1 (Alternate TRV) ²	tPCB-mink	--	--	97	--	--	--	64	--	--	12	--	--	17	--
	Barium ³	--	--	0	--	--	--	0	--	--	0	--	--	0	--
	Chromium	--	--	0	--	--	--	0	--	--	0	--	--	0	--
	Cobalt ³	--	--	0	--	--	--	0	--	--	0	--	--	0	--
	Lead	--	--	0	--	--	--	0	--	--	0	--	--	0	--
	Mercury	--	--	0	--	--	--	1	--	--	0	--	--	0	--
	Vanadium	--	--	0	--	--	--	0	--	--	0	--	--	0	--
Raccoon - 1	tPCB	2	12	2	1	1	1	3	1	2	1	1	1	1	0
	Barium ³	--	--	0	0	0	0	0	0	0	0	0	0	0	0
	Chromium	--	--	0	0	0	0	0	0	0	0	0	0	0	0
	Cobalt ³	--	--	0	0	0	0	0	0	0	0	0	0	0	0
	Lead	--	--	0	0	0	0	0	0	0	0	0	0	0	0
	Mercury	--	--	0	0	0	0	0	0	0	0	0	0	0	0
	Vanadium	--	--	0	0	0	0	0	0	0	0	0	0	0	0
Raccoon - 2	tPCB	--	--	5	--	--	--	4	--	--	1	--	--	1	--
	Barium ³	--	--	0	--	--	--	0	--	--	0	--	--	0	--
	Chromium	--	--	0	--	--	--	0	--	--	0	--	--	0	--
	Cobalt ³	--	--	0	--	--	--	0	--	--	0	--	--	0	--
	Lead	--	--	0	--	--	--	0	--	--	0	--	--	0	--
	Mercury	--	--	0	--	--	--	1	--	--	0	--	--	0	--
	Vanadium	--	--	0	--	--	--	0	--	--	0	--	--	0	--

Table AD3-1. Summary of LOAEL Hazard Quotients by Exposure Unit for Aquatic and Terrestrial Mixed Diet Receptors (Modeled Tissue) Anniston PCB Site, Anniston, Alabama

Exposure Unit→		Upper AA	C5	C5	C5	C6	C6	C6	Middle AA	Middle AA	C7	C7	C7	C8	C8	C8
Exposure Subarea→		Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment
Receptors↓		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Aquatic+Terrestrial Birds																
Carolina Wren - 2	tPCB-mid	--	0	0	--	0	0	--	0	--	0	0	--	1	0	--
	tPCB-high	--	4	4	--	3	5	--	4	--	3	4	--	6	5	--
	Barium ³	--	1	1	--	1	1	--	1	--	0	0	--	0	0	--
	Chromium	--	2	2	--	2	2	--	2	--	1	1	--	1	1	--
	Cobalt ³	--	1	1	--	1	1	--	1	--	1	0	--	0	1	--
	Lead	--	2	2	--	2	2	--	2	--	1	1	--	1	1	--
	Mercury	--	3	3	--	4	6	--	3	--	3	5	--	8	3	--
	Vanadium	--	6	6	--	6	4	--	5	--	3	3	--	2	3	--
Spotted Sandpiper - 1	tPCB-mid	3	--	--	1	--	--	1	--	1	--	--	1	--	--	1
	tPCB-high	37	--	--	10	--	--	8	--	9	--	--	9	--	--	8
	Barium ³	1	--	--	1	--	--	1	--	1	--	--	0	--	--	0
	Chromium	1	--	--	2	--	--	2	--	2	--	--	1	--	--	1
	Cobalt ³	0	--	--	1	--	--	1	--	1	--	--	0	--	--	0
	Lead	2	--	--	3	--	--	2	--	3	--	--	1	--	--	1
	Mercury	8	--	--	4	--	--	5	--	4	--	--	7	--	--	11
	Vanadium	3	--	--	5	--	--	5	--	5	--	--	2	--	--	4
Aquatic+Terrestrial Mammals																
Mink - 1	tPCB-mink	14	--	--	3	--	--	1	--	3	--	--	3	--	--	3
Mink - 1 (Alternate TRV) ²	tPCB-mink	27	--	--	6	--	--	2	--	6	--	--	6	--	--	6
	Barium ³	0	--	--	0	--	--	0	--	0	--	--	0	--	--	0
	Chromium	0	--	--	0	--	--	0	--	0	--	--	0	--	--	0
	Cobalt ³	0	--	--	0	--	--	0	--	0	--	--	0	--	--	0
	Lead	0	--	--	0	--	--	0	--	0	--	--	0	--	--	0
	Mercury	0	--	--	0	--	--	0	--	0	--	--	0	--	--	0
	Vanadium	0	--	--	0	--	--	0	--	0	--	--	0	--	--	0
Raccoon - 1	tPCB	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Barium ³	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Chromium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cobalt ³	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Lead	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mercury	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Vanadium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Raccoon - 2	tPCB	1	--	--	0	--	--	0	--	0	--	--	0	--	--	0
	Barium ³	0	--	--	0	--	--	0	--	0	--	--	0	--	--	0
	Chromium	0	--	--	0	--	--	0	--	0	--	--	0	--	--	0
	Cobalt ³	0	--	--	0	--	--	0	--	0	--	--	0	--	--	0
	Lead	0	--	--	0	--	--	0	--	0	--	--	0	--	--	0
	Mercury	0	--	--	0	--	--	0	--	0	--	--	0	--	--	0
	Vanadium	0	--	--	0	--	--	0	--	0	--	--	0	--	--	0

Table AD3-1. Summary of LOAEL Hazard Quotients by Exposure Unit for Aquatic and Terrestrial Mixed Diet Receptors (Modeled Tissue) Anniston PCB Site, Anniston, Alabama

Exposure Unit→		C9	C9	C9	C10 ¹	Lower AA	Lower AA
Exposure Subarea→		North Floodplain Soil, Riparian Soil & Sediment	South Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment	Riparian Soil & Sediment	Floodplain Soil, Riparian Soil & Sediment	Riparian Soil & Sediment
Receptors↓		LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ	LOAEL HQ
Aquatic+Terrestrial Birds							
Carolina Wren - 2	tPCB-mid	0	0	--	--	0	--
	tPCB-high	3	1	--	--	4	--
	Barium ³	0	0	--	--	0	--
	Chromium	1	1	--	--	1	--
	Cobalt ³	0	1	--	--	1	--
	Lead	1	1	--	--	1	--
	Mercury	5	3	--	--	4	--
	Vanadium	2	3	--	--	3	--
Spotted Sandpiper - 1	tPCB-mid	--	--	1	1	--	1
	tPCB-high	--	--	7	6	--	6
	Barium ³	--	--	0	0	--	0
	Chromium	--	--	1	1	--	1
	Cobalt ³	--	--	0	0	--	0
	Lead	--	--	1	1	--	1
	Mercury	--	--	5	9	--	9
	Vanadium	--	--	2	4	--	4
Aquatic+Terrestrial Mammals							
Mink - 1	tPCB-mink	--	--	1	2	--	3
Mink - 1 (Alternate TRV) ²	tPCB-mink	--	--	3	5	--	6
	Barium ³	--	--	0	0	--	0
	Chromium	--	--	0	0	--	0
	Cobalt ³	--	--	0	0	--	0
	Lead	--	--	0	0	--	0
	Mercury	--	--	0	0	--	0
	Vanadium	--	--	0	0	--	0
Raccoon - 1	tPCB	0	0	0	0	0	0
	Barium ³	0	0	0	0	0	0
	Chromium	0	0	0	0	0	0
	Cobalt ³	0	0	0	0	0	0
	Lead	0	0	0	0	0	0
	Mercury	0	0	0	0	0	0
	Vanadium	0	0	0	0	0	0
Raccoon - 2	tPCB	--	--	0	0	--	0
	Barium ³	--	--	0	0	--	0
	Chromium	--	--	0	0	--	0
	Cobalt ³	--	--	0	0	--	0
	Lead	--	--	0	0	--	0
	Mercury	--	--	0	0	--	0
	Vanadium	--	--	0	0	--	0

Table AD3-1. Summary of LOAEL Hazard Quotients by Exposure Unit for Aquatic and Terrestrial Mixed Diet Receptors (Modeled Tissue) Anniston PCB Site, Anniston, Alabama

Notes:

NOAEL HQ* ≤ 1
LOAEL HQ* ≤ 1
LOAEL HQ* > 1 and ≤ 10
LOAEL HQ* > 10

* All HQs rounded to the nearest whole number

¹ Riparian soil in reaches C1 and C10 is based on the applicable assessment area (i.e., Upper for C1 and Lower for C10). Reach C10 was not evaluated for terrestrial receptors due to lack of floodplain soil.

² Alternate TRVs were selected from Restum et al. (1998) based on growth. The LOAEL TRV is 0.05 mg/kg-day.

³ Barium and cobalt are COPCs in sediment only. Soil exposures were estimated for these metals so that the complete aquatic + terrestrial dose could be estimated.

AA: assessment area

COPCs: constituent of potential concern

HQ: hazard quotient

mg/kg-day: milligrams per kilogram per day

NOAEL: no observed adverse effect level

tPCB: total polychlorinated biphenyl

TRV: toxicity reference value

--: not available

Exposure Units:

C1: Oxford Lake Park

C2: Backwater Area

C3: Friendship Road to Highway 21

C4: Hwy 21 to Silver Run Road

C5: Silver Run Road to Mitchell Matson Road

C6: Mitchell Matson Road to 2,000 feet upstream of Curry Station Road

C7: Upstream of Curry Station Road to Eastaboga Creek

C8: Eastaboga Creek to Jackson Shoals Dam

C9: Jackson Shoals Dam to Highway 77

C10: Highway 77 Bridge to Lake Logan Martin

Exposure Subareas:

East: East Subarea Floodplain Soil

West: West Subarea Floodplain Soil

North: North Subarea Floodplain Soil

South: South Subarea Floodplain Soil

Central: Central Subarea Floodplain Soil

References:

Restum, J., S. Bursian, J. Giesy, J. Render, W. Helferich, E. Shipp, D. Verbrugge, and R. Aulerich. 1998. Multigenerational study of the effects of consumption of PCB-contaminated carp from Saginaw Bay, Lake Huron, on mink: 1. Effects on mink reproduction, kit growth, and survival, and selected biological parameters. J. Toxicol. Environ. Health Part A 54: 343 375.

Table 5-1. Comparison of 95% UCL of the measured sediment PCB concentrations by Reach and by Assessment Area (AA) to the 95% UCLs of the Surface Water Average Concentration¹.

**OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama**

AA	Reach	PCBs (mg/kg)					
		AA			Reach		
		95% UCL of measured PCBs	95%UCL of SWAC	Ratio 95% UCL of Measured / 95% UCL of SWAC	95% UCL of measured PCBs	95% UCL of SWAC	Ratio 95% UCL of Measured / 95% UCL of SWAC
C1 ²	C1 ²	16	16	1	16	16	1
Upper	C2	5.61	4.09	1.37	16.8	10	1.68
Upper	C3				1.80	1.1	1.64
Upper	C4				2.94	2.42	1.21
Middle	C5	1.46	0.758	1.926	1.54	0.826	1.86
Middle	C6				0.17 ³	0.17 ³	1.00
Lower	C7	0.919	1.11	0.83	1.71	0.897	1.91
Lower	C8				1.08	1.02	1.06
Lower	C9				0.357	0.254	1.41
Lower	C10				0.775	0.735	1.05
Site overall mean ratio				1.28			1.38

Notes

1. SWAC: Surface Weighted Average Concentration. Presented in Table 4-4 of Baseline Ecological Risk Assessment (BERA).
2. Not spatially weighted. Standard 95% Upper Confidence Limit (UCL) was selected as the reach and AA Exposure Point Concentration (EPC).
3. Insufficient data (< 8 samples), weighted maximum used for Reach C6.

Table 5-2. Comparison of 95% UCLs of the measured sediment mercury concentrations by Reach and by Assessment Area (AA) to the 95% UCLs of the SWAC¹.

**OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama**

AA	Reach	Mercury (mg/kg)					
		AA			Reach		
		95% UCL of measured PCBs	95% UCL of SWAC	Ratio 95% UCL of Measured/ 95% UCL of SWAC	95% UCL of measured PCBs	95% UCL of SWAC	Ratio 95% UCL of Measured/ 95% UCL of SWAC
C1 ²	C1 ²	0.58	0.58	1.00	0.58	0.58	1.00
Upper	C2	11	4.48	2.46	126.7 ³	27.4	4.62
Upper	C3				0.819	0.959	0.85
Upper	C4						
Middle	C5	0.827	0.845	0.979	0.907	0.815	1.11
Middle	C6						
Lower	C7	1.01	1.07	0.94	0.863	0.822	1.05
Lower	C8						
Lower	C9						
Lower	C10						
Site overall mean ratio				1.34			1.73

Notes

1. SWAC: Surface Weighted Average Concentration. Presented in Table 4-4 of Baseline Ecological Risk Assessment (BERA).
2. Not spatially weighted. Exposure Point Concentration (EPC) based on the maximum concentration.
3. Dataset is small; Upper Confidence Limit (UCL) may be unreliable.

**Table AD5-3. EPC Calculation Details Table for PCBs in Surface
Sediments Anniston PCB Site, Anniston, Alabama**

Data Groups			Descriptive Statistics						MCA (Fine + Coarse + Gravel)				
Assessment Area	Reach	Sediment Texture	Core Locations (n)	Surface Area (ac)	PCB Samples (n)	Detected Samples (n)	Mean Surface PCB (mg/kg)	Max Surface PCB (mg/kg)	Reach Sample Weighting Factor	Reach Bootstrap Mean	Reach 95%tile of Bootstrap Means	Assessment Area Bootstrap Mean	Assessment Area 95%tile of Bootstrap Means
C1	C1 ^a	Snow Creek ^a	16	NA	16	15	5.26	41.00	NA	NA	NA	NA	NA
Upper	C2	Coarse	14	2.5	15	3	0.37	3.08	0.01	5.13	9.95	1.69	4.09
		Fine	24	6.5	22	13	8.83	95.00	0.03				
		Gravel	8	2.4	2	2	0.55	0.81	0.10				
		No Recovery	2	0.7	0	0	0.05	NA					
	C3	Coarse	14	6.0	5	5	0.75	1.96	0.09	0.83	1.10		
		Fine	5	2.2	9	9	1.29	2.83	0.02				
		Gravel ^b	9	5.3	0	0	0.75	NA	0.39				
		No Recovery	4	1.7	0	0	0.05	NA					
	C4	Coarse	79	28.8	16	16	1.07	8.90	0.05	1.24	2.42		
		Fine	7	2.2	5	5	5.32	23.20	0.01				
		Gravel	18	6.8	4	4	0.58	1.45	0.05				
		No Recovery	8	3.1	0	0	0.05	NA					
Middle	C5	Coarse	75	47.2	31	26	0.52	5.15	0.03	0.55	0.83	0.49	0.76
		Fine	6	3.6	14	14	1.62	3.90	0.005				
		Gravel	9	5.5	2	1	0.07	0.08	0.05				
		No Recovery	34	19.5	0	0	0.05	NA					
	C6 ^c	Coarse	37	28.4	3	2	0.10	0.14	0.29	< 8 Samples			
		Fine	1	0.7	1	1	1.20	1.20	0.02				
		Gravel ^b	6	4.0	0	0	0.10	NA	0.12				
		No Recovery	40	24.6	0	0	0.05	NA					
Lower	C7	Coarse	56	35.4	17	11	0.56	3.17	0.04	0.61	0.90	0.83	1.11
		Fine	8	5.0	17	16	1.87	4.20	0.01				
		Gravel	14	8.3	1	1	0.09	0.09	0.17				
		No Recovery	22	12.7	0	0	0.05	NA					
	C8	Coarse	30	27.1	14	13	0.57	2.64	0.04	0.81	1.02		
		Fine	25	24.1	18	18	1.09	2.13	0.03				
		Gravel ^b	2	1.4	0	0	0.57	NA	0.03				
		No Recovery	35	30.4	0	0	0.05	NA					
	C9	Coarse	7	7.9	7	6	0.18	0.49	0.04	0.17	0.25		
		Fine	9	11.2	8	5	0.23	0.84	0.05				
		Gravel	9	11.0	2	1	0.11	0.16	0.18				
		No Recovery	31	37.1	0	0	0.05	NA					
	C10	Coarse	13	27.6	6	6	0.37	0.64	0.01	0.56	0.74		
		Fine	95	347.1	31	25	0.57	2.72	0.03				
		Gravel ^b	0	0.0	0	0	0.37	NA	0				
		No Recovery	13	26.6	0	0	0.05	NA					

**Table AD5-3. EPC Calculation Details Table for PCBs in Surface
Sediments Anniston PCB Site, Anniston, Alabama**

Notes:

Areas of no sediment recovery were not included in the assessment or spatial weighting

a. Snow Creek values are representative of 16 samples collected from individual deposits and are not spatially weighted. A standard 95% UCL of 16.0 mg/kg was selected as the reach and AA EPC.

b. Gravel areas without samples in a given reach were assumed to have a gravel PCB concentration equal to mean Coarse Sediment for that reach.

c. Dataset is small; weighted maximum EPC of 0.17 mg/kg calculated for reach C6.

 Blue shading indicates selected EPC value

AA: assessment area

ac: acres

EPC: exposure point concentration

MCA: Monte-Carlo analysis

mg/kg: milligrams per kilogram

NA: not applicable or not calculated

PCB: polychlorinated biphenyl

UCL: 95% upper confidence limit

Table AD5-4. EPC Calculation Details Table for Mercury in Surface Sediments by Reach Anniston PCB Site, Anniston, Alabama

Data Groups		Descriptive Statistics						MCA (Fine and Coarse)			MCA (Fine + Coarse + Gravel)		
Hg Reach	Sediment Texture	Core Locations (n)	Surface Area (ac)	Hg Samples (n)	Detected Samples (n)	Mean Surface Hg (mg/kg)	Max Surface Hg (mg/kg)	Sample Weighting Factor	Mean	95% of Bootstrap Means	Reach Sample Weighting Factor	Reach Bootstrap Mean	Reach 95%tile of Bootstrap Means
C1 ^a	Snow Creek ^a	16	NA	2	2	0.55	0.58				NA	NA	NA
C2	Coarse	14	2.5	4	3	0.87	2.60	0.0694	6.5	11.7	0.05	14.1	27.4
	Fine	24	6.5	2	2	23.32	46.60	0.361			0.29		
	Gravel	8	2.4	1	1	2.90	2.90				0.21		
	No Recovery	2	0.7	0	0	No samples	No samples						
C3 to C4	Coarse	93	34.7	5	5	0.94	1.30	0.178	0.89	1.25	0.14	0.801	0.96
	Fine	12	4.4	9	9	0.54	1.00	0.0124			0.01		
	Gravel	27	12.1	3	3	0.51	0.91				0.08		
	No Recovery	12	4.7	0	0	No samples	No samples						
C5 to C8	Coarse	coarse	138.1	22	22	0.57	1.40	0.0366			0.03	0.640	0.82
	Fine	fine	33.5	25	25	0.97	6.30	0.00780			0.01		
	Gravel**	gravel	19.2	0	0	0.49	No samples				0.10		
	No Recovery	NR	87.2	0	0	No samples	No samples						
C9 to C10	Coarse	coarse	35.4	1	1	0.57	0.57	0.0900			0.09	0.615	0.822
	Fine	fine	358.3	15	15	0.64	1.70	0.0607			0.06		
	Gravel ^b	gravel	11.0	0	0	0.57	No samples				0.03		
	No Recovery	NR	63.7	0	0	No samples	No samples						

Notes:

Non-weighted UCLs calculation used. No substitutions were made for gravel and no recovery samples
Areas of no sediment recovery were not included in the assessment or spatial weighting

- a. Snow Creek values are representative of 16 samples collected from individual deposits and are not spatially weighted. A reach EPC of 0.58 mg/kg based on the maximum concentration was selected.
b. Gravel areas without samples in a given reach were assumed to have a gravel PCB concentration equal to mean Coarse Sediment for that reach

*** Dataset is small; UCL may be unreliable

Blue shading indicates selected EPC value

AA: assessment area
ac: acres
EPC: exposure point concentration
Hg: mercury
mg/kg: milligrams per kilogram
NA: not applicable or not calculated
NR: no recovery
PCB: polychlorinated biphenyl
UCL: Upper Confidence Limit

**Table AD5-5. EPC Calculation Details Table for Mercury in Surface Sediments by Assessment
Area Anniston PCB Site, Anniston, Alabama**

Data Groups		Descriptive Statistics						MCA (Fine and Coarse)			MCA (Fine + Coarse + Gravel)		
Hg Reach	Sediment Texture	Core Locations (n)	Surface Area (ac)	Hg Samples (n)	Detected Samples (n)	Mean Surface Hg (mg/kg)	Max Surface Hg (mg/kg)	Sample Weighting Factor	Mean	95% of Bootstrap Means	Reach Sample Weighting Factor	Reach Bootstrap Mean	Reach 95%tile of Bootstrap Means
C1 ^a	Snow Creek ^a	16	NA	2	2	0.55	0.58				NA	NA	NA
Upper	Coarse	107	37.2	9	9	0.91	2.60	0.0861			0.07		
	Fine	36	10.8	11	11	4.68	46.60	0.0205	6.46	11.7	0.02	1.61	4.48
	Gravel	35	14.5	4	4	1.11	2.90				0.06		
	No Recovery	14	5.5	0	0	No samples	No samples						
Middle	Coarse	112	75.6	13	13	0.74	1.40	0.0727			0.07		
	Fine	7	4.4	11	11	0.70	1.20	0.0050	0.894	1.25	0.004	0.736	0.85
	Gravel**	15	9.5	0	NA	0.62	No samples				0.11		
	No Recovery	74	44.1	0	NA	No samples	No samples						
Lower	Coarse	106	97.9	10	10	0.35	0.57	0.0202			0.02		
	Fine	137	387.4	29	29	0.90	6.30	0.0275			0.03	0.769	1.07
	Gravel ^b	25	20.7	0	0	0.35	No samples				0.04		
	No Recovery	101	106.8	0	0	No samples	No samples						

Notes:

Areas of no sediment recovery were not included in the assessment or spatial weighting.

a. Snow Creek values are representative of 16 samples collected from individual deposits and are not spatially weighted. An AA EPC of 0.58 mg/kg based on the maximum concentration was selected.

b. Gravel areas without samples in a given reach were assumed to have a gravel PCB concentration equal to mean Coarse Sediment for that reach.

Blue shading indicates selected EPC value

AA: assessment area

ac: acres

EPC: exposure point concentration

Hg: mercury

MCA: Monte-Carlo analysis

mg/kg: milligrams per kilogram

NA: not applicable or not calculated

PCB: polychlorinated biphenyl

Table AD6-1. Summary of PCB Risks to Aquatic+Terrestrial Birds (Mid-Sensitivity HQs) Anniston PCB Site, Anniston, Alabama

Reach	HQ Type	Carolina Wren - 2	Spotted Sandpiper - 1
	TRV/CTC Type	mid sens	mid sens
C1 East	Modeled HQ	6	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
C1 West	Modeled HQ	37	--
	Measured HQ	9	--
	Tissue HQ	≤ 1	--
C1 Riparian	Modeled HQ	--	4
	Measured HQ	--	3
	Tissue HQ	--	≤ 1
C2 North	Modeled HQ	3	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
C2 South	Modeled HQ	3	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
C2 Central	Modeled HQ	3	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
C2 Riparian	Modeled HQ	--	11
	Measured HQ	--	4
	Tissue HQ	--	≤ 1
C3 North	Modeled HQ	2	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
C3 South	Modeled HQ	5	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
C3 Riparian	Modeled HQ	--	7
	Measured HQ	--	3
	Tissue HQ	--	≤ 1
C4 North	Modeled HQ	2	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
C4 South	Modeled HQ	2	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
C4 Riparian	Modeled HQ	--	3
	Measured HQ	--	3
	Tissue HQ	--	≤ 1
UAA Soil	Modeled HQ	3	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
UAA Riparian	Modeled HQ	--	3
	Measured HQ	--	3
	Tissue HQ	--	≤ 1

Notes:

LOAEL HQ values presented

Tissue HQs for birds based on modeled egg concentrations.

If available HQs (modeled, measured, tissue) are less than 1, the EU/Reach/AA/COPC/Receptor is not shown.

	Gray shading indicates NOAEL HQ ≤ 1
	Green shading indicates NOAEL HQ > 1 and LOAEL HQ ≤ 1
	Yellow shading indicates LOAEL HQ > 1
	Orange shading indicates LOAEL HQ > 10

AA: assessment area

COPC: constituent of potential concern

CTC: critical tissue concentration

EU: exposure unit

HQ: hazard quotient

LAA: lower assessment area

LOAEL: lowest observed adverse effect level

MAA: middle assessment area

NOAEL: no observed adverse effect level

TRV: toxicity threshold value

UAA: upper assessment area

**Table AD6-2. Summary of PCB Risks to Aquatic+Terrestrial
Mammals Anniston PCB Site, Anniston, Alabama**

Reach	HQ Type	Raccoon - 1	Raccoon - 2	Mink - 1	Mink - 1
	TRV/CTC Type	Mammal	Mammal	Mink, repro	Mink, growth
C1 East	Modeled HQ	2	--	--	--
	Measured HQ	< 1	--	--	--
C1 West	Modeled HQ	12	--	--	--
	Measured HQ	< 1	--	--	--
C1 Riparian	Modeled HQ	2	5	48	97
	Measured HQ	≤ 1	≤ 1	9	18
C2 Riparian	Modeled HQ	3	4	32	64
	Measured HQ	≤ 1	≤ 1	9	18
C3 South	Modeled HQ	2	--	--	--
	Measured HQ	≤ 1	--	--	--
C3 Riparian	Modeled HQ	≤ 1	≤ 1	6	12
	Measured HQ	≤ 1	≤ 1	9	18
C4 Riparian	Modeled HQ	≤ 1	≤ 1	9	17
	Measured HQ	≤ 1	≤ 1	9	18
C5 Riparian	Modeled HQ	≤ 1	≤ 1	3	6
	Measured HQ	≤ 1	≤ 1	8	15
C6 Riparian	Modeled HQ	≤ 1	≤ 1	≤ 1	2
	Measured HQ	≤ 1	≤ 1	8	15
C7 Riparian	Modeled HQ	≤ 1	≤ 1	3	6
	Measured HQ	≤ 1	≤ 1	8	15
C8 Riparian	Modeled HQ	≤ 1	≤ 1	3	6
	Measured HQ	≤ 1	≤ 1	8	15
C9 Riparian	Modeled HQ	≤ 1	≤ 1	≤ 1	3
	Measured HQ	≤ 1	≤ 1	8	15
C10 Riparian	Modeled HQ	≤ 1	≤ 1	2	5
	Measured HQ	≤ 1	≤ 1	8	15
UAA Riparian	Modeled HQ	≤ 1	≤ 1	14	27
	Measured HQ	≤ 1	≤ 1	9	18
MAA Riparian	Modeled HQ	≤ 1	≤ 1	3	6
	Measured HQ	≤ 1	≤ 1	8	15
LAA Riparian	Modeled HQ	≤ 1	≤ 1	3	6
	Measured HQ	≤ 1	≤ 1	8	15

Table AD6-3. Summary of PCB Risks to Aquatic+Terrestrial Birds (Mid-Sensitivity HQs) Anniston PCB Site, Anniston, Alabama

Reach	HQ Type	Carolina Wren - 2	Spotted Sandpiper - 1
	TRV/CTC Type	mid sens	mid sens
C1 East	Modeled HQ	6	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
C1 West	Modeled HQ	37	--
	Measured HQ	9	--
	Tissue HQ	≤ 1	--
C1 Riparian	Modeled HQ	--	4
	Measured HQ	--	3
	Tissue HQ	--	≤ 1
C2 North	Modeled HQ	3	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
C2 South	Modeled HQ	3	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
C2 Central	Modeled HQ	3	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
C2 Riparian	Modeled HQ	--	11
	Measured HQ	--	4
	Tissue HQ	--	≤ 1
C3 North	Modeled HQ	2	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
C3 South	Modeled HQ	5	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
C3 Riparian	Modeled HQ	--	7
	Measured HQ	--	3
	Tissue HQ	--	≤ 1
C4 North	Modeled HQ	2	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
C4 South	Modeled HQ	2	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
C4 Riparian	Modeled HQ	--	3
	Measured HQ	--	3
	Tissue HQ	--	≤ 1
UAA Soil	Modeled HQ	3	--
	Measured HQ	4	--
	Tissue HQ	≤ 1	--
UAA Riparian	Modeled HQ	--	3
	Measured HQ	--	3
	Tissue HQ	--	≤ 1

Notes:

LOAEL HQ values presented

Tissue HQs for birds based on modeled egg concentrations.

If available HQs (modeled, measured, tissue) are less than 1, the EU/Reach/AA/COPC/Receptor is not shown.

	Gray shading indicates NOAEL HQ ≤ 1
	Green shading indicates NOAEL HQ > 1 and LOAEL HQ ≤ 1
	Yellow shading indicates LOAEL HQ > 1
	Orange shading indicates LOAEL HQ > 10

AA: assessment area

COPC: constituent of potential concern

CTC: critical tissue concentration

EU: exposure unit

HQ: hazard quotient

LAA: lower assessment area

LOAEL: lowest observed adverse effect level

MAA: middle assessment area

NOAEL: no observed adverse effect level

TRV: toxicity threshold value

UAA: upper assessment area

Table AD-6-4. Dietary Exposure Models Calculated using the Maximum or 95%UCL Measured PCB concentration in Reach C1 East and C1 West Sediment and “Riparian” Soil for the Sandpiper-1 Exposure Scenario
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

Table AD-6-1 (cont.). Dietary Exposure Models Calculated using the Maximum or 95%UCL Measured PCB concentration in Reach C1 East and C1 West Sediment and “Riparian” Soil for the Sandpiper-1 Exposure Scenario
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Anniston PCB Site, Anniston, Alabama

Location		Type	Conc. In Sediment B	Sediment Ingestion Rate	Conc. In Soil ^C	Soil Ingestion Rate	Total Intake through Sediment	Conc. In Surface Water	Water Ingestion Rate	Total Intake through Water	Conc. In Ews ^A	Percent of Diet Ews	Food Ingestion Rate	Conc. In aquatic Inverts ^D	Percent of Diet Aquatic Inverts	Food Ingestion Rate	Conc. in Lumbriculus	Percent of Diet Lumbriculus	Food Ingestion Rate	Total Intake through Food	Total Intake	AUF	Body Weight	Dose	LOAEL	HQ LOAEL	NOAEL	HQ NOAEL
			mg/kg dw	kg/day dw	mg/kg dw	kg/day dw	mg/day	mg/L	L/kg BW/day	mg/kg BW/day	mg/kg dw		kg/kg BW/day dw	mg/kg dw		kg/kg BW/day dw	mg/kg dw.		kg/kg BW/day dw	mg/day ww	mg/day		kg	mg/kg/day	mg/kg/day		mg/kg/day	
C1		Mercury	0.58	0.0162	17.4	0.0162	0.291276	0.000430	0.17	0.0000731	7.362	50	0.18	0.311	50	0.18		0	0.18	0.6905700	0.98192	1	0.043	0.9819191	0.068	14.44	0.023	42.69
C1		Chromium	46	0.0162	46	0.0162	1.4904	0.032900	0.17	0.005593	19.43	50	0.18	3.87	50	0.18		0	0.18	2.0970000	3.59299	1	0.043	3.5929930	2.8	1.28	2.7	1.33
C1		Lead	110	0.0162	89.1	0.0162	3.22542	0.096400	0.17	0.016388	115.7	50	0.18	6	50	0.18		0	0.18	10.9530000	14.19481	1	0.043	14.1948080	3.3	4.30	1.6	8.87
C1		Vanadium	53	0.0162	22.8	0.0162	1.22796	0.033900	0.17	0.005763	9.408	50	0.18	2.556	50	0.18		0	0.18	1.0767600	2.31048	1	0.043	2.3104830	0.7	3.30	0.34	6.80
C1-W ~ High sensitivity TRV		PCBs	41	0.0162	206.5	0.0162	4.0095	0.000498	0.17	0.00008466	84.64	50	0.18	3.511	50	0.18	882	0	0.18	7.9335900	11.94317	1	0.043	11.9431747	0.13	91.87	0.043	277.75
C1-W -medium sensitivity TRV		PCBs	41	0.0162	206.5	0.0162	4.0095	0.000498	0.17	0.00008466	84.64	50	0.18	3.511	50	0.18	882	0	0.18	7.9335900	11.94317	1	0.043	11.9431747	1.4	8.53	0.47	25.41
C1-W ~ High sensitivity TRV		PCBs	41	0.0162	59	0.0162	1.62	0.000498	0.17	0.00008466	84.64	50	0.18	3.511	50	0.18	882	0	0.18	7.9335900	9.55367	1	0.043	9.5536747	0.13	73.49	0.043	222.18
C1-W -medium sensitivity TRV		PCBs	41	0.0162	59	0.0162	1.62	0.000498	0.17	0.00008466	84.64	50	0.18	3.511	50	0.18	882	0	0.18	7.9335900	9.55367	1	0.043	9.5536747	1.4	6.82	0.47	20.33

		0.0162		0.0162		0.17		50		0.18		50		0.18		0		0.18		1		0.043					
Location	Analyte	Conc. In Sediment	Sediment Ingestion Rate	Conc. In Soil	Soil Ingestion Rate	Total Intake through Sediment	Conc. in Surface Water	Water Ingestion Rate	Total Intake through Water	Conc. In Soil inverts	Percent of Diet Soil inverts	Food Ingestion Rate	Conc. In aquatic invert	Percent of Diet aquatic inverts	Food Ingestion Rate	Conc. in Lumbriculus	Percent of Diet Lumbriculus	Food Ingestion Rate	Total Intake through Food	Total Intake	AUF	Body Weight	Dose	LOAEL	HQ LOAEL	NOAEL	HQ NOAEL
		mg/kg dw	kg/day dw	mg/kg dw	kg/day dw	mg/day	mg/L	L/day	mg/L	mg/kg dw		kg/kg BW/day dw	mg/kg dw		kg/kg BW/day dw	mg/kg dw.		kg/kg BW/day dw	mg/day ww	mg/day		kg	mg/kg/day	mg/kg/day		mg/kg/day	
C1	Mercury	0.58	0.0162	2.8	0.0162	0.054756	0.000430	0.17	0.0000731	5.583	50	0.18	0.232	50	0.18		0	0.18	0.5233500	0.57818	1	0.043	0.5781791	0.068	8.50	0.023	25.14
C1	Chromium	46	0.0162	27.5	0.0162	1.1907	0.032900	0.17	0.005593	19.43	50	0.18	3.87	50	0.18		0	0.18	2.0970000	3.29329	1	0.043	3.2932930	2.8	1.18	2.7	1.22
C1	Lead	110	0.0162	56.5	0.0162	2.6973	0.096400	0.17	0.016388	115.7	50	0.18	6	50	0.18		0	0.18	10.9530000	13.66669	1	0.043	13.6666880	3.3	4.14	1.6	8.54
C1	Vanadium	53	0.0162	20.2	0.0162	1.18584	0.033900	0.17	0.005763	9.408	50	0.18	2.556	50	0.18		0	0.18	1.0767600	2.26836	1	0.043	2.2683630	0.7	3.24	0.34	6.67
C1-W -- High sensitivity TRV	PCBs	15.98	0.0162	206.5	0.0162	3.604176	0.000498	0.17	0.00008466	45.15	50	0.18	2.653	50	0.18	383.4	0	0.18	4.3022700	7.90653	1	0.043	7.9065307	0.13	60.82	0.043	183.87
C1-W -medium sensitivity TRV	PCBs	15.98	0.0162	206.5	0.0162	3.604176	0.000498	0.17	0.00008466	45.15	50	0.18	2.653	50	0.18	383.4	0	0.18	4.3022700	7.90653	1	0.043	7.9065307	1.4	5.65	0.47	16.82
C1-W -- High sensitivity TRV	PCBs	15.98	0.0162	59	0.0162	1.214676	0.000498	0.17	0.00008466	45.15	50	0.18	2.653	50	0.18	383.4	0	0.18	4.3022700	5.51703	1	0.043	5.5170307	0.13	42.44	0.043	128.30
C1-W -medium sensitivity TRV	PCBs	15.98	0.0162	59	0.0162	1.214676	0.000498	0.17	0.00008466	45.15	50	0.18	2.653	50	0.18	383.4	0	0.18	4.3022700	5.51703	1	0.043	5.5170307	1.4	3.94	0.47	11.74
C1 UAA abiotic mean-med sensitivity TRV	PCBs	4.09	0.0162	10.22	0.0162	0.066258	0.000498	0.17	0.00008466	45.15	50	0.18	2.653	50	0.18	383.4	0	0.18	4.3022700	4.36861	1	0.043	4.3686127	1.4	3.12	0.47	9.29
C1 UAA abiotic mean-hi Sensitivity TRV	PCBs	4.09	0.0162	10.22	0.0162	0.066258	0.000498	0.17	0.00008466	45.15	50	0.18	2.653	50	0.18	383.4	0	0.18	4.3022700	4.36861	1	0.043	4.3686127	0.13	33.60	0.043	101.60

Soil invertebrate tissue concentrations from Table 4-16 of BERA
Aquatic invertebrate tissue concentrations from Table 4-15 of BERA
^A Earthworm concentrations are the max and 95UCL in earthworms from the UAA (Table 4-16)
^B Chromium, lead and vanadium concentrations in sediment are the maximum measured in Reach C-1, n =2 (Table 4-6)
^C Mercury, chromium, lead and vanadium concentrations in soil are the Max and 95% UCL measured in riparian soils for the UAA (Tables 4-8, 4-9, 4-10, and 4-11)
^D Chromium, lead and vanadium concentrations in benthic invertebrates are the maximum measured site-wide (Table 4-15)
mg/kg d.w. = milligrams per kilogram dry weight
mg/kg w.w. = milligrams per kilogram wet weight
kg = kilogram
mg/kg/day = milligrams per kilogram body weight per day
µg/L = micrograms per liter

HQ = Hazard Quotient
mg/L = milligrams per liter

Soil invertebrate tissue concentrations from Table 4-16 of BERA
Aquatic invertebrate tissue concentrations from Table 4-15 of BERA
^A Earthworm concentrations are the max and 95UCL in earthworms from the UAA (Table 4-16)
^B Chromium, lead and vanadium concentrations in sediment are the maximum measured in Reach C-1, n =2 (Table 4-6)
^C Mercury, chromium, lead and vanadium concentrations in soil are the Max and 95% UCL measured in riparian soils for the UAA (Tables 4-8, 4-9, 4-10, and 4-11)
^D Chromium, lead and vanadium concentrations in benthic invertebrates are the maximum measured site-wide (Table 4-15)
mg/kg d.w. = milligrams per kilogram dry weight
mg/kg w.w. = milligrams per kilogram wet weight
kg = kilogram
mg/kg/day = milligrams per kilogram body weight per day
µg/L = micrograms per liter

HQ = Hazard Quotient
mg/L = milligrams per liter

Table AD6-5. Dietary Exposure Models Calculated using the Maximum or 95% UCL Measured PCB concentration in Reach C1 East and C1 West Sediment and "Riparian" Soil for the Raccoon-2 Exposure Scenario

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Anniston PCB Site, Anniston, Alabama

Table AD6-2. (cont.) Dietary Exposure Models Calculated using the Maximum or 95% UCL Measured PCB concentration in Reach C1 East and C1 West Sediment and "Riparian" Soil for the Raccoon-2 Exposure Scenario

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Anniston PCB Site, Anniston, Alabama

Table AD6-2. (cont.) Dietary Exposure Models Calculated using the Maximum or 95% UCL Measured PCB concentration in Reach C1 East and C1 West Sediment and "Riparian" Soil for the Raccoon-2 Exposure Scenario

OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

Maximum concentration, C1																																										
Raccoon-2																																										
INITIAL SETTINGS																																										
0.001260.001260.083170.0268190.0268120.0268230.0268130.026830.0268130.026815.6																																										
Location	Type	Conc. In Sediment ^a	Sediment Ingestion Rate	Conc. In Soil ^c	Soil Ingestion Rate	Total Intake through Sediment	Conc. In Surface Water	Water Ingestion Rate	Total Intake through Water	Conc. In Aquatic Plants ^a	Percent of Diet	Food Ingestion Rate	Conc. In mammals/birds ^d	Percent of Diet	Food Ingestion Rate	Conc. In Amphibians ^a	Percent of Diet	Food Ingestion Rate	Conc. In All Fish ^a	Percent of Diet	Food Ingestion Rate	Conc. In Crayfish ^a	Percent of Diet	Food Ingestion Rate	Conc. in Lumbriculus ^e	Percent of Diet	Food Ingestion Rate	Conc. In Mollusks ^a	Percent of Diet	Food Ingestion Rate	Total Intake through Food	Total Intake	AUF	Body Weight	Dose	LOAEL	HQ LOAEL	NOAEL	HQ NOAEL			
																																								mg/kg dw	kg/day dw	mg/kg dw
C1 (UAA data)	Mercury	0.58	0.00126	17.4	0.00126	0.0227	0.000430	0.083	0.000357	0.11	17	0.0268	0.69	0.19	0.0268	10.1	0.12	0.0268	1.95	0.23	0.0268	0.19	0.13	0.0268	0.03	0.0268	0.26	0.13	0.0268	13.41	0.13	0.0268	0.0977	0.120	1	5.6	0.120	0.15	0.80	0.075	1.61	
C1 (UAA data)	Chromium	46	0.00126	46	0.00126	0.116	0.0329	0.083	0.00273	3.125	17	0.0268	4.688	0.19	0.0268	18.06	0.12	0.0268	11.11	0.23	0.0268	1.387	0.13	0.0268		0.03	0.0268		0.03	0.0268	1.63	1.74	1	5.6	1.74	2.8	0.62	2.4	0.73			
C1 (UAA data)	Lead	110	0.00126	89.1	0.00126	0.251	0.0964	0.083	0.008	7.054	17	0.0268	5.313	0.19	0.0268	4.12	0.12	0.0268	2.07	0.23	0.0268	3.285	0.13	0.0268		0.03	0.0268		0.03	0.0268	4.471	0.13	0.0268	3.29	3.55	1	5.6	3.55	8.9	0.40	4.7	0.76
C1 (UAA data)	Vanadium	53	0.00126	22.8	0.00126	0.0955	0.0339	0.083	0.00281	1.944	17	0.0268	6.2	0.19	0.0268	1.62	0.12	0.0268	1.19	0.23	0.0268	1.387	0.13	0.0268		0.03	0.0268		0.03	0.0268	1.882	0.13	0.0268	0.941	1.04	1	5.6	1.04	8.3	0.13	4.2	0.25
C1-West	PCBs	41	0.00126	206.5	0.00126	0.312	0.000498	0.083	4.13E-05	1.19	17	0.0268	13.53	0.19	0.0268	38.45	0.12	0.0268	175.2	0.23	0.0268	3.8	0.13	0.0268		0.03	0.0268		0.03	0.0268	16.89	0.13	0.0268	2.60	2.91	1	5.6	2.91	0.68	4.28	0.23	12.64
C1-East	PCBs	41	0.00126	59	0.00126	0.126	0.000498	0.083	4.13E-05	1.19	17	0.0268		0.19	0.0268	38.45	0.12	0.0268	175.2	0.23	0.0268	3.8	0.13	0.0268		0.03	0.0268		0.03	0.0268	16.89	0.13	0.0268	2.60	2.72	1	5.6	2.72	0.68	4.08	0.23	11.83

95% UCL, C1 Raccoon-2 INITIAL SETTINGS																																										
0.001260.001260.083170.0268190.0268120.0268230.0268130.026830.0268130.026815.6																																										
Location	Analyte	Conc. In Sediment	Sediment Ingestion Rate	Conc. In Soil	Soil Ingestion Rate	Total Intake through Sediment	Conc. In Surface Water	Water Ingestion Rate	Total Intake through Water	Conc. In Aquatic Plants ^a	Percent of Diet	Food Ingestion Rate	Conc. In mammals/birds ^d	Percent of Diet	Food Ingestion Rate	Conc. In Amphibians ^a	Percent of Diet	Food Ingestion Rate	Conc. In All Fish	Percent of Diet	Food Ingestion Rate	Conc. In Crayfish ^a	Percent of Diet	Food Ingestion Rate	Conc. in Lumbriculus ^a	Percent of Diet	Food Ingestion Rate	Conc. In Mollusks ^a	Percent of Diet	Food Ingestion Rate	Total Intake through Food	Total Intake	AUF	Body Weight	Dose	LOAEL	HQ LOAEL	NOAEL	HQ NOAEL			
		mg/kg dw	kg/day dw	mg/kg dw	kg/day dw	mg/day	mg/L	L/day	mg/kg dw	mg/kg dw		kg/kg BW/day dw	mg/kg dw		kg/kg BW/day dw	mg/kg dw		kg/kg BW/day dw	mg/kg dw		kg/kg BW/day dw	mg/kg dw		kg/kg BW/day dw	mg/kg dw		kg/kg BW/day dw	mg/kg dw		kg/kg BW/day dw	mg/day ww	mg/day		kg	mg/kg/day	mg/kg/day		mg/kg/day				
C1 (UAA data)	Mercury	0.58	0.00126	2.8	0.00126	0.00426	0.00043	0.083	0.0000357	0.0859	17	0.0268	0.0468	0.19	0.0268	1.03	0.12	0.0268	0.736	0.23	0.0268	0.19	0.13	0.0268	0.03	0.0268	0.292	0.13	0.0268	0.0489	0.0532	1	5.6	0.0532	0.15	0.35	0.075	0.71				
C1 (UAA data)	Chromium	46	0.00126	27.5	0.00126	0.0926	0.0329	0.083	0.00273	3.125	17	0.0268	4.688	0.19	0.0268	18.06	0.12	0.0268	4.556	0.23	0.0268	1.387	0.13	0.0268		0.03	0.0268		0.03	0.0268	1.59	1.68	1	5.6	1.68	2.8	0.66	2.4	0.70			
C1 (UAA data)	Lead	110	0.00126	56.5	0.00126	0.210	0.0964	0.083	0.008	7.054	17	0.0268	5.313	0.19	0.0268	4.12	0.12	0.0268	0.547	0.23	0.0268	3.285	0.13	0.0268		0.03	0.0268		0.03	0.0268	4.471	0.13	0.0268	3.28	3.50	1	5.6	3.50	8.9	0.39	4.7	0.75
C1 (UAA data)	Vanadium	53	0.00126	20.2	0.00126	0.0922	0.0339	0.083	0.00281	1.944	17	0.0268	6.2	0.19	0.0268	1.62	0.12	0.0268	1.19	0.23	0.0268	1.387	0.13	0.0268		0.03	0.0268		0.03	0.0268	1.882	0.13	0.0268	0.941	1.04	1	5.6	1.04	8.3	0.12	4.2	0.25
C1-West	PCBs	15.98	0.00126	206.5	0.00126	0.280	0.000498	0.083	4.13E-05	0.978	17	0.0268	6.357	0.19	0.0268	38.45	0.12	0.0268	50.11	0.23	0.0268	3.8	0.13	0.0268		0.03	0.0268		0.03	0.0268	14.3	0.13	0.0268	1.28	1.56	1	5.6	1.56	0.68	2.38	0.23	6.79
C1-East	PCBs	15.98	0.00126	59	0.00126	0.0945	0.000498	0.083	4.13E-05	0.978	17	0.0268	6.357	0.19	0.0268	38.45	0.12	0.0268	50.11	0.23	0.0268	3.8	0.13	0.0268		0.03	0.0268		0.03	0.0268	14.3	0.13	0.0268	1.28	1.38	1	5.6	1.38	0.68	2.02	0.23	5.98

Soil invertebrate tissue concentrations from Table 4-16 of BERA
Aquatic invertebrate tissue concentrations from Table 4-15 of BERA
^a Aquatic tissue concentrations are the max and 95% UCL from the UAA (Table 4-15)
^b Chromium, lead and vanadium concentrations in sediment are the maximum measured in Reach C-1, n =2 (Table 4-6)
^c Mercury, chromium, lead and vanadium concentrations in soil are the Max and 95% UCL measured in riparian soils for the UAA (Tables 4-8, 4-9, 4-10, and 4-11)
^d Terrestrial tissue concentrations are the max and 95% UCL from the UAA (Table 4-16)
^e *Lumbriculus* tissue concentrations calculated from data in Appendix E. Data are wet weight, converted to dry weight using 17% solids for *Lumbriculus* cited in Section 5.5.4.1.1

Soil invertebrate tissue concentrations from Table 4-16 of BERA
Aquatic invertebrate tissue concentrations from Table 4-15 of BERA
^a Aquatic tissue concentrations are the max and 95% UCL from the UAA (Table 4-15)
^b Chromium, lead and vanadium concentrations in sediment are the maximum measured in Reach C-1, n =2 (Table 4-6)
^c Mercury, chromium, lead and vanadium concentrations in soil are the Max and 95% UCL measured in riparian soils for the UAA (Tables 4-8, 4-9, 4-10, and 4-11)
^d Terrestrial tissue concentrations are the max and 95% UCL from the UAA (Table 4-16)
^e *Lumbriculus* tissue concentrations calculated from data in Appendix E. Data are wet weight, converted to dry weight using 17% solids for *Lumbriculus* cited in Section 5.5.4.1.1

Soil invertebrate tissue concentrations from Table 4-16 of BERA
Aquatic invertebrate tissue concentrations from Table 4-15 of BERA
^a Aquatic tissue concentrations are the max and 95% UCL from the UAA (Table 4-15)
^b Chromium, lead and vanadium concentrations in sediment are the maximum measured in Reach C-1, n =2 (Table 4-6)
^c Mercury, chromium, lead and vanadium concentrations in soil are the Max and 95% UCL measured in riparian soils for the UAA (Tables 4-8, 4-9, 4-10, and 4-11)
^d Terrestrial tissue concentrations are the max and 95% UCL from the UAA (Table 4-16)
^e *Lumbriculus* tissue concentrations calculated from data in Appendix E. Data are wet weight, converted to dry weight using 17% solids for *Lumbriculus* cited in Section 5.5.4.1.1

mg/kg d.w. = milligrams per kilogram dry weight
mg/kg w.w. = milligrams per kilogram wet weight
kg = kilogram
mg/kg/day = milligrams per kilogram body weight per day
µg/L = micrograms per liter

dw = dry weight
ww = wet weight
AUF = Area Use Factor
LOAEL = Lowest observed adverse effect level
NOAEL = No observed adverse effect level

HQ = Hazard Quotient
mg/L = milligrams per liter

mg/kg d.w. = milligrams per kilogram dry weight
mg/kg w.w. = milligrams per kilogram wet weight
kg = kilogram
mg/kg/day = milligrams per kilogram body weight per day
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µg/L = micrograms per liter

dw = dry weight
ww = wet weight
AUF = Area Use Factor
LOAEL = Lowest observed adverse effect level
NOAEL = No observed adverse effect level

HQ = Hazard Quotient
mg/L = milligrams per liter

Table AD6-6. Mammalian Exposure
Parameters Anniston PCB Site, Anniston,
Alabama

Parameter	Mammalian Aerial-feeding Insectivore		Mammalian Ground-feeding Invertivore		Mammalian Omnivore		Herbivore		Piscivore		Piscivore		Aquatic-dependent Carnivore		Mammalian Terrestrial-dependent Carnivore	
	Little Brown Bat		Short-tailed Shrew		Raccoon		White-tailed Deer		Mink		River Otter		Long-tailed Weasel		Red Fox	
	Data	Source	Data	Source	Data	Source	Data	Source	Data	Source	Data	Source	Data	Source	Data	Source
Composition of Diet (%)																
Riparian Soil	0%	--	3%	riparian soil assumed whensed EPC also used.	0%	--	0%	--	0%	--	0%	--	0%	--	0%	--
Soil/Sediment	0%	Assumed to be negligible for aerial-feeding insectivores	3%	Beyer et al. (1994), as cited in USEPA (2007)	9.4%	Beyer et al. (1994)	2%	Sample and Suter (1994)	0%	Hamilton (1940), as cited in Sample and Suter (1994)	0%	Assumed to be negligible for piscivores	4.3%	Beyer et al. (1994), as cited in USEPA (2007)	2.8%	Beyer et al. (1994)
Soil Invertebrates (Worms)	0%	--	See Table 2b for values for each scenario	--	See Table 2b for values for each scenario	--	0%	--	See Table 2b for values for each scenario	--	0%	--	0%	--	See Table 2b for values for each scenario	--
Terrestrial Insects (Grasshoppers)	0%	--		--		0%	--	--		0%	--					
Terrestrial Invertebrates, Spiders, Detritivores	0%	--		--		0%	--	--		0%	--					
Aquatic Emergent and Flying Insects	100%	Belwood and Fenton (1976), as cited in Sample and Suter (1994)		--		--	0%	--		--	0%	--				
Aquatic Invertebrates, Spiders, Detritivores	0%	--		--		--	0%	--		--	0%	--				
Terrestrial Plants	0%	--		--		100%	Smith 1991, as cited in Sample and Suter (1994)	--		--	0%	--				
Aquatic Plants	0%	--		--		--	0%	--		--	0%	--				
Mammals	0%	--		--		--	0%	--		--	0%	--				
Reptiles	0%	--		--		--	0%	--		--	0%	--				
Amphibians	0%	--		--		--	0%	--		--	0%	--				
All Fish	0%	--		--		--	0%	--		--	48%	1-(%forage fish+%predator fish)	0%	--		
Predator Fish Only	0%	--		--		--	0%	--		--	22%	Stearns and Serfassi 2011	0%	--		
Forage Fish Only (4-15cm)	0%	--		--		--	0%	--		--	30%	Stearns and Serfassi 2011	0%	--		
Aquatic Invertebrates	0%	--		--		--	0%	--		--	0%	--	0%	--		
Aquatic Oligochaetes (Lumbriculus)	0%	--	--	--	0%	--	--	0%	--	0%	--					
Crayfish	0%	--	--	--	0%	--	--	0%	--	0%	--					
Mollusc	0%	--	--	--	0%	--	--	0%	--	0%	--					
Body Weight (kg)	0.009	Nagy (2001), allometric equation for little brown bat.	0.017	USEPA (1993) [Average of all mean values]	5.6	USEPA (1993) [average of adult and juvenile means values]	57	Smith (1991), as cited in Sample and Suter (1994) [average of male and female values]	0.90	USEPA (1993) [average of all adult and juvenile values]	7.4	USEPA (1993) [average of all adult and yearling values]	0.30	USEPA (2007)	4.5	USEPA (1993) [mean of all adult values]
Food Ingestion Rate (kg/kg bw-d)																
Food Ingestion Rate (kg/kw bw-d dw)	0.18	Nagy (2001), allometric equation for little brown bat.	0.1278	Nagy (2001), allometric equation for insectivores	0.0268	Nagy (2001), allometric equation for Omnivores.	0.0147	Nagy (2001), allometric equation for herbivores	0.05	Nagy (2001), allometric equation for carnivores	0.03	Nagy (2001), allometric equation for carnivores	0.06	Nagy (2001), allometric equation for carnivores	0.04	Nagy (2001), allometric equation for carnivores
Drinking Water Ingestion (kg/kg bw-d)	0.16	Calder and Braun (1983), as cited in USEPA (1993)	0.15	Calder and Braun (1983), as cited in USEPA (1993)	0.083	Calder and Braun (1983), as cited in USEPA (1993)	0.066	Calder and Braun (1983), as cited in USEPA (1993)	0.10	Calder and Braun (1983), as cited in USEPA (1993)	0.081	Calder and Braun (1983), as cited in USEPA (1993)	0.11	Calder and Braun (1983), as cited in USEPA (1993)	0.085	Calder and Braun (1983), as cited in USEPA (1993)
Home Range (acres)																
Lower Bound	0.1 Km	Bulcher (1976); Hudson River BE	0.25	Blair (1940), as cited in USEPA (1993)	48	Urban (1970); Hudson River BERA	146	Marchinton and Hirth (1984), as cited in Sample and Suter (1994)	1.9 Km	Gerell (1970) and Mitchell (1961) as cited in USEPA (1993)	10 Km	Spinola et al (1999); Hudson River BERA	30-40	Svendsen 1982	141	Ables (1969), as cited in USEPA (1993)
Central Tendency	42	Henry et al. (2002)	0.96	Buckner (1966) as cited in USEPA (1993)	270	Prange et al. (2004)	715	Marchinton and Hirth (1984), as cited in Sample and Suter (1994)	2.15 Km	in USEPA (1993)	31 Km	Melquist and Hornocker (1983) , as cited in USEPA (1993)	96-338	Gehring and Swihart (2004)	2563	USEPA (1993) [mean of all reported values]
Upper Bound	74	Henry et al. (2002)	4.4	Blair (1940), as cited in USEPA (1993)	12217	Fritzell (1978), as cited in USEPA (1993)	1284	Marchinton and Hirth (1984), as cited in Sample and Suter (1994)	3.4	Gerell (1970) and Mitchell (1961) as cited in USEPA (1993)			79-395	Quick 1944-1951	8447	Jones and Theberge (1982), as cited in USEPA (1993)

Notes:

Full references provided in Table 4-2c.

%: percent

--: not applicable

BERA: Baseline Ecological Risk Assessment

cm: centimeters

dw: dry weight

EPC: exposure point concentration

kg: kilograms

kg/kg bw-d: kilograms per kilogram of body weight per day

kg/kg bw-d dw: kilograms per kilogram of body weight be day dry weight

PCB: polychlorinated biphenyl

USEPA: United States Environmental Protection Agency

Table AD6-7. Summary of Calculated HQs from Dietary Exposure Models Calculated using the Maximum or 95% UCL Measured PCB concentration in Reach C1 East and C1 West Sediment and “Riparian” Soil

**OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama**

Analyte	Maximum sediment concentration (mg/kg)	Maximum soil concentration (mg/kg)	EPA Calculated, abiotic data from Reach C1	EPA Calculated, abiotic data from Reach C1			From the OU-4 BERA (Reach C1) (abiotic data are 95% UCL for the UAA)	
			Spotted Sandpiper	Spotted Sandpiper	Raccoon		Spotted Sandpiper	Raccoon
			LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	LOAEL HQ
Mercury	0.58	17.4	14.44	42.7	0.8	1.6	8.0	—
Chromium	46	46	1.28	1.3	0.6	0.7	< 1	—
Lead	110	89.1	4.30	8.9	0.4	0.8	4.0	—
Vanadium	53	22.8	3.30	6.8	0.1	0.2	3.0	—
C1-West -- High sensitivity TRV	41	206.5	91.87	277.7	4.3	12.6	36.0	< 1
C1-West -medium sensitivity TRV	41	206.5	8.53	25.4	—	—	3.0	—
C1-East -- High sensitivity TRV	41	59	6.82	20.3	4.0	11.8	—	< 1
C1-East -medium sensitivity TRV	41	59	6.82	20.3	—	—	—	—
Analyte	95% UCL sediment concentration (mg/kg)	95% UCL soil concentration (mg/kg)	EPA Calculated, abiotic data from Reach C1	EPA Calculated, abiotic data from Reach C1				
			Spotted Sandpiper	Spotted Sandpiper	Raccoon			
			LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ		
Mercury	0.58	2.8	8.5	25.1	0.4	0.7		
Chromium	46	27.5	1.2	1.2	0.6	0.7		
Lead	110	56.5	4.1	8.5	0.4	0.7		
Vanadium	53	20.2	3.2	6.7	0.1	0.2		
C1-West -- High sensitivity TRV	15.98	206.5	60.8	183.9	2.3	6.8		
C1-West -medium sensitivity TRV	15.98	206.5	5.6	16.8	—	—		
C1-East -- High sensitivity TRV	15.98	59	3.9	11.7	2.0	6.0		
C1-East -medium sensitivity TRV	15.98	59	3.9	11.7	—	—		

Bold text indicates NOAEL-based HQs ≥ 1.0

Grey shading indicates acceptable risk (NOAEL-based HQ < 1.0)

Green shading is indeterminate risk (NOAEL-based HQ ≥ 1.0 and LOAEL-based HQ < 1.0)

Yellow shading indicates unacceptable risk (LOAEL-based HQ ≥ 1.0)

Red shading indicates high unacceptable risk (LOAEL-based HQ ≥ 10.0 , or based on severity of effect observed in critical study LOAEL TRV was derived from

mg/kg = milligrams per kilogram

LOAEL = Lowest observed adverse effect level

NOAEL = No observed adverse effect level

HQ = Hazard quotient

UAA = Upper Assessment Area

TRV = Toxicity Reference Value

95% UCL = 95% upper confidence limit

BERA = Baseline ERA

OU = Operable Unit

Table AD8-1. Summary of Potential Risks to Lower Trophic Level Receptors from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk.
Anniston PCB Site, Anniston, Alabama
OU-4 BERA Addendum

Line of Evidence	Exposure Unit	ARCADIS			
		Potential Risk	Level of Conservatism / Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
Aquatic Plants/Aquatic Life					
Compare surface water EPC to Alabama and/or National Water Quality Standards	C1, LAA	High	Moderate	Moderate / Low	— Use of conservative Alabama water quality standards
	UAA, MAA	Moderate			— Considered to be adequately and sufficiently protective of aquatic life (including aquatic plants)
					— EPC exceeds chronic criteria but not acute
Compare surface water EPC to plant-specific benchmarks	UAA, MAA, LAA	Negligible	Moderate	Moderate / Low	— Benchmark is receptor-specific
	C1	Moderate			— Benchmark is literature-based and confidence is moderate
Weight of Evidence Conclusion					
Terrestrial Plants					
Compare soil EPCs to plant benchmark	C1 East and C2 (all EUs) through C9 (all EUs)	Negligible	Moderate	Low	—Conservative literature-based benchmarks based on laboratory tests. The applicability of this benchmark is highly uncertain
	C1 West	Moderate	High	Low	— C1 West EPC based on the maximum detected concentration
Terrestrial Plant Community Evaluation	UAA, MAA, LAA	No Impairment indicated	NA	Low	— Based on Site-specific observations
					— Evaluation indicated no upstream to downstream trend
					Overall, the results suggest no adverse effect of PCBs or other COPCs on the terrestrial plant community
Weight of Evidence Conclusion					
Benthic Invertebrates/Aquatic Invertebrates					
Compare individual sediment samples to site-specific dry weight reproduction-based toxicity thresholds	C4, C5, C6, C9 and C10	Negligible	Moderate	Moderate / High	— EC values based on site-specific toxicity tests
	C3	Low			—Impacts on population from reproductive endpoints could impact population
	C7	Moderate			— High uncertainty in results due to high control variability
	C1 and C2	High			—
Compare individual sediment samples to site-specific dry weight growth-based toxicity thresholds	Not evaluated	Not evaluated	Not evaluated	Not evaluated	— EC values based on site-specific toxicity tests
					—Impacts on population from growth endpoints could impact population

Table AD8-1. Summary of Potential Risks to Lower Trophic Level Receptors from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk.
Anniston PCB Site, Anniston, Alabama
OU-4 BERA Addendum

Line of Evidence	Exposure Unit	ARCADIS			
		Potential Risk	Level of Conservatism / Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
Compare individual sediment samples to site-specific dry weight survival-based toxicity thresholds	All reaches	Negligible	Low	Moderate / High	— EC values based on site-specific toxicity tests
					— Survival endpoints are directly related to population sustainability
Compare individual sediment samples to consensus-based toxicity benchmarks	C9	Low	High	Low	Uncertainites associated with derivation of these benchmarks:
	C1 through C8, C10	Moderate / High			— Do not reflect contaminant-specific response thresholds
					— Do not account for site-specific factors that could influence bioavailability
Evalute site-specific toxicity testing results from the three surface sediments collected					
Compare measured site tissue concentrations to CTCs	UAA, MAA, LAA	Negligible	Moderate	Moderate	— CTCs are based on relatively small toxicity datasets and results in some cases had high variability
					— Values are species-specific
					— Low end was selected if multiple values available
Benthic Invertebrate Community Evaluation	UAA, MAA, LAA	No Impairment indicated	NA	Moderate	—Based on 158 site-specific observations
					— Evaluation indicated some differences in abundance, taxa rishness, and diversity, they were not considered significant
					— Overall, the results suggest no adverse effect of PCBs or other COPCs on benthic invertebrate community
Compare surface water EPC to Alabama and/or National Water Quality Standards (applies to aquatic invertebrates rather than benthic invertebrates specifically)	C1, LAA	High	Moderate	Low	— Use of conservative Alabama water quality standards
					— Considered to be adequatlely and sufficiently protective of aquatic life (including aquatic plants)
	UAA, MAA	Moderate			— EPC exceeds chronic criteria but not actue
					— WQS not derived for protection of benthic species
Compare surface water EPC to aquatic invertebrate-specific benchmarks (applies to aquatic invertebrates	C1, UAA, MAA, LAA	Negligible	Moderate	Low	— Benchmark is not receptor-specific
					— Benchmark is literature-based and confidence is moderate
Weight of Evidence Conclusion					

Table AD8-1. Summary of Potential Risks to Lower Trophic Level Receptors from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk.
Anniston PCB Site, Anniston, Alabama
OU-4 BERA Addendum

Line of Evidence	Exposure Unit	ARCADIS			
		Potential Risk	Level of Conservatism / Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
Terrestrial Invertebrates					
Compare soil EPCs to terrestrial invertebrate benchmark	C1 East and C2 (all EUs) through C9 (all EUs)	Low to Negligible	High	Low	— Conservative literature-base benchmarks based on laboratory tests. The applicability of this benchmark is highly uncertain
	C1 West	Moderate			— C1 West EPC based on the maximum detected concentration
Compare measured earthworm tissue EPCs to worm-based CTCs	UAA, MAA, LAA	Negligible	Moderate	Moderate	— CTCs are based on relatively small toxicity datasets and results in some cases had high variability
Compare measured earthworm tissue EPCs to worm-based CTCs					
					—Low end selected when multiple values
Compare modeled earthworm tissue EPCs to worm-based CTCs	C1 West				
Compare site and reference invertebrate communities	OU-4	No Impairment indicated	NA	Low	— Based on Site-specific observations
					— Evaluation indicated that mean abundance, taxa diversity, and taxa dominance did not significantly differ by location (P > 0.05). Taxa richness is significantly higher in the Site than in the reference area
Weight of Evidence Conclusion					

Table AD8-1. Summary of Potential Risks to Lower Trophic Level Receptors from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk.
Anniston PCB Site, Anniston, Alabama
OU-4 BERA Addendum

Line of Evidence	Exposure Unit	ARCADIS			
		Potential Risk	Level of Conservatism / Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
Fish/Aquatic Life					
Compare surface water EPC to Alabama Water Quality Standards	C1, UAA, MAA, LAA	High	Moderate	Moderate	— Use of conservative Alabama water quality standards
					— Considered to be adequately and sufficiently protective of aquatic life (including fish)
					— EPC exceeds chronic criteria but not actue
Compare Surface water EPCs to fish-specific benchmarks	C1, UAA, MAA, LAA	Negligible	Moderate	Moderate	— Benchmark is receptor-specific
					— Benchmark is literature-based and confidence is moderate
Compare fish tissue EPCs to fish-based CTCs	Predator - all; bottom- UAA and LAA	Moderate	Moderate	Moderate	— Modeled tissue concentrations using site-specific BAFs; BAFs shown to be good predictors of the central tendency of the measured concentrations
	Bottom - MAA; Forage - All	Low			— Toxicity values are very conservative and based on whole body concentrations in sheepshead minnows (ecologically relevant species)
Compare Site and reference fish communities	OU-4	o Impairment indicated	NA	Low	—
					—
					—
Weight of Evidence Conclusion					

Table AD8-1. Summary of Potential Risks to Lower Trophic Level Receptors from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk.
Anniston PCB Site, Anniston, Alabama
OU-4 BERA Addendum

Line of Evidence	Exposure Area	EPA			
		Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
Aquatic Plants/Aquatic Life					
Compare surface water EPC to Alabama and/or National Water Quality Standards	C1, LAA	High	Moderate / High	Moderate / Low	— Benchmarks considered protective of 95% of aquatic species (including aquatic plants)
					— National Water Quality Standards are potential ARARs at CERCLA sites.
	UAA, MAA	Moderate			— EPC exceeds chronic criterion but not acute
					—
	UAA, MAA, LAA	Acceptable	High / High potential to underestimate population risk	Moderate / Low	—
	C1	Moderate			—
Weight of Evidence Conclusion	C1, UAA, MAA, LAA	Acceptable	Moderate/High	Moderate / Low	Lines of evidence have high uncertainty and produce divergent results.
Terrestrial Plants					
Compare soil EPCs to plant benchmark				Agree	—
Terrestrial Plant Community Evaluation	UAA, MAA, LAA	NA	NA	Low	— Survey data are a secondary line of evidence
					— No reference comparison
					— Cannot make conclusions on adverse effect of PCBs or other COPCs on the terrestrial plant community as chemistry was not measured in samples collected where community survey samples were taken
Weight of Evidence Conclusion	UAA, MAA, LAA	Acceptable	Moderate/High	Low	All lines of evidence are in concurrence
Benthic Invertebrates/Aquatic Invertebrates					
Compare individual sediment samples to site-specific dry weight reproduction-based toxicity thresholds	C1, C2, C4, C5	High Unacceptable	Low	Moderate / High	— EC values based on site-specific toxicity tests
	C3, C7, C8	Unacceptable			— Reproduction is an ecologically relevant endpoint; adverse effects on reproductive success can result in population-level effects
	C10	Indeterminate			— Control samples for all toxicity tests met all acceptibiity criteria
	C6, C9	Acceptable			—
	C1, C2, C4	High Unacceptable			— EC values based on site-specific toxicity tests
Compare individual sediment samples to site-specific dry weight growth-based toxicity thresholds	C3, C5, C7, C8, C10	Indeterminate	Low	Moderate / High	— Growth is an ecologically relevant endpoint; adverse effects on growth can result in population-level effects
	C6C9	Acceptable			— Control samples for all toxicity tests met all acceptibiity criteria

Table AD8-1. Summary of Potential Risks to Lower Trophic Level Receptors from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk.
Anniston PCB Site, Anniston, Alabama
OU-4 BERA Addendum

Line of Evidence	Exposure Area	EPA			
		Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
Compare individual sediment samples to site-specific dry weight survival-based toxicity thresholds	C2	Unacceptable	Low	Low / Moderate	— EC values based on site-specific toxicity tests
	C1, C4	Indeterminate			— Survival is an ecologically relevant endpoint and can result in population-level effects, however it is generally less sensitive than growth or
	C3, C5 through C10	Acceptable			
Compare individual sediment samples to consensus-based toxicity benchmarks				Agree	
Evaluate site-specific toxicity testing results from the three surface sediments collected	UAA	Unacceptable	Low / Moderate	Moderate / High	— Site-specific estimate of impacts to the benthic invertebrate community
	MAA	Acceptable			—
	LAA	Indeterminate			—
Compare measured site tissue concentrations to CTCs	UAA	Unacceptable	Moderate	Low	— COPC concentrations measured in benthic invertebrates collected on-site
	MAA, LAA ³	Indeterminate			— High variability in CTCs reported for benthic invertebrates in the literature.
					— HQs exceed 1.0 for molluscs in all three AAs, however site-specific toxicity testing indicates mussels are less sensitive than other benthic invertebrate species
					— Considered a secondary LOE; more weight given to other site-specific measures (e.g., toxicity tests)
Benthic Invertebrate Community Evaluation	UAA	Unacceptable	Moderate / High potential to underestimate or overestimate population risk	Low	— Low replication -- only 2 samples and 2 replicates collected per habitat type per AA
	MAA, LAA	Indeterminate			— Different sampling methods used in different habitats. Results not strictly comparable
					— Considered a secondary LOE; more weight given to other site-specific measures (e.g., toxicity tests)
					— Cannot make conclusions on adverse effect of PCBs or other COPCs on thebenthic invertebrate community as chemistry was not measured in samples collected where community survey samples were taken
Compare surface water EPC to Alabama and/or National Water Quality Standards (applies to aquatic invertebrates rather than benthic invertebrates specifically)					
				Agree	
Compare surface water EPC to aquatic invertebrate-specific benchmarks (applies to aquatic invertebrates					
				Agree	
Weight of Evidence Conclusion	C1, C2, C3, C4	Unacceptable	Moderate	Moderate	Conservatism and confidence varied widely among LoEs. Greatest weight given to LoEs with high or moderate confidence and least to those with low.
	C5, C7, C8, C10	Indeterminate			
	C6, C9	Acceptable			

Table AD8-1. Summary of Potential Risks to Lower Trophic Level Receptors from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk.
Anniston PCB Site, Anniston, Alabama
OU-4 BERA Addendum

Line of Evidence	Exposure Area	EPA			
		Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
Compare soil EPCs to terrestrial invertebrate benchmark				Agree	
Compare measured earthworm tissue EPCs to worm-based CTCs	UAA, MAA, LAA	Indeterminate	Moderate	Low	— COPC concentrations measured in earthworms collected on-site
					— High variability in CTCs reported for earthworms in the literature; very limited database
Compare measured earthworm tissue EPCs to worm-based CTCs	UAA	unacceptable	Moderate	Low	— Considered a secondary LOE; more weight given to other site-specific measures (e.g., toxicity tests)
	MAA, LAA	Indeterminate			— EPA interpretation of the critical study results in a CTC of 38 mg/kg dw.
Compare modeled earthworm tissue EPCs to worm-based CTCs	C1 West	Unacceptable	Moderate	Low	— Considered a secondary LOE; more weight given to other site-specific measures (e.g., toxicity tests)
	C1 East, C2 North and riparian, C3 (all EUEs)	Indeterminate			— High variability in CTCs reported for earthworms in the literature; very limited database
	C2 South and Central	Acceptable			— Considered a secondary LOE; more weight given to other site-specific measures (e.g., toxicity tests)
Compare site and reference invertebrate communities	OU-4	NA	NA	Low	— Cannot make conclusions on adverse effect of PCBs or other COPCs on the soil invertebrate community as chemistry was not measured in samples collected where community survey samples were taken
					— Considered a secondary LOE
Weight of Evidence Conclusion	C1 (west only)	Unacceptable	moderate/high	Low	Most LoEs were had moderate to high conservatism and all had low confidence and therefore were given equal weight. Field survey data were inconclusive. Average (or most frequent) conclusion of three LoEs selected as final conclusion.
	C2, C3, C4, C10	Indeterminate			
	C5, C6, C7, C8, C9	Acceptable			

Table AD8-1. Summary of Potential Risks to Lower Trophic Level Receptors from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk.
Anniston PCB Site, Anniston, Alabama
OU-4 BERA Addendum

Line of Evidence	Exposure Area	EPA			
		Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
Compare surface water EPC to Alabama Water Quality Standards				Agree	—
					—
					—
Compare Surface water EPCs to fish-specific benchmarks				Agree	—
					—
Compare fish tissue EPCs to fish-based CTCs	Predator -- All; Bottom - All; Forage -- MAA; All Fish -- All	Unacceptable	Moderate	Moderate	— COPC concentrations measured in fish collected on-site
	Forage -- UAA, LAA	Indeterminate			— Numerous studies available that report NOEC and LOEC CTCs for PCBs in fish. Out of 10 published studies, LOEC concentrations range from 1.1 to 15 mg/kg wet weight; available CTC data are much less variable than for other organism groups.
Compare Site and reference fish communities	OU-4	NA	NA	Low	— Considered a secondary LOE
					— Cannot make conclusions on adverse effect of PCBs or other COPCs on the fish community as chemistry was not measured in samples collected
Weight of Evidence Conclusion	C1 through C10	Unacceptable	Moderate	Moderate	All viable LoEs were moderately conservative with moderate uncertainty and therefore were given equal weight. Field survey data were inconclusive. Risks concluded to be unacceptable as this was intermediate between high unacceptable and negligible.

¹ Toxicity thresholds include EC0*, EC10*, EC20* for reproduction. Risk was considered negligible when 80* of samples or greater indicated negligible risk.
For the low, moderate and high risk, categories assigned based on the largest percent in a particular category. Result category shown is when approximately 20% (or greater) of samples in a reach fell into a particular risk category. The complete endpoint-specific results are shown in Table 6-4a and Figure 6-1.

² Reach category reflects when greater than 20 % of samples fall into the specified category
For TEC and PEC comparisons, < TEC = negligible; between TEC and PEC = low; greater than PEC = high

³ HQs exceed 1.0 for molluscs in all three AAs, however site-specific toxicity testing indicates mussels are less sensitive than other benthic invertebrate species

Line of evidence with the relatively highest level of confidence in predicting potential risk for the receptor populations is in **bold text**

BAF = Bioaccumulation factor
COPC = Contaminant of potential concern
CTC = Critical tissue concentration
EU = Exposure unit
EPC = Exposure point concentration
LAA = Lower assessment area
MAA = Middle assessment area

NA = Not applicable
OU-4 = Operable Unit 4
P-value indicates statistical significance at a selected probablity, in this case 95% (or P < 0.05)
PEC = Probable effect concentration
TEC = Threshold effect concentration
UAA = Upper assessment area

Table AD8-2. Summary of Potential Risks to Birds from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk
Anniston PCB Site, Anniston, Alabama
OU-4 BERA Addendum

	ARCADIS INTERPRETATION					EPA INTERPRETATION						
Line Of Evidence	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis		
All Aquatic Birds												
Community Metric: Compare OU-4 and reference community data and/or comparison among OU-4 assessment areas	OU-4	No impairment indicated	NA	Low	—Based on site-specific observations	OU-4	Unknown	NA	Low	— Cannot state whether there are any effects of PCBs or other COPCs on the aquatic bird community as co-located COPC concentration data not collected		
					— Mean bird abundance, richness, diversity and dominance did not differ significantly among Reaches					— No surveys conducted for aquatic birds at reference locations		
					— Overall, the results suggest no effect of PCBs or other COPCs on the aquatic bird community					— High uncertainty with findings due to low sample size, unknown regarding experimental design and statistical analysis methods, lack of reference data, and lack of co-located COPC concentration data		
					— High uncertainty with findings due to low sample size and lack of co-located COPC concentration data							
Reference Comparison: Compare OU-4 and reference sediment and prey tissues and/or comparison among OU-4 assessment areas	OU-4	Site elevated compared to reference conditions in all assessment areas	NA	NA	— This LOE indicates potential for exposure but does not speak to estimated risk	OU-4	Site elevated compared to reference conditions in all assessment areas	NA	NA	— This LOE indicates potential for exposure but does not speak to estimated risk		
Weight of Evidence Conclusion						OU4	Unknown	NA	Low	Field survey data were inconclusive and cannot be used to support or refute a conclusion of risk.		
Piscivores (belted kingfisher, great blue heron and osprey)												
HQ: Modeled diet - high sensitivity TRV	C6 and C9	Moderate	High	Low/Moderate	—High sensitivity TRVs based on chicken data, not ecologically relevant. Results given lower weight than mid-sensitiviety TRV results	C1 through C5, C7, C8, C10	High Unacceptable	Moderate/High; potential to underestimate risk	Low/Moderate	—High sensitivity TRVs based on chicken data. Results given lower weight than mid-sensitivity TRV results		
						— However, three wild species with high sensitivity to PCBs, European starling (<i>Sturnis vulgaris</i>), ruby-throated hummingbird (<i>Archilochus colubris</i>), and the gray catbird (<i>Dumetella carolinensis</i>) have been observed in OU-4 and others may be present						
						C6, C9	Unacceptable			— Modeled tissue concentrations used 95%UCL of SWAC, not 95%UCL of measured sediment concentration. On average, total PCB EPCs derived as the 95%UCLs of the SWAC were 28% to 38% lower than EPCs derived as the 95%UCL of the measured concentrations. Modeled tissue concentrations may underestimate risk.		
	C1 through C5, C7, C8, and C10	High					— Dose based on modeled fish tissue using BAFs for which no significant relationship found between sediment and tissue given lower weight than dose based on measured prey tissue					
HQ: Measured diet - high sensitivity TRV	All Reaches	High	High	Low/Moderate		C1 through C10	High Unacceptable	Moderate/High	Moderate	—High sensitivity TRVs based on chicken data. Results given lower weight than mid-sensitivity TRV results		
										— Site-specific exposure based on measured fish tissue reduces uncertainty, given higher weight than dose based on modeled prey tissue		
HQ: Modeled diet - mid- sensitivity TRV	C6	Negligible	Moderate	Moderate	— Mid-sensitivity TRVs based on mourning doves, ecologically relevant species	C1, C2	High Unacceptable	Moderate	Moderate	— Dose based on modeled fish tissue using BAFs for which no significant relationship found between sediment and tissue given lower weight than dose based on measured prey tissue		
	C9	Low			— Dose based on modeled fish tissue using BAFs for which no significant relationship found between sediment and tissue given lower weight than dose based on measured prey tissue	C3, C4, C5, C7, C8, C10	Unacceptable			— Site-specific BAFs utilized to develop modeled tissue concentrations		
	C3, C4, C5, C7, C8 and C10	Moderate				C6, C9	Indeterminate			— Mid-sensitivity TRVs based on mourning doves, ecologically relevant species		
	C1 and C2	High										
HQ: Measured diet - Mid-sensitivity TRV	All Reaches	Moderate	Moderate	Moderate/High		C1 through C10	Unacceptable	Low	High	— Site-specific exposure based on measured fish tissue reduces uncertainty, given higher weight than dose based on modeled prey tissue		
										— Mid-sensitivity TRVs based on mourning doves, ecologically relevant species		
HQ: Modeled egg - high sensitivity egg TRV	C6 and C9	Moderate	High	Low	— Egg tissue concentrations were estimated using transfer coefficient factors and not measured. Egg-based HQs given lower weight than dietary HQs	C1 through C10	High Unacceptable	High	Low	— Egg tissue concentrations were estimated using transfer coefficient factors and not measured. Egg-based HQs given lower weight than dietary HQs		
	C1 through C5, C7, C8, and C10	High			— High sensitivity TRVs based on chicken data, not ecologically relevant					— High sensitivity TRVs based on chicken data. However, a recent study indicates ecologically relevant species (grey catbird) may be as sensitive as chickens (Reported LD50 for chickens, PCB 126: 1.1 ug/kg; catbirds, 1.6 ug/kg) ¹		

Table AD8-2. Summary of Potential Risks to Birds from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk
Anniston PCB Site, Anniston, Alabama
OU-4 BERA Addendum

	ARCADIS INTERPRETATION					EPA INTERPRETATION					
Line Of Evidence	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis	
Piscivores (belted kingfisher, great blue heron and osprey)											
HQ: Modeled egg - mid-sensitivity egg TRV	C3 and C5 through C10	Negligible	Moderate	Low	— Mid-sensitivity TRVs based on kestrels and mallards, ecologically relevant species	C1, C2, C4	High Unacceptable	Moderate	Low	— Egg tissue concentrations were estimated using transfer coefficient factors and not measured. Egg-based HQs given lower weight than dietary HQs	
	C4	Low				C3, C5, C7 through C10	Unacceptable				— Mid-sensitivity TRVs based on kestrels and mallards, ecologically relevant species
	C1 and C2	Moderate				C6	Indeterminate				— The mid-sensitivity PCB egg TRV is associated with an 83% reduction in hatching and 92% reduction in hatching. Any HQ greater than 1.0 indicates unacceptable (high) risk.
Weight of Evidence Conclusion						C1, C2	High Unacceptable	moderate	moderate	Conservatism and confidence varied widely among LoEs. Greatest weight given to LoEs with high or moderate confidence and least to those with low.	
						C3 through C10	Unacceptable				
Aquatic Insectivores/Invertivores (spotted sandpiper - 2)											
HQ: Modeled diet - high sensitivity TRV	All Reaches	High	High	Low/Moderate	—High sensitivity TRVs based on chicken data, not ecologically relevant. Results given lower weight than mid-sensitivity TRV results	C1 through C10	High Unacceptable	Moderate/High	Low/Moderate	—High sensitivity TRVs based on chicken data, not ecologically relevant. Results given lower weight than mid-sensitivity TRV results	
										— Dose based on modeled tissue (i.e., 50% <i>Lumbriculus</i> for lab study) and 50% field BAF for which no significant relationship found between sediment and invertebrate tissue) given equal weight to dose-based on all measured tissue	
										— Good relationship between <i>Lumbriculus</i> and sediment identified; model applied across full range of OU-4 concentrations	
HQ: Measured diet - high sensitivity TRV	All Reaches	Moderate	High	Low/Moderate		C1 through C10	Unacceptable	Moderate/High potential to underestimate risk	Moderate	— Uncertainty with extrapolation from lab to field conditions	
										— Uncertainty with representativeness of field collected invertebrates (mostly epibenthic) to full range of possible species	
										— Concentrations of PCBs in benthic invertebrates may have been underestimated by the homolog analytical method	
										— Risk conclusions based on HQs in Table 6-3b. However, it is highly uncertain whether the measured <i>Lumbriculus</i> tissue data was used in the FCMs. The EPA review team recreated models for this receptor using the 95%UCL of <i>Lumbriculus</i> concentrations from Appendix E and calculated HQs were significantly higher (Table AD6-27) than those presented in Table 6-3b; although basis is not stated in Appendix E, it is likely wet weight. Table 4-1b of the 8-2015 draft did not include <i>Lumbriculus</i> for this receptor and Table 6-2 of the 2015 draft has the same HQs as presented in the 10-2016 draft.	
HQ: Measured diet- high sensitivity TRV and EPA FCM calculations						UAA, MAA, LAA	High Unacceptable	Moderate/High potential to underestimate risk	Moderate	— The <i>Lumbriculus</i> data set is the best paired tissue/sediment data available for this BERA	
					— Mid-sensitivity TRVs based on mourning doves, ecologically relevant species					— Based on the EPA team models using measured <i>Lumbriculus</i> and aquatic invertebrate data (Table AD6-27), the <i>Lumbriculus</i> tissue may not have been included in the Arcadis dietary exposure model for this receptor.	
HQ: Modeled diet - mid- sensitivity TRV	C6	Low	Moderate	Moderate/High	— Dose based on modeled tissue (i.e., 50% <i>lumbriculus</i> for lab study) and 50% field BAF for which no significant relationship found between sediment and invertebrate tissue) given equal weight to dose-based on all measured tissue	C1, C2	High Unacceptable	Moderate	Moderate/high	— Uncertainty with extrapolation from lab to field conditions, but <i>Lumbriculus</i> data set is the best paired tissue/sediment data available for this BERA	
	C3, C4, C5, C7, C8, C9, and C10	Moderate			— Good relationship between <i>Lmbriculus</i> and sediment identified; model applied across full range of OU-4 concentrations	C3 through C10	Unacceptable			— Mid-sensitivity TRVs based on mourning doves, ecologically relevant species	
	C1 and C2	High			— Uncertainty with extrapolation from lab to field conditions		—				
HQ: Measured diet - Mid-sensitivity TRV	C3 through C10	Negligible	Moderate	Moderate/High	— Uncertainty with representativeness of field collected invertebrates to full range of possible species	C1 through C4	Indeterminate	Moderate/ high potential to underestimate risk	Low	— Risk conclusions based on HQs in Table 6-3b. However, it is highly uncertain whether 95%UCL of measured <i>Lumbriculus</i> was used.	
						C5 through C10	Acceptable				

Table AD8-2. Summary of Potential Risks to Birds from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk
Anniston PCB Site, Anniston, Alabama
OU-4 BERA Addendum

		ARCADIS INTERPRETATION				EPA INTERPRETATION				
Line Of Evidence	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
Aquatic Insectivores/Invertivores (spotted sandpiper - 2)										
HQ: Measured diet - Mid-sensitivity TRV and EPA FCM calculations	C1 and C2	Low	Moderate	Moderate/High	—	UAA, MAA, LAA	Unacceptable	Low	Moderate/high	— The <i>Lumbriculus</i> data set is the best paired tissue/sediment data available for this BERA
										— Based on the EPA team models using measured Lumbriculus and aquatic invertebrate data (Table 6-27), the Lumbriculus tissue may not have been included in the Arcadis dietary exposure model for this receptor.
HQ: Modeled egg - high sensitivity egg TRV	C1 through C10	Negligible	High	Low	— Egg tissue concentrations were estimated using transfer coefficient factors and not measured. Egg-based HQs given lower weight than dietary HQs	C1	High Unacceptable	High	Low	— Egg tissue concentrations were estimated using transfer coefficient factors and not measured. Egg-based HQs given lower weight than dietary HQs
					— High sensitivity TRVs based on chicken data, not ecologically relevant	C2 through C5, C7, C8, C10	Unacceptable			— High sensitivity TRVs based on chicken data. However, a recent study indicates ecologically relevant species (grey catbird) may be as sensitive as chickens (Reported LD50 for chickens, PCB 126: 1.1 ug/kg; catbirds, 1.6 ug/kg) ¹
						C6, C9	Indeterminate			
HQ: Modeled egg - mid-sensitivity egg TRV	C1 through C10	Negligible	Moderate	Low	— Mid-sensitivity TRVs based on kestrels and mallards, ecologically relevant species	C1, C2	Indeterminate	Moderate	Low	— Egg tissue concentrations were estimated using transfer coefficient factors and not measured. Egg-based HQs given lower weight than dietary HQs
										— Mid-sensitivity TRVs based on kestrels and mallards, ecologically relevant species
					—	C3 through C10	Acceptable			— The mid-sensitivity PCB egg TRV is associated with an 83% reduction in hatching and 92% reduction in hatching. Any HQ greater than 1.0 indicates unacceptable (high) risk.
Weight of Evidence Conclusion						C1, C2	High Unacceptable	moderate	moderate	Conservatism and confidence varied widely among LoEs. Greatest weight given to LoEs with high or moderate confidence and least to those with low.
						C3 through C10	Unacceptable			
Aerial Invertivores (Tree swallow)										
HQ: Modeled diet - high sensitivity TRV	C6 and C9	Negligible	High	Low/Moderate	—High sensitivity TRVs based on chicken data, not ecologically relevant. Results given lower weight than mid-sensitivity TRV results	C1 through C4	High Unacceptable	moderate	Low/Moderate	—High sensitivity TRVs based on chicken data, not ecologically relevant. Results given lower weight than mid-sensitivity TRV results
	C5, C7, C8, and C10	Low			— Mid-sensitivity TRVs based on mourning doves, ecologically relevant species	C8	Unacceptable			—
	C1 through C4	High			— Dose based on modeled emergent insect tissue using BAFs for which no significant relationship found between sediment and tissue given lower weight than dose based on measured prey tissue	C5, C7, C10	Indeterminate			— Dose based on modeled emergent insect tissue using BAFs for which no significant relationship found between sediment and tissue given lower weight than dose based on measured prey tissue. However, BAF includes terrestrial Hymenoptera which likely underestimate the contribution of sediment to risks to aerial invertivores.
HQ: Measured diet - high sensitivity TRV	C5, C6	Low	Moderate	Low/Moderate		C1 through C4	High Unacceptable	Moderate	Low/Moderate	—High sensitivity TRVs based on chicken data, not ecologically relevant. Results given lower weight than mid-sensitivity TRV results
	C1 through C4	High				C5 through C10	Unacceptable			—
HQ: Modeled diet - mid- sensitivity TRV	C5 through C10	Negligible	High	Moderate		C1, C2	High Unacceptable	moderate	Low/Moderate	— Dose based on modeled emergent insect tissue using BAFs for which no significant relationship found between sediment and tissue given lower
	C3, C4	Moderate				C3, C4	Unacceptable			—
	C1, C2	High				C5 through C10	Acceptable			—
HQ: Measured diet - Mid-sensitivity TRV	C5 through C10	Negligible	Moderate	Moderate		C1 through C4	Unacceptable	Moderate	Moderate/High	— Mid-sensitivity TRVs based on mourning doves, ecologically relevant species
	C1 through C4	Negligible				C5 through C10	Acceptable			—
HQ: Modeled egg - high sensitivity egg TRV	C1 through C10	Negligible	High	Low		C1	High Unacceptable			—
					— Egg tissue concentrations were estimated using transfer coefficient factors and not measured. Egg-based HQs given lower weight than dietary HQs	C2, C4	Unacceptable			— Egg tissue concentrations were estimated using transfer coefficient factors and not measured. Egg-based HQs given lower weight than dietary HQs
					— High sensitivity TRVs based on chicken data, not ecologically relevant	C3	Indeterminate			— High sensitivity TRVs based on chicken data. However, a recent study indicates ecologically relevant species (grey catbird) may be as sensitive as chickens (Reported LD50 for chickens, PCB 126: 1.1 ug/kg; catbirds, 1.6 ug/kg) ¹
						C5 through C10	Acceptable			

Table AD8-2. Summary of Potential Risks to Birds from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk
Anniston PCB Site, Anniston, Alabama
OU-4 BERA Addendum

ARCADIS INTERPRETATION						EPA INTERPRETATION				
Line Of Evidence	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
Aerial Invertivores (Tree swallow)										
HQ: Modeled egg - mid-sensitivity egg TRV	C1 through C10	Negligible	Moderate	Low	— Mid-sensitivity TRVs based on kestrels and mallards, ecologically relevant species	C1, C2	Indeterminate			— Egg tissue concentrations were estimated using transfer coefficient factors and not measured. Egg-based HQs given lower weight than dietary HQs
									— Mid-sensitivity TRVs based on kestrels and mallards, ecologically relevant species	
					—	C3 through C10	Acceptable			— The mid-sensitivity PCB egg TRV is associated with an 83% reduction in hatching and 92% reduction in hatching. Any HQ greater than 1.0 indicates unacceptable (high) risk.
Weight of Evidence Conclusion						C1, C2 C3, C4 C5 through C10	High Unacceptable Unacceptable Acceptable	moderate	moderate	Conservatism and confidence varied widely among LoEs. Greatest weight given to LoEs with high or moderate confidence and least to those with low.
All Terrestrial Birds										
Community Metric: Compare OU-4 and reference community data and/or comparison among OU-4 assessment areas	OU-4	No impairment indicated	NA	Low	—Based on site-specific observations	OU-4	NA	NA	Low	— Cannot state whether there are any effects of PCBs or other COPCs on the terrestrial bird community as co-located COPC concentration data not collected
					— Mean abundance and species richness were significantly higher on-site than in the reference area					— High uncertainty with findings due to low sample size, unknown experimental design and statistical analysis methods,, and lack of co-located COPC concentration data
					— Diversity and dominance did not significantly differ by location (P > 0.05).					
					— Overall, the results suggest no effect of PCBs or other COPCs on the terrestrial bird community					
					— High uncertainty with findings due to low sample size and lack of co-located COPC concentration data				— Considered a secondary LOE	
Reference Comparison: Compare OU-4 and reference sediment and prey tissues and/or comparison among OU-4 assessment areas	OU-4	Site elevated compared to reference in all assessment areas	NA	NA	— This LOE indicates potential for exposure but does not speak to estimated risk		Site elevated compared to reference in all assessment areas	NA	NA	— This LOE indicates potential for exposure but does not speak to estimated risk
Weight of Evidence Conclusion						OU4	NA	NA	Low	Field survey data were inconclusive and cannot be used to support or refute a conclusion of risk.
Herbivores (Mourning dove)										
HQ: Modeled diet - high sensitivity TRV	C2 South, C9 South	Negligible	High	Low/Moderate		C1 West, C3 South	High Unacceptable			
	C2 Central, C5 North and South, C6 North, C7 North and South, C8 North and South, C9 North	Low				C1 East, C2 North and Central, C3 North, C4 North and South, C5 South, C 6 North and South, C7 South, C8 North and South, C9 North	Unacceptable		Agree	
	C1 East, C2 North, C3 North, C4 North and South, C6 South	Moderate								
	C1 West, C3 South	High				C2 South, C5 North, C7 North, C9 South	Indeterminate			

Table AD8-2. Summary of Potential Risks to Birds from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk
Anniston PCB Site, Anniston, Alabama
OU-4 BERA Addendum

		ARCADIS INTERPRETATION				EPA INTERPRETATION				
Line Of Evidence	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
Herbivores (Mourning dove)										
HQ: Measured diet - high sensitivity TRV	C2 South and Central, C5 North and South, C6 North, C7 North and South, C8 North and South, C9 North and South	Negligible	High	Low/Moderate	—High sensitivity TRVs based on chicken data, not ecologically relevant. Results given lower weight than mid-sensitiviety TRV results	C1 West	High Unacceptable		Agree	
	C2 North, C4 South, C6 South	Low			— Mid-sensitivity TRVs based on mourning doves, ecologically relevant species	C1 East, C2 North, C3 North and South, C4 North and South	Unacceptable			
	C1 East, C3 North and South, C4 North	Moderate			— Dose based on modeled plant tissue using BAFs for which no significant relationship found between sediment and tissue given lower weight than dose based on measured prey tissue	C2 South and Central, C5 through C9 (all EUs)	Indeterminate			
	C1 West	High			C1 West Soil EPC based on the maximum detected concentration - this EPC is given a lower weight than UCL-based EPCs					
HQ: Modeled diet - mid- sensitivity TRV	C2 (all EUs), C4 South through C9 (all EUs)	Negligible	Moderate	Moderate		C1 West	High Unacceptable			
	C1 East, C3 North, C4 North	Low				C3 South	Unacceptable		Agree	
	C3 South	Moderate				C1 East, C2 North, C3 North, C4 North and South	Indeterminate			
	C1 West	High		Low/Moderate	C2 South and Central, C5 through C9 (all EUs)	Acceptable				
HQ: Measured diet - Mid-sensitivity TRV	All EUs except C1 West	Negligible	Moderate	Moderate/High		C1 West	Unacceptable	Moderate	Moderate/High	
					C3 South	Indeterminate				
	C1 West	Moderate				C1 East, C2 (all EUs), C3 North, C4 through C9 (all EUs)	Acceptable			
Herbivores (Mourning dove)										
HQ: Modeled egg - high sensitivity egg TRV	C1 East, C2 (all EUs) through C9 (all EUs)	Negligible	High	Low	— Egg tissue concentrations were estimated using transfer coefficient factors and not measured. Egg-based HQs given lower weight than dietary HQs	C1 West	High Unacceptable		Agree	
						C1 East, C3 North and South	Unacceptable			
						C2 North, C4 North and South	Indeterminate			
	C1 West	Negligible		Low	— High sensitivity TRVs based on chicken data, not ecologically relevant	C5 through C10 (all EUs)	Acceptable			
HQ: Modeled egg - mid-sensitivity egg TRV	C1 (all EUs) through C9 (all EUs)	Negligible	Moderate	Low	— Mid-sensitivity TRVs based on kestrels and mallards, ecologically relevant species	C1 West	Unacceptable		Agree	
						C1 East, C2 through C10 (all EUs)	Acceptable			
Weight of Evidence Conclusion						C1	High Unacceptable	moderate	low/moderate	Conservatism and confidence varied widely among LoEs. Greatest weight given to LoEs with high or moderate confidence and least to those with low.
						C3	Unacceptable			
						C2	Indeterminate			
						C4 through C10	Acceptable			

Table AD8-2. Summary of Potential Risks to Birds from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk
Anniston PCB Site, Anniston, Alabama
OU-4 BERA Addendum

		ARCADIS INTERPRETATION				EPA INTERPRETATION				
Line Of Evidence	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
Terrestrial Insectivores/Invertevores (Carolina Wren -1)										
HQ: Modeled diet - high sensitivity TRV	C2 South, C9 South	Low	High	Low/Moderate	—	C1 East and West, C2 North, C3 North and South, C4 North and South, C6 South	High unacceptable			
	C2 Central, C5 North and South, C6 North, C7 North and South, C8 North and South, C9 North	Moderate			—	C2 South and Central, C5 North and South, C6 North, C7 through C9 (all EUs)	Unacceptable		Agree	
	C1 East and West, C2 North, C3 North and South, C4 North and South, C6 South	High			—					
HQ: Measured diet - high sensitivity TRV	C5 through C9 (all EUs)	Moderate	High	Low/Moderate	—High sensitivity TRVs based on chicken data, not ecologically relevant. Results given lower weight than mid-sensitiviety TRV results	C1 through C4	High unacceptable		Agree	
	C1 through C4 (all EUs)	High			— Mid-sensitivity TRVs based on mourning doves, ecologically relevant species	C5 through C9	Unacceptable			
HQ: Modeled diet - mid- sensitivity TRV	C2 South, C5 North, C7 North, C9 South	Negligible	Moderate	Moderate	— Dose based on modeled tissue given lower weight than dose based on measured prey tissue. Modeled tissue based over 50% on BAFs for which no significant relationship found between soil and tissue (i.e., 45% grasshopper and 9% plants) and 31% on terrestrial spiders for which earthworms used as surrogate for estimate	C1 West, C3 South	High unacceptable		Agree	
	C2 Central, C5 South, C6 North and South,	Low				C1 East, C2 North, C3 North, C4 North	Unacceptable			
	C1 East, C2 North, C3 North, C4 North and South, C6 South	Moderate			—	C2 Central, C5 North and South, C6 North and South, C7 South, C8 North and South, C9 North	Indeterminate			
	C1 West, C3 South	High			—	C2 South, C7 North, C9 South	Acceptable			
Terrestrial Insectivores/Invertevores (Carolina Wren -1)										
HQ: Measured diet - Mid-sensitivity TRV	C5 through C9 (all EUs)	Negligible	Moderate	Moderate	—	C1 through C4	Unacceptable	Moderate	Moderate/High	
	C1 through C4 (all EUs)	Moderate			—	C5 through C9	Indeterminate			
HQ: Modeled egg - high sensitivity egg TRV	C1 East, C2 (all EUs) through C9 (all EUs)	Negligible	High	Low	— Egg tissue concentrations were estimated using transfer coefficient factors and not measured. Egg-based HQs given lower weight than dietary HQs	C1 West	High Unacceptable		Agree	
					C1 East, C3 North and South	Unacceptable				
					C2 North, C4 North and South	Indeterminate				
	C1 West	Moderate			— High sensitivity TRVs based on chicken data, not ecologically relevant	C2 South and Central, C5 through C9 (all EUs)	Acceptable			
HQ: Modeled egg - mid-sensitivity egg TRV	C1 (all EUs) through C9 (all EUs)	Negligible	Moderate	Low	— Mid-sensitivity TRVs based on kestrels and mallards, ecologically relevant species	C1 West	Unacceptable		Agree	
						C1 East, C2 through C9 (all EUs)	Acceptable			
Weight of Evidence Conclusion						C1, C3	High Unacceptable	moderate	low/moderate	Conservatism and confidence varied widely among LoEs. Greatest weight given to LoEs with high or moderate confidence and least to those with low.
						C2, C4	Unacceptable			
						C5 through C9	Indeterminate			

Table AD8-2. Summary of Potential Risks to Birds from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk
Anniston PCB Site, Anniston, Alabama
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		ARCADIS INTERPRETATION				EPA INTERPRETATION				
Line Of Evidence	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
Terrestrial Omnivores (Blue jay)										
HQ: Modeled diet - high sensitivity TRV	C9 South	Negligible	High	Low/Moderate		C1 East and West, C3 North and South, C4 North	High Unacceptable			
	C2 South, C5 North, C7 North	Low				C2 North and Central, C4 South, C5 North and South, C6 North and South, C7 South, C8 North and South, C9 North	Unacceptable		Agree	
	C2 North and Central, C4 South, C5 South, C6 North and South, C7 South, C8 North and South, C9 North	Moderate				C2 South, C7 North, C9 South	Indeterminate			
	C1 East and West, C3 North and South, C4 North	High								
HQ: Measured diet - high sensitivity TRV	C5 through C9 (all EUs)	Low	High	Low/Moderate	—High sensitivity TRVs based on chicken data, not ecologically relevant. Results given lower weight than mid-sensitiviety TRV results	C1 West, C3 South	High Unacceptable		Agree	
	C1 East, C2 (all EUs), C3 North, C4 North and South	Moderate			— Mid-sensitivity TRVs based on mourning doves, ecologically relevant species	C1 East, C2 (all EUs), C3 North, C4 through C9 (all EUs)	Unacceptable			
	C1 West, C3 South	High			— Dose based on modeled tissue given lower weight than dose based on measured prey tissue. Modeled tissue based over 78% on BAFs for plants which no significant relationship found between soil and tissue.					
HQ: Modeled diet - mid- sensitivity TRV	C2 South and Central, C5 through C9 (all EUs)	Negligible	Moderate	Moderate		C1 West	High Unacceptable		Agree	
	C1 East, C2 North, C3 North, C4 North and South	Low				C1 East, C3 North and SOuth, C4 North	Unacceptable			
	C1 West, C3 North and South	Moderate				C2 North, C4 South	Indeterminate			
	C1 West	High				C2 South and Central, C5 through C9 (all EUs)	Acceptable			
HQ: Measured diet - Mid-sensitivity TRV	C5 through C9 (all EUs)	Negligible	Moderate	Moderate/High		C1 West	Unacceptable			
	C1 East, C2 (all EUs), C3 North and South, C4 North and South	Low				C1 East, C2 through C4 (all EUs)	Indeterminate			
	C1 West	Moderate				C5 through C9 (all EUs)	Acceptable			
HQ: Modeled egg - high sensitivity egg TRV	C1 East, C2 (all EUs) through C9 (all EUs)	Negligible	High	Low	— Egg tissue concentrations were estimated using transfer coefficient factors and not measured. Egg-based HQs given lower weight than dietary HQs	C1 West	high Unacceptable		Agree	
						C1 East, C3 North and South, C4 North	Unacceptable			
						C2 North, C4 South	Indeterminate			
	C1 West	Negligible			— High sensitivity TRVs based on chicken data, not ecologically relevant	C2 South and Central, C5 through C9 (all EUs)	Acceptable			

Table AD8-2. Summary of Potential Risks to Birds from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk
Anniston PCB Site, Anniston, Alabama
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		ARCADIS INTERPRETATION				EPA INTERPRETATION				
Line Of Evidence	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
Terrestrial Omnivores (Blue jay)										
HQ: Modeled egg - mid-sensitivity egg TRV	C1 (all EUs) through C9 (all EUs)	Negligible	Moderate	Low	— Mid-sensitivity TRVs based on kestrels and mallards, ecologically relevant species	C1 West	Unacceptable		Agree	
						C1 East, C2 through C9 (all EUs)	Acceptable			
Weight of Evidence Conclusion						C1	High Unacceptable	moderate	low/moderate	Conservatism and confidence varied widely among LoEs. Greatest weight given to LoEs with high or moderate confidence and least to those with low.
						C3, C4	Unacceptable			
						C2	Indeterminate			
						C5 through C9	Acceptable			
Carnivores (Red-tailed hawk)										
HQ: Modeled diet - high sensitivity TRV	C9 South	Low	High	Low/Moderate		C1 through C4 (all EUs)	High Unacceptable			
	C5 through C8 (all EUs), C9 North	Moderate								
	C1 through C4 (all EUs)	High							C5 through C9 (all EUs)	Unacceptable
HQ: Measured diet - high sensitivity TRV	C1 through C9 (all EUs)	High	High	Low/Moderate	—High sensitivity TRVs based on chicken data, not ecologically relevant. Results given lower weight than mid- sensitiviety TRV results	C1 through C9 (all EUs)	High unacceptable		Agree?	
HQ: Modeled diet - mid- sensitivity TRV	C5 North, C6 through C9 (all EUs)	Negligible	Moderate	Moderate/High	— Mid-sensitivity TRVs based on mourning doves, ecologically relevant species	C1 East and West	High Unacceptable			
	C3 (all EUs), C5 South	Low			— Dose based on modeled tissue given higher weight than dose based on measured prey tissue. Hawk diet assumed to contain 87% small mammal tissue. Modeled small mammal tissue based regression for which a statistically significant relationship between site-specific soil and tissue was identified	C2 through C4 (all EUs)	Unacceptable			
	C1 East, C2 (all EUs), C4 (all EUs)	Moderate			— Modeled tissue provides greater coverage for risk estimates across OU-4	C5 North and South, C8 North	Indeterminate			
	C1 West	High				C6 and C7 (all EUs), C8 South, C9 North and South	Acceptable			
HQ: Measured diet - Mid-sensitivity TRV	C7 through C9 (all EUs)	Low	Moderate	Moderate		C1 through C9 (all EUs)	Unacceptable			
	C1 through C6 (all EUs)	Moderate								
HQ: Modeled egg - high sensitivity egg TRV	C2 South and Central, C3 (all EUs), through C8 (all (EUs)	Moderate	High	Low	— Egg tissue concentrations were estimated using transfer coefficient factors and not measured. Egg-based HQs given lower weight than dietary HQs	C1 through C4 (all EUs)	high Unacceptable			
	C1 (all EUs) and C2 North	High			— High sensitivity TRVs based on chicken data, not ecologically relevant	C5 through C9 (all EUs)	Unacceptable			
HQ: Modeled egg - mid-sensitivity egg TRV	C1 East, C2 (all EUs) through C9 (all EUs)	Negligible	High	Low	— Mid-sensitivity TRVs based on kestrels and mallards, ecologically relevant species	C1 West	High Unacceptable			
					C1 East, C2 (all EUs), C3 North and South, C4 North and South	Unacceptable				
					C5 North and South	Indeterminate				
	C1 West	Low		— EPC based on the maximum detected concentration	C6 through C9 (all EUs)	Acceptable				

Table AD8-2. Summary of Potential Risks to Birds from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk
Anniston PCB Site, Anniston, Alabama
OU-4 BERA Addendum

		ARCADIS INTERPRETATION				EPA INTERPRETATION				
Line Of Evidence	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
Carnivores (Red-tailed hawk)										
Weight of Evidence Conclusion						C1	High Unacceptable			Conservatism and confidence varied widely among LoEs. Greatest weight given to LoEs with high or moderate confidence and least to those with low.
						C2, C3, C4	Unacceptable	moderate	low/moderate	
						C5 through C9	Indeterminate			
Mixed Diet Omnivores (Carolina wren - 2, spotted sandpiper-1)										
HQ: Modeled diet - high sensitivity TRV	C9 South	Low	High	Low		C1 through C4 (all EUs)	High Unacceptable	For Reach C1, the 95%UCL for UAA riparian soil was used as the EPC. Dietary exposure models were re-run using data from soils collected within 100 feet on either side of Snow Creek, even though these samples were not labelled riparian in the data base (Issue 6 of the BERA addendum). Use of the 95%UCL for Reach C1 underestimated potential risk to mixed diet omnivores		
	C5 through C8 (all EUs), C9 North	Moderate				C5 through C8 (all EUs), C9 North	Unacceptable			— For C1 west,
	C1 through C4 (all EUs)	High				C9 South	Indeterminate			
HQ: Measured diet - high sensitivity TRV	C5 through C9 (all EUs)	Moderate	High	Low		C1 through C4	High Unacceptable	For Reach C1, the 95%UCL for UAA riparian soil was used as the EPC. Dietary exposure models were re-run using data from soils collected within 100 feet on either side of Snow Creek, even though these samples were not labelled riparian in the data base (Issue 6 of the BERA addendum). Use of the 95%UCL for Reach C1 underestimated potential risk to mixed diet omnivores		
	C1 through C4 (all EUs)	High				C5 through C9	Unacceptable			

Table AD8-2. Summary of Potential Risks to Birds from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk
Anniston PCB Site, Anniston, Alabama
OU-4 BERA Addendum

		ARCADIS INTERPRETATION				EPA INTERPRETATION				
Line Of Evidence	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
Mixed Diet Omnivores (Carolina wren - 2 , spotted sandpiper-1)										
HQ: Modeled diet - mid- sensitivity TRV	C5 through C7 (all EUs), C8 South, C9 North and South	Negligible	Moderate	Low	—High sensitivity TRVs based on chicken data, not ecologically relevant. Results given lower weight than mid-sensitiviety TRV results	C1 West	High Unacceptable			
	C8 North	Low			— Mid-sensitivity TRVs based on mourning doves, ecologically relevant species	C1 East, C2 through C4 (all EUs)	Unacceptable			
	C1 East, C2 through C4 (all EUs)	Moderate			— Dose based on modeled tissue given lower weight than dose based on measured prey tissue. Modeled tissue based over 50% on BAFs for which no significant relationship found between soil and tissue (i.e., 45% grasshopper and 9% plants) and 31% on terrestrial spiders for which earthworms used as surrogate for estimate	C5 South, C6 South, C7 South, C8 North and South	Indeterminate			
	C1 West	High				C5 North, C6 North, C7 North, C9 North and South	Acceptable			
HQ: Measured diet - Mid-sensitivity TRV	C5 through C9 (all EUs)	Negligible	Moderate	Low/Moderate		C1 through C4	Unacceptable	See Measured diet, high sensitivity TRV	Low/Moderate	
	C1 through C4 (all EUs)	Moderate				C5 through C9	Indeterminate			
HQ: Modeled egg - high sensitivity egg TRV	C9 (all EUs)	Low	High	Low	— Egg tissue concentrations were estimated using transfer coefficient factors and not measured. Egg-based HQs given lower weight than dietary HQs	C1 East and West, C3 South	Unacceptable			
	C2 South and Central, C3 (all EUs), through C8 (all (EUs)	Moderate				C2 (all EUs), C3 North, C4 North	Indeterminate			
	C1 (all EUs) and C2 North	High				— High sensitivity TRVs based on chicken data, not ecologically relevant	C4 South, C5 through C9 (all EUs)	Acceptable		
HQ: Modeled egg - mid-sensitivity egg TRV	C1 East, C2 (all EUs) through C9 (all EUs)	Negligible	High	Low	— Mid-sensitivity TRVs based on kestrels and mallards, ecologically relevant species	C1 West	Indeterminate			
	C1 West	Low		Low	— EPC based on the maximum detected concentration	C1 East, C2 through C9 (all EUs)	Acceptable			
Weight of Evidence Conclusion						C1	High Unacceptable			Conservatism and confidence varied widely among LoEs. Greatest weight given to LoEs with high or moderate confidence and least to those with low.
						C2, C3, C4	Unacceptable	moderate	low/moderate	
						C5 through C9	Indeterminate			

Weight of evidence presented for receptor within each feeding guild that had highest predicted risk
Line of evidence with the relatively highest level of confidence in predicting potential risk for the receptor populations is in **bold text**

BAF = Bioaccumulation factor
COPC = Contaminant of potential concern
EU = Exposure unit
EPC = Exposure point concentration
HQ = Hazard quotient
LOE = Line of evidence

NA = Not applicable
OU-4 = Operable Unit 4
P-value indicates statistical significance at a selected probability, in this case 95% (or P < 0.05)
PCBs = Polychlorinated biphenyls
TRVs = Toxicity reference values

¹ Chicken LD50: Head, J. A. and S. W. Kennedy "Correlation between an in vitro and an in vivo measure of dioxin sensitivity in birds." Ecotoxicology Advance access published on September 26, 2009; doi:10.1007/s10646-009-0421-3. Grey catbird LD50: Eng, M. L., C. A. Bishop, et al. (2017). "The catbird is the new chicken: high sensitivity to a dioxin-like compound in a wildlife species." Environ. Sci. Technol. 51(9): 5252-5258.

Table AD8-3. Summary of Potential Risks to Mammals from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk
Anniston PCB Site, Anniston, Alabama
OU-4 BERA Addendum

Line of Evidence	Exposure Unit	ARCADIS INTERPRETATION			
		Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
All Aquatic Mammals					
Community Metric: Compare OU-4 and reference community data and/or comparison among OU-4 assessment areas	OU-4	No impairment indicated	NA	Low	—Based on site-specific observations
					— Mean mammal richness, diversity and dominance did not differ significantly among Reaches
					— Abundance was significantly lower in the MAA than in the UAA and LAA
					—
					— Overall, the results suggest no effect of PCBs or other COPCs on the aquatic mammal community
					— High uncertainty with findings due to low sample size and lack of co-located COPC concentration data
Reference Comparison: Compare OU-4 and reference sediment and prey tissues and/or comparison among OU-4 assessment areas	OU-4	Site elevated compared to reference conditions in all assessment areas	NA	NA	— This LOE indicates potential for exposure but does not speak to estimated risk
Weight of Evidence Conclusion					
Piscivores (mink and river otter)					
Reproduction-Based TRV					
HQ: Modeled diet - growth-based mink TRV	C6 and C9	Moderate	High	Low/Moderate	
	C1 through C5, C7, C8, and C10	High			— TRVs based on mink, uncertain as study based on co-contaminanted compounds and considered artificailly low
HQ: Measured diet - growth-based mink TRV	All Reaches	High	High	Low/Moderate	— Reproduction TRV given higher weight for potential population-level effects than growth TRV
HQ: Modeled diet - reproduction-based mink TRV	C5 through C7, C9 and C10	Moderate	Moderate	Moderate	— Dose based on modeled fish tissue using BAFs for which no significant relationship found between sediment and tissue given lower weight than dose based on measured tissue
	C1 through C4	High			— Habitat suitability is limited, this species and other piscivorous mammals not directly observed on-site, but evidence of mink and otter was observed

Table AD8-3. (cont.) Summary of Potential Risks to Mammals from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk.
Anniston PCB Site, Anniston, Alabama.
OU4 BERA Addendum

Line of Evidence	Exposure Unit	ARCADIS INTERPRETATION			
		Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
HQ: Measured diet - reproduction-based mink TRV	All Reaches	High	Moderate	Moderate/High	
Weight of Evidence Conclusion					
Aerial Invertivores (brown bat)					
HQ: Modeled diet - reproduction-based small mammal TRV	C5 through C10	Negligible	Moderate	Moderate	
	C3	Moderate			— TRVs considered appropriate for small mammals (based on multigenerational mice studies)
	C1, C2 and C4	High			— Dose based on modeled emergent insect tissue using BAFs for which no significant relationship found between sediment and tissue given lower weight than dose based on measured prey tissue
HQ: Measured diet - reproduction-based small mammal TRV	C5 through C10	Negligible	Moderate	Moderate/High	— Two special status bat species (indiana bat and grey bat) may be present in Calhoun County but have not been observed in OU-
	C1 through C4	Moderate			—
Weight of Evidence Conclusion					
All Terrestrial Mammals					
Compare OU-4 and reference community data	OU-4	No impairment indicated	NA	Low	—Based on site-specific observations
					— Mean abundance, species richness, diversity and dominance did not significantly differ between Site and reference locations
					— Overall, the results suggest no effect of PCBs or other COPCs on the terrestrial mammal community
					— High uncertainty with findings due to low sample size and lack of co-located COPC concentration data
Reference Comparison: Compare OU-4 and reference soil and prey tissues and/or comparison among OU-4 assessment areas	OU-4	Site elevated compared to reference conditions in all assessment areas	NA	NA	— This LOE indicates potential for exposure but does not speak to estimated risk
Weight of Evidence Conclusion					
Herbivores (White-tailed deer)					
HQ: Modeled diet - reproduction-based small mammal TRV	C1 East and C2 through C9 (all EUS)	Negligible	Moderate	Moderate	— TRVs considered appropriate for small mammals (based on multigenerational mice studies)

Table AD8-3. (cont.) Summary of Potential Risks to Mammals from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk.
Anniston PCB Site, Anniston, Alabama.
OU4 BERA Addendum

Line of Evidence	Exposure Unit	ARCADIS INTERPRETATION			
		Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
	C1 West	Moderate			— Dose based on modeled plant tissue using BAFs for which no significant relationship found between soil and tissue given lower weight than dose based on measured terrestrial plant tissue
HQ: Measured diet - reproduction-based small mammal TRV	All Eus	Negligible	Moderate	Moderate/High	—
Weight of Evidence Conclusion					
Terrestrial Insectivores/Invertivores (Short-tailed shrew-1)					
HQ: Modeled diet - reproduction-based small mammal TRV	C2 South, C7 North, and C9 South	Negligible	Moderate	Moderate	
	C2 Central, C5 North and South, C6 North, C7 South, C8 North and South, C9 North	Low			
	C1 East, C2 North, C3 North, C4 North andSOuth, C6 South	Moderate			— TRVs considered appropriate for small mammals (based on multigenerational mice studies)
					— Dose based on modeled tissue given lower weight than dose based on measured tissue. Modeled tissue based 25% on BAFs for which no significant relationship found between soil and tissue (i.e., 26% grasshoppers) and 26% terrestrial spiders for which earthworms used as a surrogate for estimate.
	C1 West and C3 South	High			
HQ: Measured diet - reproduction-based small mammal TRV			Moderate	Moderate/High	— Tissue-based exposure model given higher weight than dietary models due to uncertainites associated with estimating prey exposure
	C5 through C9 (all Eus)	Low			
	C1 through C4 (all Eus)	Moderate			
HQ: Measured tissue - reproduction-based small mammal TRV	All AAs	Negligible	Moderate	High	— Measured site-specific tissue is a direct measure of exposure
					— TRVs based on multigenerational studies for small mammals
Weight of Evidence Conclusion					
Terrestrial Insectivores/Invertivores (Short-tailed shrew-2) Arcadis part added by KK - Not included in their table					
HQ: Modeled diet - reproduction-based small mammal TRV	C7 North and C9 South	Negligible	Moderate	Moderate	
	C5 North and South, C6 North an South, C7 South, C8 North and South, C9 North	Low			
	C1 East, C2 (all Eus), C3 North, C4 North and South	Moderate			— TRVs considered appropriate for small mammals (based on multigenerational mice studies)

Table AD8-3. (cont.) Summary of Potential Risks to Mammals from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk.
Anniston PCB Site, Anniston, Alabama.
OU4 BERA Addendum

Line of Evidence	Exposure Unit	ARCADIS INTERPRETATION			
		Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
	C1 West and C3 South	High			— Dose based on modeled tissue given lower weight than dose based on measured tissue. Modeled tissue based 25% on BAFs for which no significant relationship found between soil and tissue (i.e., 26% grasshoppers) and 26% terrestrial spiders for which earthworms used as a surrogate for estimate.
HQ: Measured diet - reproduction-based small mammal TRV	C5 through C9 (all Eus)	Low	Moderate	Moderate/High	— Tissue-based exposure model given higher weight than dietary models due to uncertainites associated with estimating prey exposure
	C1 through C4 (all Eus)	Moderate			
HQ: Measured tissue - reproduction-based small mammal TRV	All AAs	Negligible	Moderate	High	— Measured site-specific tissue is a direct measure of exposure
					— TRVs based on multigenerational studies for small mammals
Weight of Evidence Conclusion					
Terrestrial Carnivores (Long-tailed weasel and red fox)					
HQ: Modeled diet - reproduction-based small mammal TRV	C2 (all Eus), C5 through C9 (all Eus)	Negligible	Moderate	Moderate/High	— TRVs considered appropriate for small mammals (based on multigenerational mice studies)
	C1 East, C3 and C4 (all Eus)	Low			— Dose based on modeled tissue given higher weight than dose based on measured tissue. Weasel diet assumed to contain 100% small mammal tissue. Modeled small mammal tissue based regression for which a statistically significant relationship
	C1 West	Moderate		Moderate/High	— Modeled tissue provides greater coverage for risk estimates across OU-4
HQ: Measured diet - reproduction-based small mammal TRV	C1 through C9 (all Eus)	Low	Moderate	Moderate	
Weight of Evidence Conclusion					
Mixed Diet Omnivores exposed to riparian soil and sediment (Raccoon-2)					
HQ: Modeled diet - reproduction-based small mammal TRV	C5 through C10 Riparian and Floodplain Eus	Negligible	Moderate	Moderate	
	C2 and C3 North Floodplain Eus, C4 all Eus, C3 Riparian	Low			— TRVs considered appropriate for small mammals (based on multigenerational mice studies)
	C1 and C2 Riparian, C1 East and C3 South Floodplain Eus	Moderate			— Dose based on modeled tissue using BAFs for which no significant relationship found between soil/sediment and tissue given lower weight than dose based on measured tissue
	C1 West floodplain EU	High			

Table AD8-3. (cont.) Summary of Potential Risks to Mammals from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk.
Anniston PCB Site, Anniston, Alabama.
OU4 BERA Addendum

Line of Evidence	Exposure Unit	ARCADIS INTERPRETATION			
		Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
HQ: Measured diet - reproduction-based small mammal TRV	C1 through C10 Riparian, C1 through C4 floodplain Eus	Low	High	Moderate/High	
	C5 through C10 Floodplain Eus	Negligible	High	Moderate/High	
Weight of Evidence Conclusion					
Mixed Diet Omnivores exposed to riparian soil and sediment (Mink-1) Arcadis part added by KK -- raccoon was identified as most sensitive, but mink is more sensitive					
HQ: Modeled diet - growth-based mink TRV	C5 through C10	Moderate			
	C1 through C4	High			
HQ: Measured diet - growth-based mink TRV	C1 through C10	High			
	C6, C9	Low			
HQ: Modeled diet - reproduction-based mink TRV	C3, C4, C5, C7, C8, C10	Moderate			
	C1, C2	High			
HQ: Measured diet - reproduction-based mink TRV	C1 through C10	Moderate			
Weight of Evidence Conclusion					

Table AD8-3. (cont.) Summary of Potential Risks to Mammals from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk.
Anniston PCB Site, Anniston, Alabama.
OU4 BERA Addendum

Line of Evidence	EPA INTERPRETATION				
	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
All Aquatic Mammals					
Community Metric: Compare OU-4 and reference community data and/or comparison among OU-4 assessment areas	OU-4	Unknown	NA	Low	— Cannot state whether there are any effects of PCBs or other COPCs on the aquatic mammal community as co-located COPC concentration data not collected
					— No surveys conducted for aquatic mammals at reference locations
					— High uncertainty with findings due to low sample size, unknown regarding experimental design and statistical analysis methods, lack of reference data, and lack of co-located COPC concentration data
Reference Comparison: Compare OU-4 and reference sediment and prey tissues and/or comparison among OU-4 assessment areas	OU-4	Site elevated compared to reference conditions in all assessment areas	NA	NA	— This LOE indicates potential for exposure but does not speak to estimated risk
Weight of Evidence Conclusion	OU4	Unknown	NA	Low	Field survey data were inconclusive and cannot be used to support or refute a conclusion of risk.
Piscivores (mink and river otter)					
Reproduction-Based TRV					
HQ: Modeled diet - growth-based mink TRV	C1 through C5, C7, C8, C10	High unacceptable	Moderate	Moderate	— TRV based on mink. Growth is an ecologically relevant endpoint; adverse effects on growth can result in population-level effects. Growth TRV is given more weight than reproduction TRV.
	C6 and C9	Unacceptable			— Dose based on modeled fish tissue using BAFs for which no significant relationship found between sediment and tissue given lower weight than dose based on measured tissue.
HQ: Measured diet - growth-based mink TRV	C1 through C10	High unacceptable	Low / Moderate	Moderate / High	— Growth TRV is valid and defensible. Falls within range of TRVs reported in Bursian et al. 2013 and EC20 value calculated from dose-response regression for reproductive success based on 50 published mink studies from Fuchsman et al. 2008.
HQ: Modeled diet - reproduction-based mink TRV	C1 through C4, C8	High unacceptable	Moderate	Moderate	— Dose based on modeled fish tissue using BAFs for which no significant relationship found between sediment and tissue given lower weight than dose based on measured tissue.
	C5, C6, C7, C9, C10	Unacceptable			— Reproduction TRV is dietary concentration at which kit survival at six weeks of age was only 13%. Any exceedance of this LOAEL TRV should be considered high unacceptable.

Table AD8-3. (cont.) Summary of Potential Risks to Mammals from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk.
Anniston PCB Site, Anniston, Alabama.
OU4 BERA Addendum

Line of Evidence	EPA INTERPRETATION				
	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
HQ: Measured diet - reproduction-based mink TRV	C1 through C10	High unacceptable	Low / Moderate	Moderate / High	
Weight of Evidence Conclusion	C1 thorough C10	High unacceptable	Moderate	Moderate	Conservative and confidence ranged from low/Moderate to Moderate/High, and risk conclusions similar for all LOEs. Greatest weight given to the LOE with the highest confidence level
Aerial Invertivores (brown bat)					
HQ: Modeled diet - reproduction-based small mammal TRV	C1, C2, C4	High unacceptable	moderate/potential to underestimate risk	Low/Moderate	
	C3	Unacceptable			— Dose based on modeled emergent insect tissue using BAFs for which no significant relationship found between sediment and tissue given lower weight than dose based on measured prey tissue. However, BAF includes terrestrial Hymenoptera which likely underestimate the contribution of sediment to risks to aerial invertivores.
	C5 through C10	Acceptable			
HQ: Measured diet - reproduction-based small mammal TRV	C1 through C4	Unacceptable	Low/Moderate	Moderate/High	
	C5 through C9	Acceptable			
Weight of Evidence Conclusion	C1 thorough C4	Unacceptable	Moderate	Moderate / High	Conservative and confidence ranged from low/Moderate to Moderate/High, and risk conclusions similar for both LOEs. Greatest weight given to the LOE with the highest confidence level
	C5 through C10	Acceptable			
All Terrestrial Mammals					
Compare OU-4 and reference community data	OU-4	Unknown	NA	Low	— Cannot state whether there are any effects of PCBs or other COPCs on the terrestrial mammal community as co-located COPC concentration data not collected
					— High uncertainty with findings due to low sample size, unknown regarding experimental design and statistical analysis methods, lack of reference data, and lack of co-located COPC concentration data
					— Community survey data considered a secondary line of evidence
Reference Comparison: Compare OU-4 and reference soil and prey tissues and/or comparison among OU-4 assessment areas	OU-4	Site elevated compared to reference conditions in all assessment areas	NA	NA	— This LOE indicates potential for exposure but does not speak to estimated risk
Weight of Evidence Conclusion	OU4	NA	NA	Low	Field survey data were inconclusive and cannot be used to support or refute a conclusion of risk.
Herbivores (White-tailed deer)					
HQ: Modeled diet - reproduction-based small	C1 West	Unacceptable			—

Table AD8-3. (cont.) Summary of Potential Risks to Mammals from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk.
Anniston PCB Site, Anniston, Alabama.
OU4 BERA Addendum

Line of Evidence	EPA INTERPRETATION				
	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
mammal TRV	C1 East, C2 through C9 (all Eus)	Acceptable		Agree	—
HQ: Measured diet - reproduction-based small mammal TRV	C1 through C9 (all Eus)	Acceptable			—
Weight of Evidence Conclusion	All EUs	Acceptable	Moderate	Moderate	Greatest weight given to the LOE with the highest confidence level
Terrestrial Insectivores/Invertivores (Short-tailed shrew-1)					
HQ: Modeled diet - reproduction-based small mammal TRV	C1 West, C3 South	High Unacceptable	Moderate	Moderate	
	C1 East, C2 North, C3 North, C4 North and South, C6 South, C8 North	Unacceptable			— TRVs considered appropriate for small mammals (based on multigenerational mice studies)
	C2 Central, C5 North and South, C6 North, C7 North and South, C8 South, C9 North	Indeterminate			— Dose based on modeled tissue given lower weight than dose based on measured tissue. Modeled tissue based 25% on BAFs for which no significant relationship found between soil and tissue (i.e., 26% grasshoppers) and 26% terrestrial spiders for which earthworms used as a surrogate for estimate.
	C2 South, C9 South	Acceptable			
HQ: Measured diet - reproduction-based small mammal TRV	C1 through C4	Unacceptable	Moderate	Moderate / High	— Dose based on measured tissue given higher weight
	C5 through C9	Indeterminate			
HQ: Measured tissue - reproduction-based small mammal TRV	UAA	Acceptable	High / Potential for under or overestimation of risk	Low	— Very limited database for CTCs in small mammal tissue; high uncertainty
	LAA, MAA	Indeterminate			— Considered a secondary LOE; more weight given to other site-specific measures
Weight of Evidence Conclusion	C1 through C4	Unacceptable	Moderate	Moderate	Dietary Exposure LOEs had moderate conservatism and moderate to high confidence. Tissue concentration data had low confidence, greater weight given to the dietary LOEs.
	C5 through C10	Indeterminate			
Terrestrial Insectivores/Invertivores (Short-tailed shrew-2) Arcadis part added by KK - Not included in their table					
HQ: Modeled diet - reproduction-based small mammal TRV	C1 West, C3 South	High Unacceptable	moderate	Moderate	
	C1 East, C2 (all Eus), C3 North, C4 North and South, C6 South, C8 North	Unacceptable			— TRVs considered appropriate for small mammals (based on multigenerational mice studies)
	C5 North and South, C6 North, C7 North and South, C8 South, C9 North	Indeterminate			— Dose based on modeled tissue given lower weight than dose based on measured tissue. Modeled tissue based 25% on BAFs for which no significant relationship found between soil and tissue (i.e., 26% grasshoppers) and 26% terrestrial spiders for which earthworms used as a surrogate for estimate.

Table AD8-3. (cont.) Summary of Potential Risks to Mammals from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk.
Anniston PCB Site, Anniston, Alabama.
OU4 BERA Addendum

Line of Evidence	EPA INTERPRETATION				
	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
	C9 South	Acceptable			
HQ: Measured diet - reproduction-based small mammal TRV	C1 through C4	Unacceptable	moderate	Moderate / High	— Dose based on measured tissue given higher weight
	C5 through C9	Indeterminate			
HQ: Measured tissue - reproduction-based small mammal TRV	UAA	Acceptable	High / Potential for under or overestimation of risk	Low	— Very limited database for CTCs in small mammal tissue; high uncertainty
	LAA, MAA	Indeterminate			— Considered a secondary LOE; more weight given to other site-specific measures
Weight of Evidence Conclusion	C1 through C4	Unacceptable	Moderate	Moderate	Dietary Exposure LOEs had moderate conservatism and moderate to high confidence. Tissue concentration data had low confidence, greater weight given to the dietary LOEs.
	C5 through C10	Indeterminate			
Terrestrial Carnivores (Long-tailed weasel and red fox)					
HQ: Modeled diet - reproduction-based small mammal TRV	C1 West, C3 South	Unacceptable			
	C1 East, C2 North, C3 North, C4 North and South,	Indeterminate		Agree	
	C2 South and Central, C5 through C9 (all Eus)	Acceptable			
HQ: Measured diet - reproduction-based small mammal TRV	C1 West, C5 through C9 (all Eus)	Unacceptable			
	C1 East, C2 through C4 (all Eus)	Indeterminate			
Weight of Evidence Conclusion	C1	Unacceptable	Moderate	Moderate/High	Greatest weight given to the LOE with the highest confidence level
	C3, C4	Indeterminate			
	C2, C5 through C9 (all EUs)	Acceptable			
Mixed Diet Omnivores exposed to riparian soil and sediment (Raccoon-2)					
HQ: Modeled diet - reproduction-based small mammal TRV	C1 Riparian, C2 Riparian,	Unacceptable	Moderate	Moderate	
	C3 Riparian, C4 Riparian, C8 Riparian	Indeterminate			
	C5 through C7 Riparian, C9 Riparian, C10 Riparian	Acceptable			— Dose based on modeled tissue using BAFs for which no significant relationship found between soil/sediment and tissue given lower weight than dose based on measured tissue

Table AD8-3. (cont.) Summary of Potential Risks to Mammals from PCBs Weighted by Ecological Relevance and Confidence in the Predicted Risk.
Anniston PCB Site, Anniston, Alabama.
OU4 BERA Addendum

Line of Evidence	EPA INTERPRETATION				
	Exposure Unit	Potential Risk	Level of Conservatism/ Potential Overestimation of Population Risk	Confidence in Risk Prediction	Basis
HQ: Measured diet - reproduction-based small mammal TRV	C1 through C10	Indeterminate	Moderate	Moderate/high	— Dose based on measured tissue given higher weight
Weight of Evidence Conclusion	C1 through C10	Indeterminate	Moderate	Moderate	Greatest weight given to the LOE with the highest confidence level
Mixed Diet Omnivores exposed to riparian soil and sediment (Mink-1) Arcadis part added by KK -- raccoon was identified as most sensitive, but mink is more sensitive					
HQ: Modeled diet - growth-based mink TRV	C1 Riparian through C4 Riparian	High Unacceptable			— TRV based on mink. Growth is an ecologically relevant endpoint; adverse effects on growth can result in population-level effects. Growth TRV is given more weight than reproduction TRV.
	C5 through C10 Riparian	Unacceptable			— Dose based on modeled tissue using BAFs for which no significant relationship found between soil/sediment and tissue, except for small mammals, given lower weight than dose based on measured tissue
HQ: Measured diet - growth-based mink TRV	C1 through C10 Riparian	High Unacceptable			— Growth TRV is valid and defensible. Falls within range of TRVs reported in Bursian et al. 2013 and EC20 value calculated from dose-response regression for reproductive success based on 50 published mink studies from Fuchsman et al. 2008.
					—
HQ: Modeled diet - reproduction-based mink TRV	C1 Riparian, C2 Riparian	High Unacceptable			—
	C3 through C10 Riparian	Unacceptable			— Reproduction TRV is dietary concentration at which kit survival at six weeks of age was only 13%. Any exceedance of this LOAEL TRV should be considered high unacceptable.
HQ: Measured diet - reproduction-based mink TRV	C1 through C10 Riparian	Unacceptable			
Weight of Evidence Conclusion	C1 Riparian, C2 Riparian	High Unacceptable	Moderate	Moderate	Greatest weight given to the LOE with the highest confidence level

Weight of evidence presented for receptor within each feeding guild that had highest predicted risk (receptor noted in blue text)
Line of evidence with the relatively highest level of confidence in predicting potential risk for the receptor populations is in **bold text**
BAF = Bioaccumulation factor
COPC = Contaminant of potential concern
EU = Exposure unit
EPC = Exposure point concentration
LOE = Line of evidence
LAA = Lower Assessment Area
MAA = Middle Assessment Area

Table AD8-4. Hazard Quotient Calculation Checks, Anniston BERA
Birds, PCBs

95%UCL

Spotted Sandpiper - 2

INITIAL SETTINGS

0.753

0.17

0

Location	Type	Conc. in Sediment ^A	Sediment Ingestion Rate	Total Intake through Sediment	Conc. In Surface Water	Water Ingestion Rate	Total Intake through Water	Conc. in EWs ^B	Percent of Diet Ews
		mg/kg dw	kg/kg BW/dayday dw	mg/day	mg/L	L/kg BW/day	mg/kgBW.day	mg/kg dw	
UAA	PCBs	5.61	0.753	4.22433		0.17	0		0
MAA	PCBs	1.46	0.753	1.09938		0.17	0		0
LAA	PCBs	0.919	0.753	0.692007		0.17	0		0
UAA	PCBs	5.61	0.753	4.22433		0.17	0		0
MAA	PCBs	1.46	0.753	1.09938		0.17	0		0
LAA	PCBs	0.919	0.753	0.692007		0.17	0		0

^A Sediment 95%UCL concentrations from Table AD5-1

^B Aquatic invertebrate tissue concentrations from Table 6-11 of BERA

mg/kg d.w. = milligrams per kilogram dry weight
mg/kg w.w. = milligrams per kilogram wet weight
kg = kilogram
mg/kg/day = milligrams per kilogram body weight per day
µg/L = micrograms per liter

dw = dry weight
ww = wet weight
AUF = Area Use Factor
LOAEL = Lowest observed adverse effect level
NOAEL = No observed adverse effect level

HQ = Hazard Quotient
mg/L = milligrams per liter
EWs = Earthworms

Table AD8-4. (cont.) Hazard Quotient Calculation Checks, Anniston BERA
Birds, PCBs

0.18		50	0.18		50	0.18		
Food Ingestion Rate	Conc. in Aquatic Inverts ^C	Percent of Diet Aquatic Inverts	Food Ingestion Rate	Conc. in Lumbriculus	Percent of Diet Lumbriculus	Food Ingestion Rate	Total Intake through Food	Total Intake
kg/kg BW/day dw	mg/kg dw		kg/kg BW/day dw	mg/kg dw.		kg/kg BW/day dw	mg/day dw	mg/day
0.18	2.65	50	0.18	65.18	50	0.18	6.1047000	10.32903
0.18	1.83	50	0.18	65.18	50	0.18	6.0309000	7.13028
0.18	1.09	50	0.18	65.18	50	0.18	5.9643000	6.65631
0.18	2.65	50	0.18	65.18	50	0.18	6.1047000	10.32903
0.18	1.83	50	0.18	65.18	50	0.18	6.0309000	7.13028
0.18	1.09	50	0.18	65.18	50	0.18	5.9643000	6.65631

^C Lumbriculus 95%UCL concentration calculated from data in Appendix E using ProUCL version 5.1. Basis not stated in Appendix E, but values are similar to values in Appendix 1 of Ingersoll et al. (2014); page 39 of Ingersoll et al. (2014) states the PCB tissue concentrations are wet weight. Use of the values from Appendix E , which are likely wet weight, underestimates this EPC.

mg/kg d.w. = milligrams per kilogram dry weight
mg/kg w.w. = milligrams per kilogram wet weight
kg = kilogram
mg/kg/day = milligrams per kilogram body weight per d
µg/L = micrograms per liter

dw = dry weight
ww = wet weight
AUF = Area Use Factor
LOAEL = Lowest observed adverse effect level
NOAEL = No observed adverse effect level

HQ = Hazard Quotient
mg/L = milligrams per liter
EWs = Earthworms

Table AD8-4. (cont.) Hazard Quotient Calculation Checks, Anniston BERA
Birds, PCBs

1 0.043

AUF	Body Weight	Dose	LOAEL	HQ LOAEL	NOAEL	HQ NOAEL
	kg	mg/kg/day	mg/kg/day		mg/kg/day	
1	0.043	10.3290300	0.13	79.45	0.043	240.21
1	0.043	7.1302800	0.13	54.85	0.043	165.82
1	0.043	6.6563070	0.13	51.20	0.043	154.80
1	0.043	10.3290300	1.4	7.38	0.47	21.98
1	0.043	7.1302800	1.4	5.09	0.47	15.17
1	0.043	6.6563070	1.4	4.75	0.47	14.16

mg/kg d.w. = milligrams per kilogram dry weight
mg/kg w.w. = milligrams per kilogram wet weight
kg = kilogram
mg/kg/day = milligrams per kilogram body weight per day
µg/L = micrograms per liter

dw = dry weight
ww = wet weight
AUF = Area Use Factor
LOAEL = Lowest observed adverse effect level
NOAEL = No observed adverse effect level

HQ = Hazard Quotient
mg/L = milligrams per liter
EWs = Earthworms

Table AD8-5. Weight of Evidence Evaluation Summary
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

[illegible]

Table AD8-6. Weight of Evidence Evaluation Summary for Barium
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

[illegible]

Table AD8-7. Weight of Evidence Evaluation Summary for Chromium
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

[illegible]

Table AD8-8. Weight of Evidence Evaluation Summary for Cobalt
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

[illegible]

Table AD8-9. Weight of Evidence Evaluation Summary for Lead
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

[illegible]

Table AD8-10. Weight of Evidence Evaluation Summary for Vanadium
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

[illegible]

Table AD8-12. Weight of Evidence Evaluation Summary for Mercury
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

[illegible]

Table AD11-1. Summary of Toxicity Benchmarks, TRVs, and CTCs for Ecological Receptors Anniston PCB Site, Anniston, Alabama

Media	Receptor	PCBs			Mercury ^b			Barium			Chromium			Cobalt			Lead			Vanadium		
		(low)	(high)	Reference	(low)	(high)	Reference	(low)	(high)	Reference	(low)	(high)	Reference	(low)	(high)	Reference	(low)	(high)	Reference	(low)	(high)	Reference
Media-Based Toxicity Benchmarks																						
Sediment (mg/kg dw)		TEC	PEC		TEC	PEC		TEC	PEC		TEC	PEC		TEC	PEC		TEC	PEC		TEC	PEC	
	Benthic invertebrates*	0.060	0.68	MacDonald et al. (2000)	0.18	1.1	MacDonald et al. (2000)	NA	NA	--	43	111	MacDonald et al. (2000)	NA	NA	--	36	128	MacDonald et al. (2000)	NA	NA	--
Soil (mg/kg dw)		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL	
	Terrestrial plants	40	NA	Efroymson et al. (1997a)	0.30	NA	Efroymson et al. (1997a)	--	--	Not a soil COPC	1.0	NA	Efroymson et al. (1997a)	--	--	Not a soil COPC	120	NA	USEPA (2005c)	2.0	NA	Efroymson et al. (1997a)
	Terrestrial invertebrates	3.6	36	USEPA (2015) ⁱ	0.10	0.23	Efroymson et al. (1997b) / Son et al. 1997	--	--	Not a soil COPC	0.40	NA	Efroymson et al. (1997b)	--	--	Not a soil COPC	1700	NA	USEPA (2005c)	NA	NA	--
Water (µg/L)		Acute	Chronic		Acute	Chronic		Acute	Chronic		Acute	Chronic		Acute	Chronic		Acute	Chronic		Acute	Chronic	
	Aquatic life (water column invertebrates, fish, and amphibians)	0.60	0.014	ADEM (2015) ^a , USEPA (2016)	2.4 1.4	0.012 0.77	ADEM (2015) ^g , USEPA (2016) ^h	110	4.0	Suter and Tsao (1996)	1005	131	ADEM (2015) ^c , USEPA (2016)	1500	23	Suter and Tsao (1996)	136	5	ADEM (2015) ^c , USEPA (2016)	280	20	Suter and Tsao (1996)
	Aquatic plants	NA	0.14	Suter and Tsao (1996)	NA	5.0	Suter and Tsao (1996)	NA	NA	--	NA	400	Suter and Tsao (1996)	NA	NA	--	NA	500	Suter and Tsao (1996)	NA	NA	--
	Aquatic invertebrates	NA	1.2	Suter and Tsao (1996)	NA	0.87	Suter and Tsao (1996)	NA	NA	--	NA	NA	--	NA	4.4	Suter and Tsao (1996)	NA	NA	--	NA	430	Suter and Tsao (1996)
	Fish	NA	0.4	Suter and Tsao (1996)	NA	0.87	Suter and Tsao (1996)	NA	NA	--	NA	89	Suter and Tsao (1996)	NA	810	Suter and Tsao (1996)	NA	22	Suter and Tsao (1996)	NA	41	Suter and Tsao (1996)
Dietary Toxicity Reference Values		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL	
Dietary TRV (mg/kg bw-d; dw)	Birds - high sensitivity	0.043	0.13	Lillie et al. (1974)	0.023	0.068	Spalding et al. (2000)	21	42	Sample et al. (1996)	2.7	2.8	USEPA (2008) ^d	7.6	7.8	USEPA (2005b) ^d	1.6	3.3	USEPA (2005c) ^d	0.34	0.70	USEPA (2005d) ^d
	Birds - mid-range sensitivity	0.47	1.4	Koval et al. (1987)																		
	Small mammals	0.23	0.68	McCoy et al. (1995)	0.075	0.15	Dansereau et al. (1999)	52	121	USEPA (2005a) ^d	2.4	2.8	USEPA (2008) ^d	7.3	10	USEPA (2005b) ^d	4.7	8.9	USEPA (2005c) ^d	4.2	8.3	USEPA (2005d) ^d
	Mink	0.050	0.10	Restum et al. (1998)																		
	Mink (alternate)	NA	0.05	Restum et al. (1998) ^k																		
Tissue Critical Tissue Concentrations (dry weight basis) ^f		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL	
Benthic Invertebrates	Oligochaetes	541	659	converted to dw assuming 17% solids (Landrum et al. 2004)	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
	Emergent Insects	21	NA	converted to dw assuming 31% solids (OU-4 data)	24	NA	converted to dw assuming 31% solids	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
	Odonata/Epibenthic	158	422	converted to dw assuming 18% solids (OU-4 data)	56	90	converted to ww assuming 18% solids (OU-4 data)	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
	Molluscs	1263	1875	converted to dw assuming 8% solids (OU-4 data)	8	150	converted to dw assuming 8% solids	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
	Crayfish	21	57	converted to dw assuming 28% solids (OU-4 data)	0.92	16	converted to ww assuming 10% solids (Biesinger et al. 1984)	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
Terrestrial Invertebrates	Earthworms	78	83	converted to ww assuming 22% solids (Rodriguez-Grau et al. 1989)	15	NA	converted to ww assuming 29% solids (OU-4 data)	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
	Grasshoppers/Crickets	307	480	converted to dw assuming 30% solids (Paine et al. 1993)	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
Amphibians and Reptiles	Frogs	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
	Snakes	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--

Table AD11-1. Summary of Toxicity Benchmarks, TRVs, and CTCs for Ecological Receptors Anniston PCB Site, Anniston, Alabama

Media	Receptor	PCBs			Mercury ^b			Barium			Chromium			Cobalt			Lead			Vanadium		
		(low)	(high)	Reference	(low)	(high)	Reference	(low)	(high)	Reference	(low)	(high)	Reference	(low)	(high)	Reference	(low)	(high)	Reference	(low)	(high)	Reference
Bird Eggs (mg/kg dw)	Birds - high sensitivity	2.1	4.5	Britton and Houston (1973)	0.44	0.80	Jackson et al. (2011)	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
	Birds - mid-range sensitivity	28	66	NOAEL : McLane and Hughes (1980) LOAEL : Peakall and Peakall (1973), Peakall et al. (1972)				NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
Mammal Tissue (mg/kg dw)	Small mammals	10	23	McCoy et al. (1995) ^e	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
Fish Tissue (mg/kg dw)	Non-salmonid	7.0	34	Hansen et al. (1974)	0.85	0.93	Webber and Haines 2003/Friedmann et al. 1976	NA	NA	--	NA	NA	--	NA	NA	--	9.3	15	Holcombe et al. (1976)	0.090	2.1	Hilton and Bettger (1988)
Tissue Critical Tissue Concentrations (wet weight basis) ^f		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL		NOAEL	LOAEL	
Benthic Invertebrates (mg/kg ww)	Oligochaetes	92	112	Fisher et al. 1999	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
	Emergent Insects	6.5	NA	Sanders and Chandler 1974	7.5	NA	Saouter et al. 1993	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
	Odonata/Epibenthic	28	76	Borgman et al. 1990; Nebeker and Puglisi 1974	10	16	Borgmann et al. 1993	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
	Molluscs	101	150	Lowe et al. 1972	0.6	12	LOAEL: Thain et al. 1984 NOAEL: Dillon et al. 1977; acute-to-chronic UF (0.1)	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
	Crayfish	6.0	16	Sanders and Chandler 1974; Duke et. al 1970	0.092	1.6	Biesinger et al. 1982	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
Terrestrial Invertebrates (mg/kg ww)	Earthworms	17	18	Rodriguez-Grau et al. 1989, acute-to-chronic UF (0.1)	4.4	NA	Burton et al. 2006	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
	Grasshoppers/Crickets	92	144	Paine et al. 1993	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
Amphibians and Reptiles (mg/kg ww)	Frogs	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
	Snakes	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
Bird Eggs (mg/kg ww)	Birds - high sensitivity	0.52	1.1	Britton and Houston (1973)	0.11	0.20	Jackson et al. (2011)	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
	Birds - mid-range sensitivity	7.1	17	NOAEL : McLane and Hughes (1980) LOAEL : Peakall and Peakall (1973), Peakall et al. (1972)				NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
Mammal Tissue (mg/kg ww)	Small mammals	3.3	7.2	McCoy et al. (1995) ^e	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--	NA	NA	--
Fish Tissue (mg/kg ww)	Non-salmonid	1.9	9.3	Hansen et al. (1974)	0.23	0.25	Webber and Haines 2003/Friedmann et al. 1976	NA	NA	--	NA	NA	--	NA	NA	--	2.5	4	Holcombe et al. (1976)	0.024	0.554	Hilton and Bettger (1988)

Table AD11-1. Summary of Toxicity Benchmarks, TRVs, and CTCs for Ecological Receptors Anniston PCB Site, Anniston, Alabama

- Notes:**
- a. No ADEM low value available. Screening value from Tier II Secondary Acute Value (Suter and Tsao 1996) for Aroclor 1254.
 - b. Mercury values based on total, inorganic, or methylmercury depending on media.
 - c. Ambient water quality criteria were adjusted for hardness = 200 mg/L, which represents a mid-range of site hardness data.
 - d. LOAELs selected from USEPA EcoSSL datasets were selected as the lowest LOAEL in the dataset for reproduction, growth, or survival that was above the selected NOAEL. Values were used as presented in the EcoSSL dataset. Specific underlying studies were note reviewed. See Appendix D for details on development of specific TRVs.
 - e. Study results assumed to be in dw.
 - f. Tissue-based CTCs were available on wet weight basis, as reported in the studies, but converted to dw for the risk assessment using site-specific percent solids data where available, or using appropriate literature values (see text).
 - g. Value based on methylmercury but applies to total mercury
 - h. Value based on total mercury but also applies to methylmercury
 - i. Soil benchmark calculated using equilibrium partitioning approach from USEPA (2015) using a LOAEL water quality criteria based on freshwater aquatic invertebrate Final Chronic Value (0.54 ug/L), as calculated by Fuchsman et al. (2006). An uncertainty factor of 10 was applied to estimate the NOAEL-equivalent benchmark.
 - j. Based on reproductive endpoint
 - k. Based on kit growth endpoint
- * Site-specific PCB toxicity values for benthic invertebrates are presented in Table 5-2a.

ADEM: Alabama Department of Environmental Management	mg/L: milligrams per liter	
BERA: Baseline Ecological Risk Assessment	mg/kg bw-d: milligrams per kilogram body weight per day	--: not applicable
COPC: constituent of potential concern	NA: value not available	
CTC: Common toxicity criteria	NOAEL: no-observed adverse effects level	
dw: dry weight	PCB: polychlorinated biphenyl	
EcoSSL = ecological soil screening level	PEC: probable effects concentration	
high: selected high toxicity benchmark	TEC: threshold effects concentration	
LOAEL: lowest-observed adverse effects level	TRV: toxicity reference value	
low: selected low toxicity benchmark	USEPA: United States Environmental Protection Agency	
mg/kg dw: milligrams per kilogram of dry weight	µg/L: micrograms per liter	

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Table AD11-1. Summary of Toxicity Benchmarks, TRVs, and CTCs for Ecological Receptors Anniston PCB Site, Anniston, Alabama

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**Table AD15-1. Multimetric Index Score for Riffles and Runs
Reference Locations and OU-4 Assessment Areas
Benthic Invertebrate Community Surveys**

Area	Rifle Index Score		Run Index Score	
	Score	Area Average	Score	Area Average
Reference 1	36.7	44.4	48.3	44.7
Reference 2	52.1		41.1	
Upper AA 1	11.1	13.4	14.3	17.0
Upper AA 2	15.7		19.6	
Middle AA 1	30.8	30.9	27.8	32.8
Middle AA 2	30.9		37.8	
Lower AA 1	27.4	31.0	43.1	37.3
Lower AA 2	34.6		31.5	

Table AD19-1. Summary of bioassay results for surface sediment samples from Anniston OU4 as presented in Ingersoll et al. (2014)¹
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				Percent of Bioassay Responses with Toxicity Categories					
				<i>Hyalella azteca</i>			<i>Chironomus dilutus</i>		
Station ID	AA	Reach	ΣPCBs (μg/kg) ²	Not Toxic ^{3,4}	Moderately Toxic ^{3,4}	Highly Toxic ^{3,4}	Not Toxic ^{3,5}	Moderately Toxic ^{3,5}	Highly Toxic ^{3,5}
TXR1 ⁶	Reference	Reference	<32 to 62	100%	0%	0%	100%	0%	0%
TX50-01-P	Upper	C2	770,000	31%	0%	69%	33%	0%	67%
TX50-02-P	Upper	C2	1,200,000	25%	0%	75%	11%	0%	89%
TX50-04-P	Upper	C2	240,000	62%	0%	38%	58%	8%	33%
TX50-05-P	Upper	C2	410,000	31%	0%	69%	100%	0%	0%
		Mean	655,000	37%	0%	63%	51%	2%	47%
TX20-01-P	Middle	C5	220	85%	8%	8%	100%	0%	0%
TX20-03-P	Middle	C5	310	92%	8%	0%	92%	8%	0%
		Mean	265	89%	8%	4%	96%	4%	0%
TX10-01-P	Lower	C10	91.2	15%	31%	54%	67%	33%	0%

Notes

1. Results from Table C4-1 and C4-2 from Ingersoll et al. (2014)
2. ΣPCBs calculated as sum of 10 congeners; from Ingersoll et al. (2014)
3. Toxicity of sample as determined by Ingersoll et al. (2014) using response-specific reference envelopes; not toxic=samples with effect values
4. Toxicity was evaluated based on 13 different effect metrics.
5. Toxicity was evaluated based on 12 different effect metrics.
6. Results represent 5 reference samples; Results for all 5 samples were 100% not toxic

Reference :

Ingersoll, C. G., J. A. Steevens, et al. (2014). Evaluation of toxicity to the amphipod, *Hyalella azteca* , and to the midge, *Chironomus dilutus* ; and bioaccumulation by the oligochaete, *Lumbriculus variegatus* , with exposure to PCB-contaminated sediments from Anniston, Alabama. U.S. Geological Survey Scientific Investigations Report 2013-5125. <http://pubs.usgs.gov/sir/2013/5125/pdf/sir2013-5125.pdf>. 122 pp.

Table AD20-1. Site-Specific PCB and Mercury Toxicity Thresholds for Benthic Invertebrates Anniston PCB Site, Anniston Alabama

Species ^d	Endpoint Type	Endpoint	Site-Specific PCB Toxicity Thresholds (mg PCB/kg dw sed)				Site-Specific PCB Toxicity Thresholds (mg PCB/kg OC)			Site-Specific Mercury Toxicity Thresholds (mg/kg dw sed)		
			EC0 ^b	EC0* ^a	EC10* ^a	EC20* ^a	EC0* ^a	EC10* ^a	EC20* ^a	EC0* ^a	EC10* ^a	EC20* ^a
<i>C. dilutus</i>	Growth	13-d ash-free dry weight	0.05 ^c	6.0	17	32	322	880	1610	1.6	5.3	7.6
		13-d biomass per replicate chamber	0.05 ^c	6.0	14	23	346	711	1170	2.3	5.0	6.6
<i>H. azteca</i>		28-d biomass per replicate chamber	0.05 ^c	1.7	25	58	UND ^e	4880	7600	0.90	4.0	7.5
42-d biomass per replicate chamber		0.05 ^c	18	40	68	1220	2520	3930	4.1	6.9	10	
<i>C. dilutus</i>	Reproduction	Emergence percentage	0.05 ^c	2.0	6.8	14	170	465	873	0.94	3.0	4.7
		No. of egg cases	0.05 ^c	21	31	46	1160	1660	2310	3.1	4.5	6.3
		Total young	0.05 ^c	69	89	114	3390	4150	5080	11	12	14
		Young/egg case	18 ^b	209	260	324	8390	9890	11700	18	20	22
<i>H. azteca</i>		42-d total young	0.05 ^c	9.2	13	18	453	627	866	2.2	2.8	3.5
		42-d young/female	0.05 ^c	1.5	3.0	5.4	102	181	302	0.50	0.84	1.3
		42-d young/female (normalized to 42-d survival)	0.05 ^c	1.4	2.6	4.4	73	120	195	0.41	0.66	1.0
<i>C. dilutus</i>	Survival	13-d survival	0.05 ^c	14	76	123	1000	3710	5570	3.6	9.2	13
Adult survival time		1 ^b	98	186	323	4580	8320	13900	-- ^f	-- ^f	-- ^f	
<i>H. azteca</i>		28-d survival	0.05 ^c	UND ^e	105	152	UND ^e	4636	6390	2.4	8.1	11
		42-d survival	0.05 ^c	31	127	165	2380	5250	6690	5.6	10	13

Notes:

^a EC0*, EC10*, and EC20* are the regression-predicted PCB concentrations (measured as Aroclors) that would cause an additional 0%, 10%, or 20% effect beyond the lowest response measured in the reference sediments (i.e., 1×, 0.9×, and 0.8× the response at the “bottom” of the reference envelope).

^b EC0 is the PCB concentration at which the average reference-sediment response would be predicted to occur, when projected onto the concentration-response curve generated for that endpoint with OU-4 sediments.

^c EC0 was set at a concentration of 0.05 (the mean reference sediment concentration) when the average reference-sediment response was greater than the regression-predicted maximum control-normalized response.

^d Values not calculated for 7 endpoints because a decreasing concentration-response relationship did not exist for the endpoint (see Table C-1 in Appendix C). In addition, values for the adult biomass endpoint for *C. dilutus* are not included as site-specific toxicity thresholds because of the high uncertainty associated with the fact that adult ash-free dry weight was not measured.

^e UND: undefined EC0*, because the lowest control-normalized reference-sediment response (88.8%) was greater than the regression-predicted maximum control-normalized response (85.9%).

^f Value not calculated because a decreasing concentration-response relationship did not exist for the endpoint.

d: day

mg/kg dw sed: milligrams per kilogram dry weight sediment

PCB: polychlorinated biphenyl

OC: organic carbon

Table AD20-2. ECx estimates for 42d young/female (Normalised to survival and as % control). Analysis by TRAP ver 1.30a, 2 parameter threshold sigmoid model.
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Anniston PCB Site, Anniston, Alabama

Non-Detects at Method Detection Limit (MDL)						% Change (MDL vs 0.5 MDL)	Non-Detects at 0.5 Method Detection Limit (MDL)					
p	Xp	95% LCL	95% UCL	Xp SE	Log Xp		p	Xp	95% LCL	95% UCL	Xp SE	Log Xp
50	18.915	6.9286	51.639	0.21386	1.2768	11%	50	21.253	7.7185	58.52	0.21568	1.3274
20	3.1084	0.35521	27.202	0.4619	0.49254	16%	20	3.6838	0.40014	33.914	0.4727	0.5663
10	1.251	5.62E-02	27.868	0.66086	9.73E-02	18%	10	1.523	6.16E-02	37.627	0.68291	0.18269
5	0.65731	1.24E-02	34.856	0.84555	-0.18223	19%	5	0.81554	1.32E-02	50.5	0.87857	-8.86E-02
0	0.139	2.82E-04	68.504	1.3203	-0.857	23%	0	0.18055	2.73E-04	119.41	1.3829	-0.74341

UCL = Upper Confidence Limit

LCL = Lower Confidence Limit

BERA = Baseline Ecological Risk Assessment

TRAP ver 1.30 = US EPA Toxicity Relationship Analysis Program version 1.30

**Table AD20-3. ECx estimates for 42d Survival. Analysis by TRAP ver 1.30a, 3 parameter threshold sigmoid model.
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama**

Non-Detects at Method Detection Limit (MDL)						% Change (MDL vs 0.5 MDL)	Non-Detects at 0.5 Method Detection Limit (MDL)					
p	Xp	95%LCL	95%UCL	Xp SE	Log Xp		p	Xp	95%LCL	95%UCL	Xp SE	Log Xp
50	261.86	197.09	347.92	6.05E-02	2.4181	0%	50	261.86	197.09	347.92	6.05E-02	2.4181
20	172.03	103.57	285.77	0.10806	2.2356	0%	20	172.03	103.57	285.77	0.10806	2.2356
10	139.21	68.23	284.02	0.15185	2.14	0%	10	139.21	68.23	284.02	0.15185	2.1437
5	119.85	45.64	314.75	0.2056	2.0786	0%	5	119.85	45.64	314.75	0.2056	2.08
0	83.494	4.82	1446.6	0.60735	1.9217	0%	0	83.494	4.82	1446.6	0.60735	1.9217

UCL = Upper Confidence Limit

LCL = Lower Confidence Limit

BERA = Baseline Ecological Risk Assessment

TRAP ver 1.30 = US EPA Toxicity Relationship Analysis Program version 1.30

Table AD20-4. ECx estimates for 42d biomass per replicate chamber. Analysis by TRAP ver 1.30a, 3 parameter threshold sigmoid model.
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

Non-Detects at Method Detection Limit (MDL)						% Change (MDL vs 0.5 MDL)	Non-Detects at 0.5 Method Detection Limit (MDL)					
p	Xp	95%LCL	95%UCL	Xp SE	Log Xp		p	Xp	95%LCL	95%UCL	Xp SE	Log Xp
50	348.96	249.23	488.61	7.17E-02	2.5428	0%	50	348.96	249.23	488.61	7.17E-02	2.5428
20	279.89	152.24	514.59	0.12967	2.447	0%	20	279.89	152.24	514.59	0.12967	2.447
10	250.45	110.47	567.78	0.17429	2.3987	0%	10	250.45	110.47	567.78	0.17429	2.3987
5	231.51	80.897	662.56	0.2239	2.3646	0%	5	231.51	80.897	662.56	0.2239	2.3646
0	191.5	15.062	2434.8	0.54145	2.2822	0%	0	191.5	15.062	2434.8	0.54145	2.2822

UCL = Upper Confidence Limit

LCL = Lower Confidence Limit

BERA = Baseline Ecological Risk Assessment

TRAP ver 1.30 = US EPA Toxicity Relationship Analysis Program version 1.30

Table AD22-1. Comparison of Correct Classification Rates for the TT_{LR} and the TT_{HR} using Reliable TTs for Whole Sediment and for Pore Water
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

COPC	Pore Water				Sediment			
	TT _{LR} (µg/L)	TT _{HR} (µg/L)	Correct classification rate for TT _{LR}	Correct classification rate for TT _{HR}	TT _{LR} (µg/kg)	TT _{HR} (µg/kg)	Correct classification rate for TT _{LR}	Correct classification rate for TT _{HR}
<i>Chironomus dilutus</i> , adult emergence								
Total monochlorobiphenyls	1.71	7.87	85	78	292	1,340	85	89
Total dichlorobiphenyls	0.00536	0.0625	96	89	473	1,940	85	89
Total trichlorobiphenyls	1.1	2.87	85	89	410	1,420	85	89
Total pentachlorobiphenyls	0.0191	0.0484	85	85	260	821	85	85
Total hexachlorobiphenyls	0.000423	0.00565	85	85	279	871	85	85
Total heptachlorobiphenyls	0.00346	0.00107	81	89	137	420	85	89
Total Octachlorobiphenyls	0.000011	0.0000753	85	85	56.2	169	85	81
Σ Mono- and di-chlorobiphenyls	0.675	4.16	85	81	789	3,360	85	89
Σ Tetra- and penta-chlorobiphenyls	0.91	2.59	85	89	526	1,670	85	85
Σ Tri-, tetra-, and penta-chlorobiphenyls	0.0116	0.0478	85	85	945	3,120	85	85
Total PCBs (homologs)	4.31	14.1	85	81	1,870	7,110	85	89
<i>Hyalella azteca</i> , reproduction, young per female normalized to survival								
Total monochlorobiphenyls	0.435	1.14	88	88	242	562	88	88
Total dichlorobiphenyls	0.00287	0.0106	88	92	468	997	88	88
Total trichlorobiphenyls	0.0863	0.208	88	88	284	565	88	88
Total pentachlorobiphenyls	0.0068	0.0133	84	88	201	373	88	88
Total heptachlorobiphenyls	0.000131	0.000264	92	88	69	121	88	88
Σ Mono- and di-chlorobiphenyls	0.967	2.53	88	88	701	1,550	88	88
Σ Mono-, di-, and tri-chlorobiphenyls	0.231	0.727	88	84	876	1,880	88	88
Σ Tetra- and penta-chlorobiphenyls	0.142	0.354	88	84	421	792	88	88
Σ Tri-, tetra-, and penta-chlorobiphenyls	0.0389	0.085	88	84	728	1,400	88	88

Bold, italicized numbers indicate reliable TTs

TT_{LR} = Toxicity threshold, low risk

TT_{HR} = Toxicity threshold, high risk

µg/L = micrograms per liter

µg/kg = micrograms per kilogram

Reliable TTs and correct classification rates for porewater are from Tables C5-8 and C5-10 of Ingersoll et al. 2014

Reliable TTs and correct classification rates for sediment are from Tables C5-5 and C5-7 of Ingersoll et al. 2014

Reference:

Ingersoll, C. G., J. A. Steevens, et al. (2014). Evaluation of toxicity to the amphipod, *Hyalella azteca* , and to the midge, *Chironomus dilutus* ; and bioaccumuation by the oligochaete, *Lumbriculus variegatus* , with exposure to PCB-contaminated sediments from Anniston, Alabama. U.S. Geological Survey Scientific Investigations Report 2013-5125. <http://pubs.usgs.gov/sir/2013/5125/pdf/sir2013-5125.pdf>. 122.

Table 24-1. Summary of Studies Proposed for Derivation of Critical Tissue Concentrations for Benthic Invertebrates
Slide 15 from the Powerpoint Presentation, May 16 2017 Meeting
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

Test Organism	Organism Group	Chemical Form	Exposure Route	Effect Group	Endpoint	TRV	Reported Total PCB or Hg CTC (mg/kg)	Basis	Total PCB or Hg (mg/kg ww)	Percent solids	Total PCB or Hg (mg/kg dw)	Reference
Hexagenia spp.	emergent insects	PCB	sediment	MOR	36% mortality	LOEC	1.4	ww	1.4	0.31	5	Van Geest et al. 2011
Penaeus duorarum	crustacean	Aroclor 1254	water	MOR	72% mortality	LOEC	16 ^C	NS	NA	0.28	16	Duke et al. 1970
Culex tarsalis	emergent insects	Aroclor 1254	water	GRO	no metamorphosis	LOEC	27	dw	NA		27	Sanders and Chandler 1972
Crassostrea virginica	mollusc	Aroclor 1254	water	GRO	41% decrease in growth rate	LOEC	33	NS	NA	0.08	33	Duke et al. 1970
Gammarus pseudolimnaeus	epibenthic	Aroclor 1242	water	REP	complete reproductive failure	LOEC	316	NS	NA	0.18	316	Nebeker and Puglisi 1974
Lumbriculus variegatus	oligochaete	Congener 1	diet	GRO, MOR	survival, biomass	LOEC	64.7 ^A	ww	64.7	0.17	381	Fisher et al. 1999
Lumbriculus variegatus	oligochaete	Congener 47	diet	GRO, MOR	survival, biomass	LOEC	112.7	ww	112.7	0.17	663	Fisher et al. 1999
Lumbriculus variegatus	oligochaete	Congener 15	diet	GRO, MOR	survival, biomass	LOEC	118.7	ww	118.7	0.17	698	Fisher et al. 1999
Lumbriculus variegatus	oligochaete	Congener 153	diet	GRO, MOR	survival, biomass	LOEC	126.3	ww	126.3	0.17	743	Fisher et al. 1999
Crassostrea virginica	mollusc	Aroclor 1254	water	GRO	weight	LOEC	119	ww	119	0.08	1488	Lowe et al. 1972
Orconectes nais	crustacean	Aroclor 1254	water	MOR	no effect	NOEC	0.2	dw	NA	0.28	0.2	Sanders and Chandler 1972
Hexagenia spp.	emergent insects	PCB	sediment	MOR	survival	NOEC	0.59	ww	0.59	0.31	2	van Geest et al. 2011
Pteronarcys dorsata	emergent insects	Aroclor 1254	water	MOR	no effect	NOEC	7	dw	NA		7	Sanders and Chandler 1972
Palaemonetes kadiakensis	crustacean	Aroclor 1254	water	MOR	no effect	NOEC	16 ^D	dw	NA	0.28	16	Sanders and Chandler 1972
Callinectes sapidus	crustacean	Aroclor 1254	water	MOR	5% mortality; also 5% mortality in c	NOEC	23	NS	NA	0.28	23	Duke et al. 1970
Gammarus pseudolimnaeus	epibenthic	Aroclor 1242	water	REP	no effect	NOEC	76	NS	NA	0.18	76	Nebeker and Puglisi 1974
Hyaella azteca	epibenthic	Aroclor 1242	water	GRO, REP, MOR	survival, weight, # of young	NOEC	28	ww	28	0.18	156	Borgmann et al. 1990
Lumbriculus variegatus	oligochaete	Congener 1	diet	GRO, MOR	survival, biomass	NOEC	33.2	ww	33.2	0.17	195	Fisher et al. 1999
Lumbriculus variegatus	oligochaete	Congener 47	diet	GRO, MOR	survival, biomass	NOEC	49.3	ww	49.3	0.17	290	Fisher et al. 1999
Lumbriculus variegatus	oligochaete	Congener 15	diet	GRO, MOR	survival, biomass	NOEC	63.1 ^B	ww	63.1	0.17	371	Fisher et al. 1999
Lumbriculus variegatus	oligochaete	Congener 153	diet	GRO, MOR	survival, biomass	NOEC	64.9	ww	64.9	0.17	382	Fisher et al. 1999
Tubifex tubifex	aquatic worms	Hg	sediment	GRO, REP	growth rate, total young	LOEC	89.6 nmol/g	dw	NA	NA	18	Mendez-Fernandez et al. 2014
Rangia cuneata	mollusc	Hg	water	MOR	survival	LOEC	6	ww	6	0.08	75	Dillon 1977
Hyaella azteca	Epibenthic	Hg	water	MOR	survival	LOEC	90	dw	NA	NA	90	Borgmann et al. 1993
Tubifex tubifex	aquatic worms	Hg	sediment	GRO, REP	growth rate, total young	NOEC	63.5 nmol/g	dw	NA	NA	12.7	Mendez-Fernandez et al. 2014
Hexagenia rigida+A27:M28	emergent	CH3HgCl	water	GRO	growth	NOEC	7.48	ww	7.48	0.31	24	Saouter et al. 1993
Hyaella azteca	Epibenthic	Hg	water	MOR	survival	NOEC	56	dw	NA	NA	56	Borgmann et al. 1993

Shading indicates studies proposed for derivation of CTCs by Arcadis, 5-16-17 meeting Slide 15

Blue shading indicates study recommended for TRV derivation by EPA

^A Paper cited tissue concentrations in units of mmol/kg. Arcadis used the molecular weight of Aroclor 1254 to convert to mg/kg, I used the congener-specific molecular weights. Arcadis value is 92 mg/kg ww.

^B Paper cited tissue concentrations in units of mmol/kg. Arcadis used the molecular weight of Aroclor 1254 to convert to mg/kg, I used the congener-specific molecular weights. Arcadis value is 112 mg/kg ww.

^C Value cited in paper is 16 mg/kg. Paper does not state whether basis is wet or dry weight.

^D Value cited in paper is 16 mg/kg. Paper states residue concentrations presented in the text and tables are on a dry-weight whole body basis (page 259).

NOEC = No observed effect concentration

LOEC = Low observed effect concentration

ww = wet weight

dw = dry weight

CTC = Critical tissue concentration

GRO = Growth

REP = Reproduction

MOR= Mortality

Hg = Mercury

CH3HgCL = Methylmercuric chloride

mg/kg = milligrams per kilogram

nmol/g = nanomols per gram

NA = Not applicable

NS = Not stated

TRV = Toxicity Reference Value

Table 24-1. (cont.) Summary of Studies Proposed for Derivation of Critical Tissue Concentrations for Benthic Invertebrates
Slide 15 from the Powerpoint Presentation, May 16 2017 Meeting
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

References:

Borgmann, U., W. P. Norwood, et al. (1990). "Chronic toxicity and bioaccumulation of 2,5,2',5'- and 3,4,3',4'-tetrachlorobiphenyl and Aroclor 1232 in the amphipod *Hyalella azteca* ." Arch Environ. Contam. Toxicol. 19: 558-564.

Borgmann, U., W. P. Norwood, et al. (1993). "Accumulation, regulation and toxicity of copper, zinc, lead and mercury in *Hyalella azteca* ." Hydrobiologia 259(2): 79-89.

Dillon, T. M. (1977). "Mercury and the estuarine marsh clam, *Rangia cuneata* Gray. I. Toxicity." Arch Environ. Contam. Toxicol. 06: 249-255.

Duke, T. W., J. L. Lowe, et al. (1970). "A polychlorinated biphenyl (Aroclor 1254) in the water, sediment and biota of Escambia Bay, Florida." Bull Environ. Contam. Toxicol. 5: 171-180.

Fisher, S. W., S. W. I. Chordas, et al. (1999). "Lethal and sublethal body reisdues for PCB intoxication in the oligochaete, *Lumbriculus variegatus* ." Aquatic Toxicology 45(2-3): 115-126.

Mendez-Fernandez, L., P. Rodriguez, et al. (2015). "Sediment toxicity and bioaccumulation assessment in abandoned copper and mercury mining areas of the Naol. River Basin (Spain)." Arch Environ. Contam. Toxicol. 68(1): 107-123.

Nebeker, A. V. and F. A. Puglisi (1974). "Effect of polychlorinated biphenyls (PCBs) on survival and reproduction of *Daphnia* , *Gammarus* and *Tanytarsus* ." Trans. Am. Fish Soc. 103: 722-728.

Sanders, H. O. and J. H. Chandler (1972). "Biological magnification of a polychlorinated biphenyl (Aroclor 1254) from water by aquatic invertebrates." Bull Environ. Contam. Toxicol. 7(5): 237-263.

Saouter, E., L. Hare, et al. (1993). "Mercury accumulation in the burrowing mayfly *Hexagenia rigida* (Ephemeroptera) exposed to CH3, HgCl, or HgCl2 in water and sediment." Water Res. 27: 1041-1048.

Van Geest, J. L., D. G. Poirier, et al. (2011). "A comparison of the bioaccumulation potential of three freshwater organisms exposed to sediment-associated contaminants under laboratory conditions." Environ. Toxicol. Chem. 30(4): 939-949.

Table AD24-2. HQs calculated for Benthic Invertebrates Using Critical Tissue Concentrations Proposed by Pharmacia/Solutia and EPA
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

Analyte	Assessment Area	Receptor	EPC	P/S				EPA			
				NOEC (mg/kg dw)	LOEC (mg/kg dw)	NOEC HQ	LOEC HQ	NOEC (mg/kg dw)	LOEC (mg/kg dw)	NOEC HQ	LOEC HQ
PCBs	UAA	Benthic invertebrates	2.65	NA	NA	NA	NA	2	5	1.3	0.5
		Crayfish	3.8	21	57	0.2	0.1	2	5	1.9	0.8
		Crayfish ^A	3.8	0.2	16	19.0	0.2	2	5	1.9	0.8
		Emergent insects	23	7	27	3.3	0.9	2	5	11.5	4.6
		Mollusks	14	NA	NA	NA	NA	2	5	7.0	2.8
PCBs	MAA	Benthic invertebrates	1.83	NA	NA	NA	NA	2	5	0.9	0.4
		Crayfish	2.62	21	57	0.1	0.0	2	5	1.3	0.5
		Crayfish ^A	2.62	0.2	16	13.1	0.2	2	5	1.3	0.5
		Emergent insects	0.806	7	27	0.1	0.0	2	5	0.4	0.2
		Mollusks	9.48	NA	NA	NA	NA	2	5	4.7	1.9
PCBs	LAA	Benthic invertebrates	1.09	NA	NA	NA	NA	2	5	0.5	0.2
		Crayfish	1.05	21	57	0.1	0.0	2	5	0.5	0.2
		Crayfish ^A	1.05	0.2	16	5.3	0.1	2	5	0.5	0.2
		Emergent insects	1.11	7	27	0.2	0.0	2	5	0.6	0.2
		Mollusks	12	NA	NA	NA	NA	2	5	6.0	2.4
Mercury	UAA	Benthic invertebrates	0.232	56	90	0.0	0.0	12.7	17.97	0.0	0.0
		Crayfish	0.19	0.92	16	0.2	0.0	12.7	17.97	0.0	0.0
		Emergent insects	0.321	24	NA	0.0	NA	12.7	17.97	0.0	0.0
		Mollusks	0.292	7.5	150	0.0	0.0	12.7	17.97	0.0	0.0
		Mollusks ^B	0.292	NA	75	NA	0.0	12.7	17.97	0.0	0.0
Mercury	MAA	Benthic invertebrates	0.35	56	90	0.0	0.0	12.7	17.97	0.0	0.0
		Crayfish	0.206	0.92	16	0.2	0.0	12.7	17.97	0.0	0.0
		Emergent insects	0.188	24	NA	0.0	NA	12.7	17.97	0.0	0.0
		Mollusks	0.292	7.5	150	0.0	0.0	12.7	17.97	0.0	0.0
		Mollusks ^B	0.36	NA	75	NA	0.0	12.7	17.97	0.0	0.0
Mercury	LAA	Benthic invertebrates	0.48	56	90	0.0	0.0	12.7	17.97	0.0	0.0
		Crayfish	0.23	0.92	16	0.3	0.0	12.7	17.97	0.0	0.0
		Emergent insects	0.21	24	NA	0.0	NA	12.7	17.97	0.0	0.0
		Mollusks	0.292	7.5	150	0.0	0.0	12.7	17.97	0.0	0.0
		Mollusks ^B	0.86	NA	7.5	NA	0.1	12.7	17.97	0.1	0.0

^A The NOEC value from Sanders and Chandler (1972) on slide 15 of the May 16, 2017 presentation (21 mg/kg dw) checks in terms of numeric value and basis. The LOEC value from Duke et al. 1970 is 16 mg/kg, however basis is not stated anywhere in the text or on the tables in this paper. Therefore, the conservative assumption that this value is dry weight must be made. The NOEC value (0.2 mg/kg dw) is cited on Table 1 of Sanders and Chandler for *Orconectes nais*.

PCB = polychlorinated biphenyl
UAA = Upper assessment area
MAA = Middle assessment area
LAA = Lower assessment area
mg/kg dw = milligrams per kilogram dry weight

EPC = Exposure point concentration
NOEC = No observed effect concentration
LOEC = Lowest observed effect concentration
NA = Not available
P/S = Pharmacia/Solutia

Bold, italicized text indicates NOEC HQ ≥ 1.0
Grey shading indicates acceptable risk
Green shading indicates indeterminate risk
Yellow shading indicates unacceptable risk

Table AD24-2. (cont.) HQs calculated for Benthic Invertebrates Using Critical Tissue Concentrations Proposed by Pharmacia/Solutia and EPA
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

References:

Duke, T. W., J. L. Lowe, et al. (1970). "A polychlorinated biphenyl (Aroclor 1254) in the water, sediment and biota of Escambia Bay, Florida." Bull Environ. Contam. Toxicol. 5: 171-180.

Sanders, H. O. and J. H. Chandler (1972). "Biological magnification of a polychlorinated biphenyl (Aroclor 1254) from water by aquatic invertebrates." Bull Environ. Contam. Toxicol. 7(5): 237-263.

Table 27-1. Summary of Studies Reporting Critical Tissue Concentrations for PCBs in Fish
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

Common Name	Scientific Name	Exposure Route	Effect Group	Endpoint	TRV	Reported Total PCB CTC (mg/kg)	Basis	Total PCB (mg/kg ww)	Percent Solids	Total PCB (mg/kg dw)	Reference
Zebrafish	<i>Danio rerio</i>	diet	GRO	Growth (weight)	LOEC	0.14	ww	0.14		0.56	Orn et al. 1998
Guppy	<i>Poecilia reticulata</i>	diet	MOR	LD22	LOEC	2.6	ww	2.6		10.4	Opperhuizen and Schrap 1988
Zebrafish	<i>Danio rerio</i>	diet	MOR	Decrease in median larval survival time	LOEC	2.7	ww	2.7	25	10.8	Orn et al. 1998
Common sole	<i>Solea solea</i>	water	GRO	Delayed larval development	LOEC	6.82	ww	6.82	25	27.28	Foekema et al. 2014
Winter flounder	<i>Pseudopleuronectes americanus</i>	NS	GRO	Reduced growth	LOEC	7.1	ww	7.1		28.4	Black et al. 1988
Common sole	<i>Solea solea</i>	water	MOR	LD50 for larvae	LOEC	7.48	ww	7.48	25	29.92	Foekema et al. 2014
Sheepshead minnow	<i>Cyprinodon variegatus</i>	water	MOR	Decrease in fry survival	LOEC	9.3	ww	9.3	25	37.2	Hansen et al. 1974
Channel catfish	<i>Ictalurus punctatus</i>	diet	GRO	Reduced growth	LOEC	14.3	ww	14.3		57.2	Hansen et al. 1976
Minnow	<i>Phoxinus phoxinus</i>	diet	REP, MOR	Reduction in time to hatch, death of fry within 1 week of hatching	LOEC	15	ww	15	25	60	Bengtsson 1980
Norfolk Spot	<i>Leiostomus xanthurus</i>	water	MOR	LD17	LOEC	17	ww	17		68	Hansen et al. 1971
Pinfish	<i>Lagodon rhomboides</i>	water	MOR	Reduced survival	LOEC	65	ww	65		260	Hansen et al. 1974
Zebrafish	<i>Danio rerio</i>	diet	MOR	Decrease in median larval survival time	NOEC	1.1	ww	1.1	25	4.4	Orn et al. 1998
Minnow	<i>Phoxinus phoxinus</i>	diet	REP, MOR	Reduction in time to hatch, death of fry within 1 week of hatching	NOEC	1.6	ww	1.6	25	6.4	Bengtsson 1980
Sheepshead minnow	<i>Cyprinodon variegatus</i>	water	MOR	Decrease in fry survival	NOEC	1.9	ww	1.9	25	7.6	Hansen et al. 1974

Shading indicates studies proposed for derivation of CTCs by Arcadis, 5-16-17 meeting Slide 15

Blue shading indicates study recommended for TRV derivation by EPA

Red shading indicates study with non-salmonid species extracted from the ERED database. Original paper not reviewed to confirm values

NOEC = No observed effect concentration
LOEC = Low observed effect concentration
ww = wet weight
dw = dry weight
CTC = Critical tissue concentration

GRO = Growth
REP = Reproduction
MOR= Mortality
mg/kg = milligrams per kilogram
LDX = Lethal dose to X% of tested organisms

TRV = Toxicity Reference Value

Table 27-1. (cont.) Summary of Studies Reporting Critical Tissue Concentrations for PCBs in Fish
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

References:

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Table AD27-2. HQs Calculated for Fish Using Critical Tissue Concentrations Proposed by Pharmacia/Solutia and EPA

OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

Assessment Area	Matrix	Detects	Total Samples	Min	Max	Mean	95% UCL	EPC	Critical Tissue Concentration		Hazard Quotients	
									NOAEL CTC	LOAEL CTC	NOAEL HQ	LOAEL HQ
PCBs -- P/S CTC Values												
Upper Assessment Area	bottom fish	9	9	33.8	67.5	52.7	60.8	60.8	7	34.4	8.7	1.8
	forage fish	27	27	6.8	43.7	20.9	23.8	23.8	7	34.4	3.4	0.7
	predator fish	9	9	21.8	175.2	84.0	111.3	111.3	7	34.4	15.9	3.2
	all fish	45	45	6.8	175.2	39.9	50.1	50.1	7	34.4	7.2	1.5
Middle Assessment Area	bottom fish	9	9	18.2	50.8	32.3	38.9	38.9	7	34.4	5.6	1.1
	forage fish	27	27	18.4	51.1	32.8	36.0	36.0	7	34.4	5.1	1.0
	predator fish	9	9	37.0	126.5	74.0	95.4	95.4	7	34.4	13.6	2.8
	all fish	45	45	18.2	126.5	41.0	46.0	46.0	7	34.4	6.6	1.3
Lower Assessment Area	bottom fish	9	9	22.4	84.3	53.5	66.2	66.2	7	34.4	9.5	1.9
	forage fish	27	27	16.5	47.4	30.7	33.5	33.5	7	34.4	4.8	1.0
	predator fish	9	9	42.5	126.8	83.2	101.8	101.8	7	34.4	14.5	3.0
	all fish	45	45	16.5	126.8	45.8	52.8	52.8	7	34.4	7.5	1.5
PCBs -- EPA CTC Values												
Upper Assessment Area	bottom fish	9	9	33.8	67.5	52.7	60.8	60.8	—	27.3	—	2.2
	forage fish	27	27	6.8	43.7	20.9	23.8	23.8	—	27.3	—	0.9
	predator fish	9	9	21.8	175.2	84.0	111.3	111.3	—	27.3	—	4.1
	all fish	45	45	6.8	175.2	39.9	50.1	50.1	—	27.3	—	1.8
Middle Assessment Area	bottom fish	9	9	18.2	50.8	32.3	38.9	38.9	—	27.3	—	1.4
	forage fish	27	27	18.4	51.1	32.8	36.0	36.0	—	27.3	—	1.3
	predator fish	9	9	37.0	126.5	74.0	95.4	95.4	—	27.3	—	3.5
	all fish	45	45	18.2	126.5	41.0	46.0	46.0	—	27.3	—	1.7
Lower Assessment Area	bottom fish	9	9	22.4	84.3	53.5	66.2	66.2	—	27.3	—	2.4
	forage fish	27	27	16.5	47.4	30.7	33.5	33.5	—	27.3	—	1.2
	predator fish	9	9	42.5	126.8	83.2	101.8	101.8	—	27.3	—	3.7
	all fish	45	45	16.5	126.8	45.8	52.8	52.8	—	27.3	—	1.9

All units in mg/kg dw

CTC: critical tissue concentration

EPC: exposure point concentration

HQ: hazard quotient

LOAEL: lowest observed adverse effect level

m: maximum

N/A: Measured tissue concentrations were not detected

NA: CTC not available

NOAEL: no observed adverse effect level

PCB: polychlorinated biphenyl

UCL: upper confidence limit on arithmetic mean

Tissue CTCs are presented in Table 5-2b.

Bold, italicized text indicates NOEC HQ ≥ 1.0

Green shading indicates indeterminate risk

Yellow shading indicates unacceptable risk

Table AD28-1. HQs calculated for Dioxin-Like Compounds (2,3,7,8-TCDD) in Fish Using Critical Tissue Concentrations Proposed by Pharmacia/Solutia and EPA

**OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama**

Species Group	Assessment Area	Whole body concentration (pg/g dw)	P/S CTC Values				EPA CTC Values				Tillitt et al. 2017	
			Critical Tissue Concentration (pg/g dw)		Hazard Quotients		Critical Tissue Concentration (pg/g dw)		Hazard Quotients		Critical Tissue Concentration (pg/g dw)	Hazard Quotient
			Mean Lipid CTC	Max Lipid CTC	Mean HQ	Max HQ	Mean Lipid CTC	Max Lipid CTC	Mean HQ	Max HQ	Mean Lipid CTC	LOAEL HQ
Bottom Fish	Lower	0.552	255	572	0.0	0.0	81	182	0.0	0.0	1220	0.0
Bottom Fish	Middle	4.36	255	572	0.0	0.0	81	182	0.1	0.0	1220	0.0
Forage Fish	Lower	0.852	255	572	0.0	0.0	81	182	0.0	0.0	1220	0.0
Forage Fish	Lower	12.6	255	572	0.0	0.0	81	182	0.2	0.1	1220	0.0
Forage Fish	Lower	358.4	255	572	1.4	0.6	81	182	4.4	2.0	1220	0.3
Forage Fish	Middle	1.148	255	572	0.0	0.0	81	182	0.0	0.0	1220	0.0
Forage Fish	Middle	1.864	255	572	0.0	0.0	81	182	0.0	0.0	1220	0.0
Forage Fish	Upper	0.736	255	572	0.0	0.0	81	182	0.0	0.0	1220	0.0
Forage Fish	Upper	0.816	255	572	0.0	0.0	81	182	0.0	0.0	1220	0.0
Forage Fish	Upper	0.888	255	572	0.0	0.0	81	182	0.0	0.0	1220	0.0
Forage Fish	Upper	0.888	255	572	0.0	0.0	81	182	0.0	0.0	1220	0.0
Forage Fish	Upper	1.108	255	572	0.0	0.0	81	182	0.0	0.0	1220	0.0
Forage Fish	Upper	1.116	255	572	0.0	0.0	81	182	0.0	0.0	1220	0.0
Forage Fish	Upper	1.208	255	572	0.0	0.0	81	182	0.0	0.0	1220	0.0
Forage Fish	Upper	2.436	255	572	0.0	0.0	81	182	0.0	0.0	1220	0.0
Predator Fish	Lower	1.396	255	572	0.0	0.0	81	182	0.0	0.0	1220	0.0
Predator Fish	Upper	4.88	255	572	0.0	0.0	81	182	0.1	0.0	1220	0.0
Bottom Fish	Lower	146.8	255	572	0.6	0.3	81	182	1.8	0.8	1220	0.1
Bottom Fish	Middle	300.4	255	572	1.2	0.5	81	182	3.7	1.7	1220	0.2
Forage Fish	Lower	171.2	255	572	0.7	0.3	81	182	2.1	0.9	1220	0.1
Forage Fish	Lower	328.4	255	572	1.3	0.6	81	182	4.1	1.8	1220	0.3

Species Group	Assessment Area	Whole body concentration (pg/g dw)	P/S CTC Values				EPA CTC Values				Tillitt et al. 2017	
			Critical Tissue Concentration (pg/g dw)		Hazard Quotients		Critical Tissue Concentration (pg/g dw)		Hazard Quotients		Critical Tissue Concentration (pg/g dw)	Hazard Quotient
			Mean Lipid CTC	Max Lipid CTC	Mean HQ	Max HQ	Mean Lipid CTC	Max Lipid CTC	Mean HQ	Max HQ	Mean Lipid CTC	LOAEL HQ
Forage Fish	Lower	668	255	572	2.6	1.2	81	182	8.2	3.7	1220	0.5
Forage Fish	Middle	98.4	255	572	0.4	0.2	81	182	1.2	0.5	1220	0.1
Forage Fish	Middle	256.4	255	572	1.0	0.4	81	182	3.2	1.4	1220	0.2
Forage Fish	Upper	18.76	255	572	0.1	0.0	81	182	0.2	0.1	1220	0.0
Forage Fish	Upper	19	255	572	0.1	0.0	81	182	0.2	0.1	1220	0.0
Forage Fish	Upper	21.32	255	572	0.1	0.0	81	182	0.3	0.1	1220	0.0
Forage Fish	Upper	22.68	255	572	0.1	0.0	81	182	0.3	0.1	1220	0.0
Forage Fish	Upper	25.08	255	572	0.1	0.0	81	182	0.3	0.1	1220	0.0
Forage Fish	Upper	27.04	255	572	0.1	0.0	81	182	0.3	0.1	1220	0.0
Forage Fish	Upper	31.64	255	572	0.1	0.1	81	182	0.4	0.2	1220	0.0
Forage Fish	Upper	40.8	255	572	0.2	0.1	81	182	0.5	0.2	1220	0.0
Predator Fish	Upper	45.2	255	572	0.2	0.1	81	182	0.6	0.2	1220	0.0
Predator Fish	Lower	242	255	572	0.9	0.4	81	182	3.0	1.3	1220	0.2

pg/g dw = picograms per gram dry weight

CTC = critical tissue concentration

HQ: hazard quotient

LOAEL: lowest observed adverse effect level

N/A: Measured tissue concentrations were not detected

NOAEL: no observed adverse effect level

PCB: polychlorinated biphenyl

UCL: upper confidence limit on arithmetic mean

Bold, italicized text indicates NOEC HQ ≥ 1.0

Green shading indicates indeterminate risk

Yellow shading indicates unacceptable risk

References:

Tillitt, D. E., J. A. Buckler, et al. (2017). "Sensitivity of lake sturgeon (*Acipenser fulvescens*) early life stages to 2,3,7,8-tetrachlorodibenzo-*p*-dioxin and 3,3',4,4',5-pentachlorobiphenyl." *Environ. Toxicol. Chem.* **36**(4): 988-998.

Table AD31-1. Summary of Site-Specific BAFs for Dioxin/Furan and Dioxin-like PCB Congeners Anniston PCB Site, Anniston, Alabama

Congeners	Sitewide Median Soil BAFs ¹ (dw/dw)					Sitewide Median Sediment BAFs ¹ (dw/dw)					
	Mammals	BAF Type ²	Invertebrates	Terrestrial Plants	BAF Type	Aquatic Plants	BAF Type	Benthic Invertebrates	BAF Type	Crayfish	BAF Type
Soil/sediment BSA KM Means (N)	5		5	5		4		4		4	
Individual Tissue (N)	6		0	2		2		2		2	
PCDD/PCDF Congeners											
1,2,3,4,6,7,8-HpCDD	0.042	median	No Data	0.136	median	0.395	median	0.701	median	0.110	median
1,2,3,4,6,7,8-HpCDF	0.087	median	No Data	NA		NA		0.521	median	NA	
1,2,3,4,7,8,9-HpCDF	0.026	ave ratio	No Data	NA		NA		NA		NA	
1,2,3,4,7,8-HxCDD	NA		No Data	NA		NA		NA		NA	
1,2,3,4,7,8-HxCDF	0.181	median	No Data	0.164	median	0.285	median	0.955	median	NA	
1,2,3,6,7,8-HxCDD	0.116	ave ratio	No Data	NA		NA		NA		NA	
1,2,3,6,7,8-HxCDF	0.167	median	No Data	0.086	median	NA		NA		NA	
1,2,3,7,8,9-HxCDD	NA		No Data	NA		NA		NA		NA	
1,2,3,7,8,9-HxCDF	NA		No Data	NA		NA		NA		NA	
1,2,3,7,8-PeCDD	NA		No Data	NA		NA		NA		NA	
1,2,3,7,8-PeCDF	NA		No Data	NA		0.557	median	2.85	median	0.815	median
2,3,4,6,7,8-HxCDF	2.26	median	No Data	NA		NA		NA		NA	
2,3,4,7,8-PeCDF	1.76	median	No Data	NA		NA		2.29	median	0.725	median
2,3,7,8-TCDD	NA		No Data	NA		NA		NA		NA	
2,3,7,8-TCDF	0.040	median	No Data	0.081	median	1.56	median	6.50	median	1.06	median
Octa CDD	0.026	median	No Data	0.087	median	0.243	median	0.365	median	0.062	median
Octa CDF	0.016	ave ratio	No Data	NA		NA		NA		NA	
Dioxin-Like PCB Congeners											
BZ#105	0.542	median	No Data	0.148	median	0.625	median	1.05	median	0.822	median
BZ#114	NA		No Data	NA		NA		NA		NA	
BZ#118	0.652	median	No Data	0.134	median	0.528	median	0.952	median	0.882	median
BZ#123	NA		No Data	NA		NA		NA		NA	
BZ#126	NA		No Data	NA		NA		NA		NA	
BZ#153	NA		No Data	NA		NA		NA		NA	
BZ#156	2.49	median	No Data	NA		NA		2.83	median	0.648	median
BZ#157	NA		No Data	NA		NA		NA		NA	
BZ#167	NA		No Data	NA		NA		NA		NA	
BZ#169	NA		No Data	NA		NA		NA		NA	
BZ#189	NA		No Data	NA		NA		NA		NA	
BZ#77	NA		No Data	NA		NA		NA		NA	
BZ#81	NA		No Data	NA		NA		NA		NA	

Table AD31-1. Summary of Site-Specific BAFs for Dioxin/Furan and Dioxin-like PCB Congeners
Anniston PCB Site, Anniston, Alabama

Congeners	Sitewide Median BAF Sediment BAFs ¹ (dw/dw)															
	Emergent Insects	BAF Type	Bottom Fish	BAF Type	Forage Fish	BAF Type	Predator Fish	BAF Type	Frogs	BAF Type	Snakes	BAF Type	Molluscs	BAF Type	All Fish	BAF Type
Soil/sediment BSA KM Means (N)	4		4		4		4		4		4		4		4	
Individual Tissue (N)	2		2		7		1		2		1		2		10	
PCDD/PCDF Congeners																
1,2,3,4,6,7,8-HpCDD	4.55	median	NA		NA		NA		0.196	median	NA		0.552	median	NA	
1,2,3,4,6,7,8-HpCDF	2.53	median	0.173	median	0.157	median	NA		0.134	median	NA		NA		0.165	median
1,2,3,4,7,8,9-HpCDF	0.980	median	NA		NA		NA		NA		NA		NA		NA	
1,2,3,4,7,8-HxCDD	NA		NA		2.92	median	2.68	median	NA		NA		NA		2.92	median
1,2,3,4,7,8-HxCDF	0.445	median	NA		NA		NA		0.378	median	0.325	median	1.16	median	NA	
1,2,3,6,7,8-HxCDD	14.7	median	NA		NA		NA		NA		0.504	median	NA		NA	
1,2,3,6,7,8-HxCDF	NA		NA		NA		NA		0.624	median	0.534	median	12.7	median	NA	
1,2,3,7,8,9-HxCDD	NA		NA		NA		NA		NA		NA		NA		NA	
1,2,3,7,8,9-HxCDF	NA		NA		NA		NA		NA		NA		NA		NA	
1,2,3,7,8-PeCDD	NA		NA		NA		NA		NA		NA		NA		NA	
1,2,3,7,8-PeCDF	2.11	median	NA		4.35	median	NA		0.999	median	0.925	median	NA		4.35	median
2,3,4,6,7,8-HxCDF	NA		NA		NA		NA		NA		0.352	median	NA		NA	
2,3,4,7,8-PeCDF	NA		8.15	median	NA		NA		1.25	median	3.80	median	6.95	median	8.15	median
2,3,7,8-TCDD	NA		NA		215	ave ratio	NA		NA		4.77	median	NA		151	ave ratio
2,3,7,8-TCDF	2.75	median	12.6	median	9.48	median	12.6	median	0.839	median	0.983	median	55.0	median	10.2	median
Octa CDD	1.86	median	0.032	median	0.091	median	NA		0.040	median	0.055	median	0.471	median	0.082	median
Octa CDF	2.07	median	NA		NA		NA		NA		0.051	median	NA		NA	
Dioxin-Like PCB Congeners																
BZ#105	17.9	median	13.0	median	10.7	median	17.5	median	3.11	median	10.6	median	6.81	median	11.0	median
BZ#114	NA		NA		NA		NA		NA		NA		NA		NA	
BZ#118	20.5	median	18.8	median	15.5	median	26.5	median	5.87	median	16.6	median	12.5	median	16.4	median
BZ#123	NA		NA		NA		NA		NA		NA		NA		NA	
BZ#126	NA		NA		NA		NA		NA		NA		NA		NA	
BZ#153	NA		NA		NA		NA		NA		NA		NA		NA	
BZ#156	17.6	median	15.4	median	13.6	median	26.3	median	4.00	median	16.4	median	8.38	median	14.0	median
BZ#157	NA		NA		2.26	ave ratio	NA		NA		NA		NA		1.58	ave ratio
BZ#167	NA		NA		NA		NA		NA		NA		NA		NA	
BZ#169	NA		NA		NA		NA		NA		NA		NA		NA	
BZ#189	NA		NA		NA		NA		NA		NA		NA		NA	
BZ#77	NA		NA		NA		NA		NA		NA		NA		NA	
BZ#81	NA		NA		NA		NA		NA		NA		NA		NA	

**Table AD31-1. Summary of Site-Specific BAFs for Dioxin/Furan and Dioxin-like PCB
Congeners Anniston PCB Site, Anniston, Alabama**

Notes:

¹ Soil and sediment BAFs calculated using soil/sediment Kaplan-Meier Mean in BSA and individual tissue composites (detects only); OU-4 data only.

² ave ratio: site-wide average ratio BAF. See Attachment F1 text for details.

median: Sitewide median BAF. See Attachment F1 text for details.

BAF: bioaccumulation factor

BSA: biological sampling area

CDD: chlorodibenzo-p-dioxin

CDF: chlorodibenzo-p-furan

dw: dry weight

KM: Kaplan-Meier

HpCDD: heptachlorodibenzo-p-dioxin

HpCDF: heptachlorodibenzofuran

HxCDD: hexachlorodibenzo-p-dioxin

HxCDF: hexachlorodibenzofuran

N: number of samples

NA: Not available because dioxin/furan congeners were not detected above the laboratory reporting limits in tissue sample

PCB: polychlorinated biphenyl

PCDD: polychlorinated dibenzodioxin

PCDF: polychlorinated dibenzofuran

PeCDD: pentachlorodibenzo-p-dioxin

PeCDF: pentachlorodibenzofuran

TCDD: tetrachlorodibenzo-p-dioxin

TCDF: tetrachlorodibenzofuran

Table AD31-2. Estimated Exposure of Carolina wren to PCB-126 as a Representative Dioxin-like PCB in Anniston OU4.
OU-4 BERA Addendum
Anniston PCB Site, Anniston, Alabama

AA ¹	Location	PCB 126 concentrations in earthworms from OU4						FIR (kg/kg/d) ⁸	Fraction of earthworms in diet ⁹	Estimated exposure (ng/kg/d) ¹⁰	NOAEL (ng/kg/d) ¹¹	HQ ¹²
		Measured (mg/kg ww) ²	Moisture Content ³	Measured (mg/kg dw) ⁴	Measured (ng/kg dw) ⁵	TEF ⁶	TEQ Conc. (ng/kg dw) ⁷					
Upper	C3-N	0.043	0.84	0.2688	268750	0.1	26875	0.24	0.46	2967	145	20.5
Lower	C7-N	0.011	0.84	0.0688	68750	0.1	6875	0.24	0.46	759	145	5.2
Lower	C7-N	0.0047	0.84	0.0294	29375	0.1	2937.5	0.24	0.46	324.3	145	2.2

Notes

1. AA: Assessment Area
2. Data from Anniston OU4 BERA, Appendix E. Only detected concentrations were included.
3. Fraction moisture from USEPA (1993)
4. Dry weight concentration=wet weight concentration/(1-moisture content)
5. ng/kg=mg/kg*1,000,000
6. Avian TCDD toxicity equivalency factor for PCB 126; from Table F-3, Anniston OU4 BERA, and Van den Berg et al. (1998)
7. TEQ concentration: TCDD-like concentration; measured concentration*TEF.
8. FIR: food ingestion rate for Carolina wrens; from Table F-4a, Anniston OU4 BERA.
9. From Table F-5a, Anniston OU4 BERA; 15% worms, 31% spiders (worm tissue used as a surrogate for spider tissue)
10. TEQ concentration*FIR*fraction earthworms in diet
11. NOAEL from Appendix F, Anniston OU4 BERA, Section 3.1.3
12. HQ: exposure/NOAEL

References:

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Table AD31-3. Avian Exposure Parameter
Scenarios Anniston PCB Site, Anniston, Alabama

Parameter	Aquatic Ground-feeding Invertivore				Piscivore				Ground-feeding Invertivore			
	Spotted Sandpiper				Belted Kingfisher				Carolina Wren			
	Data	Source	Data	Source	Data	Source	Data	Source	Data	Source	Data	Source
	Scenario 1		Scenario 2		Scenario 1		Scenario 2		Scenario 1		Scenario 2	
Composition of Diet (%)												
Soil Invertebrates (Worms)	50%	Assumed, based on Oring et al. (1997)	0%	--	0%	--	0%	--	15%	Cristol et al. 2008; Walters et al. 2010	15%	Cristol et al. 2008; Walters et al. 2010
Terrestrial Invertebrates (grasshoppers)	0%	--	0%	--	0%	--	0%	--	45%	Cristol et al. 2008; Walters et al. 2010	45%	Cristol et al. 2008; Walters et al. 2010
Terrestrial Invertebrates, Spiders, Detritivores	0%	--	0%	--	0%	--	0%	--	31%	Cristol et al. 2008; Walters et al. 2010	0%	--
Aquatic Emergent and Flying Insects	0%	--	0%	--	0%	--	0%	--	0%	--	0%	--
Aquatic Invertebrates, Spiders, Detritivores	0%	--	0%	--	0%	--	0%	--	0%	--	31%	Cristol et al. 2008; Walters et al. 2010
Terrestrial Plants	0%	--	0%	--	0%	--	0%	--	9%	Cristol et al. 2008; Walters et al. 2010	0%	--
Aquatic Plants	0%	--	0%	--	0%	--	0%	--	0%	--	9%	Cristol et al. 2008; Walters et al. 2010
Mammals	0%	--	0%	--	0%	--	0%	--	0%	--	0%	--
Reptiles	0%	--	0%	--	0%	--	0%	--	0%	--	0%	--
Amphibians	0%	--	0%	--	0%	--	5%	Alexander (1977), Salyer and Lagler (1946) and Davis (1982) as cited in USEPA (1993)	0%	--	0%	--
All Fish	0%	--	0%	--	0%	--	0%	--	0%	--	0%	--
Predator Fish Only	0%	--	0%	--	0%	--	0%	--	0%	--	0%	--
Forage Fish (4-15 cm)	0%	--	0%	--	100%	Consume primarily fish (Hamas 2009); Prose (1985) fish size	76%	Alexander (1977), Salyer and Lagler (1946) and Davis (1982) as cited in USEPA (1993); Prose (1985) fish size	0%	--	0%	--
Aquatic Invertebrates (Odonata Larvae)	50%	Rubbelke (1976)	50%	Rubbelke (1976)	0%	--	0%	--	0%	--	0%	--
Aquatic Oligochaetes (Lumbriculus)	0%	--	50%	Assumed	0%	--	0%	--	0%	--	0%	--
Crayfish	0%	--	0%	--	0%	--	19%	Alexander (1977), Salyer and Lagler (1946) and Davis (1982) as cited in USEPA (1993) - crayfish	0%	--	0%	--
Mollusc	0%	--	0%	--	0%	--	0%	--	0%	--	0%	--

Notes:
Full references provided in Table 4-2c.
%: percent
--: not applicable
cm: centimeters
PCB: polychlorinated biphenyl
USEPA: United States Environmental Protection Agency

Table AD31-4. Soil Summary Statistics by Assessment
Area Anniston PCB Site, Anniston, Alabama

Constituent	Units	Depth (ft bgs)	Summary Statistics											Exposure Point Concentration				
			Detects	/	Total	FOD	Minimum Detect	Maximum Detect	Minimum Nondetect	Maximum Nondetect	Mean	Median	Variance	Standard Deviation	95% UCL	95% UCL Method	Selected EPC	Basis
Upper Assessment Area																		
Dioxin/Furan Congeners																		
1,2,3,4,6,7,8-HpCDD	ng/kg	0-0.5	38	/	38	100	22.5	178	N/A	N/A	89.12	92.25	1341	36.62	99.14	95% Student's-t UCL	99.14	UCL
1,2,3,4,6,7,8-HpCDF	ng/kg	0-0.5	29	/	38	76	10.7	71.6	4.83	70.8	36.4	35.6	198.8	14.1	36.31	95% KM (t) UCL	36.31	UCL
1,2,3,4,7,8,9-HpCDF	ng/kg	0-0.5	36	/	38	95	1.1	16.4	2.84	3.66	8.276	8.035	14.49	3.807	9.044	95% KM (t) UCL	9.044	UCL
1,2,3,4,7,8-HxCDD	ng/kg	0-0.5	34	/	38	89	0.489	2.8	0.276	0.842	1.139	1.12	0.202	0.45	1.155	95% KM Student's t	1.155	UCL
1,2,3,4,7,8-HxCDF	ng/kg	0-0.5	38	/	38	100	4.19	59	N/A	N/A	29.21	26.85	217	14.73	33.24	95% Student's-t UCL	33.24	UCL
1,2,3,6,7,8-HxCDD	ng/kg	0-0.5	34	/	38	89	0.49	7.01	0.95	2.04	2.877	2.75	2.027	1.424	3.087	95% KM (t) UCL	3.087	UCL
1,2,3,6,7,8-HxCDF	ng/kg	0-0.5	36	/	38	95	1.1	94.6	3.35	5.59	13.87	8.16	313.5	17.71	17.64	95% KM H-UCL	17.64	UCL
1,2,3,7,8,9-HxCDD	ng/kg	0-0.5	34	/	38	89	0.659	7.38	1.38	3.36	2.929	2.82	1.858	1.363	3.196	95% GROS Adjusted Gamma UCL	3.196	UCL
1,2,3,7,8,9-HxCDF	ng/kg	0-0.5	24	/	38	63	0.315	1.17	0.165	2.46	0.761	0.819	0.0687	0.262	0.746	95% KM (t) UCL	0.746	UCL
1,2,3,7,8-PeCDD	ng/kg	0-0.5	26	/	38	68	0.283	1.36	0.148	1.11	0.605	0.55	0.0739	0.272	0.612	95% GROS Adjusted Gamma UCL	0.612	UCL
1,2,3,7,8-PeCDF	ng/kg	0-0.5	35	/	38	92	1.11	15.2	2.7	45.7	7.094	6.4	12.31	3.508	7.945	95% KM (t) UCL	7.945	UCL
2,3,4,6,7,8-HxCDF	ng/kg	0-0.5	38	/	38	100	0.72	9.77	N/A	N/A	4.561	4.575	4.646	2.155	5.151	95% Student's-t UCL	5.151	UCL
2,3,4,7,8-PeCDF	ng/kg	0-0.5	38	/	38	100	1.63	28.4	N/A	N/A	13.26	11.8	46.28	6.803	15.12	95% Student's-t UCL	15.12	UCL
2,3,7,8-TCDD	ng/kg	0-0.5	6	/	38	16	0.137	0.327	0.0722	1.38	0.227	0.223	0.00442	0.0665	0.131	95% KM (t) UCL	0.131	UCL
2,3,7,8-TCDF	ng/kg	0-0.5	36	/	38	95	1.71	81	7.65	56.8	21.59	18.4	250.9	15.84	25.86	95% GROS Adjusted Gamma UCL	25.86	UCL
octa CDD	ng/kg	0-0.5	38	/	38	100	353	9960	N/A	N/A	3101	2325	4421036	2103	3737	95% Adjusted Gamma UCL	3737	UCL
octa CDF	ng/kg	0-0.5	36	/	38	95	7.73	141	28.6	55.7	67.8	65	957.4	30.94	74.35	95% KM (t) UCL	74.35	UCL
Polychlorinated Biphenyl Congeners																		
BZ#77	mg/kg	0-0.5	0	/	39	0	N/A	N/A	0.0016	0.017	N/A	N/A	N/A	N/A	--	--	Not Detected	Not Detected
BZ#81	mg/kg	0-0.5	0	/	39	0	N/A	N/A	0.0032	0.034	N/A	N/A	N/A	N/A	--	--	Not Detected	Not Detected
BZ#105	mg/kg	0-0.5	39	/	39	100	0.012	0.14	N/A	N/A	0.0615	0.053	0.00128	0.0357	0.0712	95% Student's-t UCL	0.0712	UCL
BZ#114	mg/kg	0-0.5	1	/	39	3	0.0089	0.0089	0.0016	0.017	0.0089	0.0089	N/A	N/A	--	--	0.0089	Maximum Detect
BZ#118	mg/kg	0-0.5	39	/	39	100	0.024	0.28	N/A	N/A	0.116	0.11	0.00443	0.0666	0.134	95% Student's-t UCL	0.134	UCL
BZ#123	mg/kg	0-0.5	0	/	39	0	N/A	N/A	0.0016	0.017	N/A	N/A	N/A	N/A	--	--	Not Detected	Not Detected
BZ#126	mg/kg	0-0.5	4	/	39	10	0.016	0.028	0.0015	0.017	0.0203	0.0185	0.000029583	0.00544	--	--	0.028	Maximum Detect
BZ#153	mg/kg	0-0.5	39	/	39	100	0.048	0.42	N/A	N/A	0.184	0.16	0.00964	0.0982	0.21	95% Student's-t UCL	0.21	UCL
BZ#156	mg/kg	0-0.5	39	/	39	100	0.005	0.048	N/A	N/A	0.0209	0.02	0.00012208	0.011	0.0239	95% Student's-t UCL	0.0239	UCL
BZ#157	mg/kg	0-0.5	18	/	39	46	0.0018	0.017	0.0032	0.017	0.00765	0.0082	0.00001433	0.00379	0.00674	95% KM (t) UCL	0.00674	UCL
BZ#167	mg/kg	0-0.5	11	/	39	28	0.0027	0.015	0.0037	0.034	0.00883	0.0088	0.000018618	0.00431	0.00802	95% KM (t) UCL	0.00802	UCL
BZ#169	mg/kg	0-0.5	0	/	39	0	N/A	N/A	0.0015	0.017	N/A	N/A	N/A	N/A	--	--	Not Detected	Not Detected
BZ#189	mg/kg	0-0.5	0	/	39	0	N/A	N/A	0.0015	0.017	N/A	N/A	N/A	N/A	--	--	Not Detected	Not Detected
TEQ																		
Avian PCDD/PCDF TEQ (ND=0)	µg/kg	0-0.5	38	/	38	100	0.00429	0.106	--	--	0.0407	--	--	0.0212	0.0465	95% Student's-t UCL	0.0465	UCL
Avian PCDD/PCDF TEQ (ND=1/2DL)	µg/kg	0-0.5	38	/	38	100	0.0045	0.107	--	--	0.0419	--	--	0.022	0.0479	95% Student's-t UCL	0.0479	UCL
Avian PCDD/PCDF TEQ (ND=FullIDL)	µg/kg	0-0.5	38	/	38	100	0.00471	0.108	--	--	0.0431	--	--	0.0238	0.0496	95% Student's-t UCL	0.0496	UCL
Avian DL-PCB TEQ (ND=0)	µg/kg	0-0.5	39	/	39	100	0.00205	2.81	--	--	0.217	--	--	0.641	0.665	95% Chebyshev (Mean, Sd) UCL	0.665	UCL
Avian DL-PCB TEQ (ND=1/2DL)	µg/kg	0-0.5	39	/	39	100	0.285	4.27	--	--	1.575	--	--	0.954	1.88	95% Adjusted Gamma UCL	1.88	UCL
Avian DL-PCB TEQ (ND=FullIDL)	µg/kg	0-0.5	39	/	39	100	0.565	5.985	--	--	2.932	--	--	1.567	3.45	95% Adjusted Gamma UCL	3.45	UCL
Avian Total TEQ (ND=0)	µg/kg	0-0.5	39	/	39	100	0.00259	2.855	--	--	0.257	--	--	0.642	0.705	95% Chebyshev (Mean, Sd) UCL	0.705	UCL
Avian Total TEQ (ND=1/2DL)	µg/kg	0-0.5	39	/	39	100	0.3	4.315	--	--	1.615	--	--	0.962	1.925	95% Adjusted Gamma UCL	1.925	UCL
Avian Total TEQ (ND=FullIDL)	µg/kg	0-0.5	39	/	39	100	0.585	6.088	--	--	2.974	--	--	1.578	3.497	95% Adjusted Gamma UCL	3.497	UCL
Mammalian PCDD/PCDF TEQ (ND=0)	µg/kg	0-0.5	38	/	38	100	0.00205	0.0269	--	--	0.0142	--	--	0.00591	0.0158	95% Student's-t UCL	0.0158	UCL
Mammalian PCDD/PCDF TEQ (ND=1/2DL)	µg/kg	0-0.5	38	/	38	100	0.00226	0.0308	--	--	0.0146	--	--	0.00625	0.0163	95% Student's-t UCL	0.0163	UCL
Mammalian PCDD/PCDF TEQ (ND=FullIDL)	µg/kg	0-0.5	38	/	38	100	0.00247	0.0352	--	--	0.015	--	--	0.00666	0.0169	95% Student's-t UCL	0.0169	UCL
Mammalian DL-PCB TEQ (ND=0)	µg/kg	0-0.5	39	/	39	100	0.00127	2.81	--	--	0.214	--	--	0.641	0.662	95% Chebyshev (Mean, Sd) UCL	0.662	UCL
Mammalian DL-PCB TEQ (ND=1/2DL)	µg/kg	0-0.5	39	/	39	100	0.1	2.92	--	--	0.673	--	--	0.588	0.884	95% H-UCL	0.884	UCL
Mammalian DL-PCB TEQ (ND=FullIDL)	µg/kg	0-0.5	39	/	39	100	0.198	3.03	--	--	1.131	--	--	0.674	1.352	95% Adjusted Gamma UCL	1.352	UCL
Mammalian Total TEQ (ND=0)	µg/kg	0-0.5	39	/	39	100	0.00163	2.826	--	--	0.228	--	--	0.642	0.676	95% Chebyshev (Mean, Sd) UCL	0.676	UCL
Mammalian Total TEQ (ND=1/2DL)	µg/kg	0-0.5	39	/	39	100	0.1	2.936	--	--	0.687	--	--	0.59	0.9	95% H-UCL	0.9	UCL
Mammalian Total TEQ (ND=FullIDL)	µg/kg	0-0.5	39	/	39	100	0.198	3.046	--	--	1.146	--	--	0.678	1.368	95% Adjusted Gamma UCL	1.368	UCL
Fish PCDD/PCDF TEQ (ND=0)	µg/kg	0-0.5	38	/	38	100	0.00174	0.0312	--	--	0.0145	--	--	0.00675	0.0163	95% Student's-t UCL	0.0163	UCL
Fish PCDD/PCDF TEQ (ND=1/2DL)	µg/kg	0-0.5	38	/	38	100	0.002	0.0343	--	--	0.0149	--	--	0.00701	0.0168	95% Student's-t UCL	0.0168	UCL
Fish PCDD/PCDF TEQ (ND=FullIDL)	µg/kg	0-0.5	38	/	38	100	0.00226	0.0374	--	--	0.0153	--	--	0.0073	0.0173	95% Student's-t UCL	0.0173	UCL
Fish DL-PCB TEQ (ND=0)	µg/kg	0-0.5	39	/	39	100	0.000212	0.141	--	--	0.0114	--	--	0.032	0.0337	95% Chebyshev (Mean, Sd) UCL	0.0337	UCL
Fish DL-PCB TEQ (ND=1/2DL)	µg/kg	0-0.5	39	/	39	100	0.00538	0.148	--	--	0.0333	--	--	0.0298	0.0435	95% H-UCL	0.0435	UCL
Fish DL-PCB TEQ (ND=FullIDL)	µg/kg	0-0.5	39	/	39	100	0.0103	0.155	--	--	0.0551	--	--	0.0336	0.066	95% Adjusted Gamma UCL	0.066	UCL
Fish Total TEQ (ND=0)	µg/kg	0-0.5	39	/	39	100	0											

Table AD31-4. Soil Summary Statistics by Assessment
Area Anniston PCB Site, Anniston, Alabama

Constituent	Units	Depth (ft bgs)	Summary Statistics												Exposure Point Concentration				
			Detects	/	Total	FOD	Minimum Detect	Maximum Detect	Minimum Nondetect	Maximum Nondetect	Mean	Median	Variance	Standard Deviation	95% UCL	95% UCL Method	Selected EPC	Basis	
Middle Assessment Area																			
Dioxin/Furan Congeners																			
1,2,3,4,6,7,8-HpCDD	ng/kg	0-0.5	34	/	34	100	25.5	425	N/A	N/A	109.6	88.45	6422	80.14	132.9	95% Student's-t UCL	132.9	UCL	
1,2,3,4,6,7,8-HpCDF	ng/kg	0-0.5	23	/	34	68	8.87	156	13.3	66.7	51.54	45	1148	33.88	50.82	95% KM (t) UCL	50.82	UCL	
1,2,3,4,7,8,9-HpCDF	ng/kg	0-0.5	33	/	34	97	1.37	54.5	13.5	13.5	10.99	9.55	94.46	9.719	13.57	95% GROS Adjusted Gamma UCL	13.57	UCL	
1,2,3,4,7,8-HxCDD	ng/kg	0-0.5	25	/	34	74	0.314	3.19	0.24	5.6	1.386	1.2	0.619	0.787	1.433	95% KM (t) UCL	1.433	UCL	
1,2,3,4,7,8-HxCDF	ng/kg	0-0.5	33	/	34	97	5.54	183	6.63	6.63	37.97	29.9	1235	35.14	50.19	95% GROS Adjusted Gamma UCL	50.19	UCL	
1,2,3,6,7,8-HxCDD	ng/kg	0-0.5	30	/	34	88	0.949	17.6	1.23	5.81	4.811	3.85	12.75	3.571	5.468	95% KM (t) UCL	5.468	UCL	
1,2,3,6,7,8-HxCDF	ng/kg	0-0.5	29	/	34	85	1.4	372	8.67	23.9	71.21	43.3	6764	82.24	94.96	95% Gamma Adjusted KM-UCL	94.96	UCL	
1,2,3,7,8,9-HxCDD	ng/kg	0-0.5	24	/	34	71	0.708	8.21	1.07	7.81	3.987	4.205	4.864	2.205	4.07	95% KM (t) UCL	4.07	UCL	
1,2,3,7,8,9-HxCDF	ng/kg	0-0.5	9	/	34	26	0.223	1.83	0.505	6.71	0.878	0.704	0.316	0.562	0.813	95% KM (t) UCL	0.813	UCL	
1,2,3,7,8-PeCDD	ng/kg	0-0.5	3	/	34	9	0.393	1.56	0.11	2.41	0.833	0.547	0.402	0.634	--	--	1.56	Maximum Detect	
1,2,3,7,8-PeCDF	ng/kg	0-0.5	19	/	34	56	1.83	1140	0.815	780	67.79	6.34	67440	259.7	186	95% KM (Chebyshev) UCL	186	UCL	
2,3,4,6,7,8-HxCDF	ng/kg	0-0.5	23	/	34	68	1.01	16.3	3.45	15.5	5.194	4.36	13.94	3.734	5.52	95% KM (t) UCL	5.52	UCL	
2,3,4,7,8-PeCDF	ng/kg	0-0.5	32	/	34	94	3.17	73.7	3.61	15.3	15.79	11.15	189.5	13.77	20.28	95% GROS Adjusted Gamma UCL	20.28	UCL	
2,3,7,8-TCDD	ng/kg	0-0.5	2	/	34	6	0.136	0.543	0.106	13.9	0.34	0.34	0.0828	0.288	--	--	0.543	Maximum Detect	
2,3,7,8-TCDF	ng/kg	0-0.5	31	/	34	91	5.3	437	36.6	602	73.56	47.6	7608	87.22	95.74	95% GROS Adjusted Gamma UCL	95.74	UCL	
octa CDD	ng/kg	0-0.5	34	/	34	100	441	6520	N/A	N/A	2260	1980	1742230	1320	2709	95% Adjusted Gamma UCL	2709	UCL	
octa CDF	ng/kg	0-0.5	34	/	34	100	16.3	252	N/A	N/A	89.16	76.85	3012	54.88	105.1	95% Student's-t UCL	105.1	UCL	
Polychlorinated Biphenyl Congeners																			
BZ#77	mg/kg	0-0.5	1	/	35	3	0.071	0.071	0.0016	0.018	0.071	0.071	N/A	N/A	--	--	0.071	Maximum Detect	
BZ#81	mg/kg	0-0.5	0	/	35	0	N/A	N/A	0.0031	0.037	N/A	N/A	N/A	N/A	--	--	Not Detected	Not Detected	
BZ#105	mg/kg	0-0.5	35	/	35	100	0.0047	0.13	N/A	N/A	0.0454	0.04	0.00087173	0.0295	0.0559	95% Adjusted Gamma UCL	0.0559	UCL	
BZ#114	mg/kg	0-0.5	0	/	35	0	N/A	N/A	0.0016	0.018	N/A	N/A	N/A	N/A	--	--	Not Detected	Not Detected	
BZ#118	mg/kg	0-0.5	35	/	35	100	0.0099	0.22	N/A	N/A	0.088	0.08	0.00284	0.0533	0.107	95% Adjusted Gamma UCL	0.107	UCL	
BZ#123	mg/kg	0-0.5	0	/	35	0	N/A	N/A	0.0016	0.018	N/A	N/A	N/A	N/A	--	--	Not Detected	Not Detected	
BZ#126	mg/kg	0-0.5	0	/	35	0	N/A	N/A	0.0016	0.018	N/A	N/A	N/A	N/A	--	--	Not Detected	Not Detected	
BZ#153	mg/kg	0-0.5	35	/	35	100	0.031	0.32	N/A	N/A	0.156	0.14	0.00624	0.079	0.178	95% Student's-t UCL	0.178	UCL	
BZ#156	mg/kg	0-0.5	35	/	35	100	0.0023	0.04	N/A	N/A	0.0167	0.015	0.00008546	0.00924	0.0193	95% Student's-t UCL	0.0193	UCL	
BZ#157	mg/kg	0-0.5	12	/	35	34	0.0024	0.012	0.0016	0.018	0.00648	0.0056	9.8742E-06	0.00314	0.00511	95% KM (t) UCL	0.00511	UCL	
BZ#167	mg/kg	0-0.5	0	/	35	0	N/A	N/A	0.0031	0.037	N/A	N/A	N/A	N/A	--	--	Not Detected	Not Detected	
BZ#169	mg/kg	0-0.5	0	/	35	0	N/A	N/A	0.0016	0.018	N/A	N/A	N/A	N/A	--	--	Not Detected	Not Detected	
BZ#189	mg/kg	0-0.5	0	/	35	0	N/A	N/A	0.0016	0.018	N/A	N/A	N/A	N/A	--	--	Not Detected	Not Detected	
TEQ																			
Avian PCDD/PCDF TEQ (ND=0)	µg/kg	0-0.5	34	/	34	100	0.00976	0.482	--	--	0.0971	--	--	0.0965	0.128	95% Adjusted Gamma UCL	0.128	UCL	
Avian PCDD/PCDF TEQ (ND=1/2DL)	µg/kg	0-0.5	34	/	34	100	0.00986	0.498	--	--	0.114	--	--	0.117	0.151	95% Adjusted Gamma UCL	0.151	UCL	
Avian PCDD/PCDF TEQ (ND=FullIDL)	µg/kg	0-0.5	34	/	34	100	0.00996	0.808	--	--	0.131	--	--	0.158	0.177	95% Adjusted Gamma UCL	0.177	UCL	
Avian DL-PCB TEQ (ND=0)	µg/kg	0-0.5	35	/	35	100	0.000799	3.55	--	--	0.109	--	--	0.599	0.55	95% Chebyshev (Mean, Sd) UCL	0.55	UCL	
Avian DL-PCB TEQ (ND=1/2DL)	µg/kg	0-0.5	35	/	35	100	0.277	4.05	--	--	1.279	--	--	0.844	1.539	95% Adjusted Gamma UCL	1.539	UCL	
Avian DL-PCB TEQ (ND=FullIDL)	µg/kg	0-0.5	35	/	35	100	0.553	6.445	--	--	2.448	--	--	1.428	2.909	95% Adjusted Gamma UCL	2.909	UCL	
Avian Total TEQ (ND=0)	µg/kg	0-0.5	35	/	35	100	0.00505	3.644	--	--	0.203	--	--	0.607	0.254	95% H-UCL	0.254	UCL	
Avian Total TEQ (ND=1/2DL)	µg/kg	0-0.5	35	/	35	100	0.287	4.144	--	--	1.389	--	--	0.902	1.671	95% Adjusted Gamma UCL	1.671	UCL	
Avian Total TEQ (ND=FullIDL)	µg/kg	0-0.5	35	/	35	100	0.563	7.253	--	--	2.575	--	--	1.525	3.011	95% Student's-t UCL	3.011	UCL	
Mammalian PCDD/PCDF TEQ (ND=0)	µg/kg	0-0.5	34	/	34	100	0.00309	0.097	--	--	0.0256	--	--	0.0208	0.0323	95% Adjusted Gamma UCL	0.0323	UCL	
Mammalian PCDD/PCDF TEQ (ND=1/2DL)	µg/kg	0-0.5	34	/	34	100	0.0032	0.135	--	--	0.0288	--	--	0.0256	0.0367	95% Adjusted Gamma UCL	0.0367	UCL	
Mammalian PCDD/PCDF TEQ (ND=FullIDL)	µg/kg	0-0.5	34	/	34	100	0.00331	0.173	--	--	0.032	--	--	0.0313	0.0442	95% H-UCL	0.0442	UCL	
Mammalian DL-PCB TEQ (ND=0)	µg/kg	0-0.5	35	/	35	100	0.000507	0.0117	--	--	0.00477	--	--	0.00281	0.00579	95% Adjusted Gamma UCL	0.00579	UCL	
Mammalian DL-PCB TEQ (ND=1/2DL)	µg/kg	0-0.5	35	/	35	100	0.105	1.19	--	--	0.441	--	--	0.262	0.524	95% Adjusted Gamma UCL	0.524	UCL	
Mammalian DL-PCB TEQ (ND=FullIDL)	µg/kg	0-0.5	35	/	35	100	0.209	2.371	--	--	0.878	--	--	0.521	1.042	95% Adjusted Gamma UCL	1.042	UCL	
Mammalian Total TEQ (ND=0)	µg/kg	0-0.5	35	/	35	100	0.00308	0.106	--	--	0.0296	--	--	0.0226	0.0371	95% Adjusted Gamma UCL	0.0371	UCL	
Mammalian Total TEQ (ND=1/2DL)	µg/kg	0-0.5	35	/	35	100	0.108	1.325	--	--	0.469	--	--	0.278	0.557	95% Adjusted Gamma UCL	0.557	UCL	
Mammalian Total TEQ (ND=FullIDL)	µg/kg	0-0.5	35	/	35	100	0.213	2.544	--	--	0.909	--	--	0.541	1.079	95% Adjusted Gamma UCL	1.079	UCL	
Fish PCDD/PCDF TEQ (ND=0)	µg/kg	0-0.5	34	/	34	100	0.00313	0.12	--	--	0.0243	--	--	0.0224	0.0309	95% Adjusted Gamma UCL	0.0309	UCL	
Fish PCDD/PCDF TEQ (ND=1/2DL)	µg/kg	0-0.5	34	/	34	100	0.00324	0.143	--	--	0.0271	--	--	0.026	0.0365	95% H-UCL	0.0365	UCL	
Fish PCDD/PCDF TEQ (ND=FullIDL)	µg/kg	0-0.5	34	/	34	100	0.00335	0.166	--	--	0.03	--	--	0.0301	0.0406	95% H-UCL	0.0406	UCL	
Fish DL-PCB TEQ (ND=0)	µg/kg	0-0.5	35	/	35	100	0.0000845	0.00732	--	--	0.00096484	--	--	0.0012	0.00124	95% Adjusted Gamma UCL	0.00124	UCL	
Fish DL-PCB TEQ (ND=1/2DL)	µg/kg	0-0.5	35	/	35	100	0.005	0.0574	--	--	0.0216	--	--	0.0125	0.0255	95% Adjusted Gamma UCL	0.0255	UCL	
Fish DL-PCB TEQ (ND=FullIDL)	µg/kg	0-0.5	35	/	35	100	0.00992	0.113	--	--	0.0422	--	--	0.0247	0.05	95% Adjusted Gamma UCL	0.05	UCL	
Fish Total TEQ (ND=0)	µg/kg	0-0.5	35	/	35	100	0.000514	0.122	--	--	0.0246	--	--	0.0227	0.0319	95% Adjusted Gamma UCL	0.0319	UCL	
Fish Total TEQ (ND=1/2DL)	µg/kg	0-0.5	35	/	35	100	0.00824	0.2	--	--	0.0479	--	--	0.0352	0.0584	95% Adjusted Gamma UCL	0.0584	UCL	
Fish Total TEQ																			

Table AD31-4. Soil Summary Statistics by Assessment
Area Anniston PCB Site, Anniston, Alabama

Constituent	Units	Depth (ft bgs)	Summary Statistics											Exposure Point Concentration				
			Detects	/	Total	FOD	Minimum Detect	Maximum Detect	Minimum Nondetect	Maximum Nondetect	Mean	Median	Variance	Standard Deviation	95% UCL	95% UCL Method	Selected EPC	Basis
Lower Assessment Area																		
Dioxin/Furan Congeners																		
1,2,3,4,6,7,8-HpCDD	ng/kg	0-0.5	28	/	28	100	11.8	250	N/A	N/A	69.87	57.2	2499	49.99	87.69	95% Adjusted Gamma UCL	87.69	UCL
1,2,3,4,6,7,8-HpCDF	ng/kg	0-0.5	20	/	28	71	2.7	109	0.34	34.6	22.99	13.45	753.5	27.45	30.03	95% KM Adjusted Gamma UCL	30.03	UCL
1,2,3,4,7,8,9-HpCDF	ng/kg	0-0.5	20	/	28	71	0.18	24.3	0.17	2.15	5.785	3.235	43.82	6.62	7.361	95% Gamma Adjusted KM-UCL	7.361	UCL
1,2,3,4,7,8-HxCDD	ng/kg	0-0.5	19	/	28	68	0.19	2.51	0.119	2.53	0.947	0.82	0.382	0.618	1.025	95% GROS Adjusted Gamma UCL	1.025	UCL
1,2,3,4,7,8-HxCDF	ng/kg	0-0.5	23	/	28	82	0.59	86.7	0.082	4.61	16.38	10.3	438.9	20.95	23.88	95% Gamma Adjusted KM-UCL	23.88	UCL
1,2,3,6,7,8-HxCDD	ng/kg	0-0.5	22	/	28	79	0.195	10	0.928	2.62	2.296	1.18	6.381	2.526	2.918	95% GROS Adjusted Gamma UCL	2.918	UCL
1,2,3,6,7,8-HxCDF	ng/kg	0-0.5	25	/	28	89	1.12	365	0.25	1.88	65.51	41.5	7859	88.65	103.2	95% Gamma Adjusted KM-UCL	103.2	UCL
1,2,3,7,8,9-HxCDD	ng/kg	0-0.5	25	/	28	89	0.316	5.42	1.45	2.77	2.017	1.83	1.394	1.181	2.309	95% KM (t) UCL	2.309	UCL
1,2,3,7,8,9-HxCDF	ng/kg	0-0.5	2	/	28	7	1.41	2.665	0.11	4.4	2.038	2.038	0.788	0.887	--	--	2.665	Maximum Detect
1,2,3,7,8-PeCDD	ng/kg	0-0.5	1	/	28	4	0.969	0.969	0.093	1.62	0.969	0.969	N/A	N/A	--	--	0.969	Maximum Detect
1,2,3,7,8-PeCDF	ng/kg	0-0.5	8	/	28	29	0.4	23.6	0.13	708	7.989	3.425	74.74	8.645	6.04	95% KM (t) UCL	6.04	UCL
2,3,4,6,7,8-HxCDF	ng/kg	0-0.5	18	/	28	64	0.3	13.7	0.097	5.78	3.498	2.05	14.38	3.792	4.113	95% KM Adjusted Gamma UCL	4.113	UCL
2,3,4,7,8-PeCDF	ng/kg	0-0.5	21	/	28	75	0.66	37.1	0.14	4.73	7.437	4	88.05	9.384	19.45	95% KM H-UCL	19.45	UCL
2,3,7,8-TCDD	ng/kg	0-0.5	2	/	28	7	0.441	0.75	0.092	0.752	0.596	0.596	0.0477	0.218	--	--	0.75	Maximum Detect
2,3,7,8-TCDF	ng/kg	0-0.5	26	/	28	93	1.24	683	0.58	4.32	83.51	11.55	32648	180.7	222.2	95% KM (Chebyshev) UCL	222.2	UCL
octa CDD	ng/kg	0-0.5	28	/	28	100	899	4200	N/A	N/A	2149	2130	684060	827.1	2415	95% Student's-t UCL	2415	UCL
octa CDF	ng/kg	0-0.5	27	/	28	96	2.2	216	0.74	0.74	36.67	20	2306	48.02	59.2	95% Gamma Adjusted KM-UCL	59.2	UCL
Polychlorinated Biphenyl Congeners																		
BZ#77	mg/kg	0-0.5	5	/	28	18	0.0019	0.315	0.0014	0.017	0.0711	0.012	0.0186	0.136	0.0812	95% Gamma Adjusted KM-UCL	0.0812	UCL
BZ#81	mg/kg	0-0.5	0	/	28	0	N/A	N/A	0.0028	0.035	N/A	N/A	N/A	N/A	--	--	Not Detected	Not Detected
BZ#105	mg/kg	0-0.5	21	/	28	75	0.0023	0.12	0.0014	0.0017	0.0269	0.012	0.00124	0.0352	0.0378	95% Gamma Adjusted KM-UCL	0.0378	UCL
BZ#114	mg/kg	0-0.5	0	/	28	0	N/A	N/A	0.0014	0.017	N/A	N/A	N/A	N/A	--	--	Not Detected	Not Detected
BZ#118	mg/kg	0-0.5	24	/	28	86	0.0019	0.23	0.0014	0.0015	0.0462	0.015	0.00436	0.0661	0.0736	95% Gamma Adjusted KM-UCL	0.0736	UCL
BZ#123	mg/kg	0-0.5	2	/	28	7	0.0041	0.023	0.0014	0.017	0.0136	0.0136	0.00017861	0.0134	--	--	0.023	Maximum Detect
BZ#126	mg/kg	0-0.5	7	/	28	25	0.002	0.044	0.0014	0.017	0.0148	0.0031	0.00035273	0.0188	0.00506	95% KM H-UCL	0.00506	UCL
BZ#153	mg/kg	0-0.5	25	/	28	89	0.0032	0.37	0.0028	0.003	0.0853	0.042	0.0139	0.118	0.136	95% Gamma Adjusted KM-UCL	0.136	UCL
BZ#156	mg/kg	0-0.5	17	/	28	61	0.0019	0.042	0.0014	0.0017	0.0125	0.0069	0.0001806	0.0134	0.0129	95% KM H-UCL	0.0129	UCL
BZ#157	mg/kg	0-0.5	1	/	28	4	0.0031	0.0031	0.0014	0.017	0.0031	0.0031	N/A	N/A	--	--	0.0031	Maximum Detect
BZ#167	mg/kg	0-0.5	2	/	28	7	0.0031	0.0041	0.0028	0.035	0.0036	0.0036	0.0000005	0.00070711	--	--	0.0041	Maximum Detect
BZ#169	mg/kg	0-0.5	0	/	28	0	N/A	N/A	0.0014	0.017	N/A	N/A	N/A	N/A	--	--	Not Detected	Not Detected
BZ#189	mg/kg	0-0.5	1	/	28	4	0.0015	0.0015	0.0014	0.017	0.0015	0.0015	N/A	N/A	--	--	0.0015	Maximum Detect
TEQ																		
Avian PCDD/PCDF TEQ (ND=0)	µg/kg	0-0.5	28	/	28	100	0.000186	0.743	--	--	0.0914	--	--	0.189	0.247	95% Chebyshev (Mean, Sd) UCL	0.247	UCL
Avian PCDD/PCDF TEQ (ND=1/2DL)	µg/kg	0-0.5	28	/	28	100	0.000674	0.744	--	--	0.0952	--	--	0.192	0.253	95% Chebyshev (Mean, Sd) UCL	0.253	UCL
Avian PCDD/PCDF TEQ (ND=FullIDL)	µg/kg	0-0.5	28	/	28	100	0.00116	0.745	--	--	0.0989	--	--	0.195	0.26	95% Chebyshev (Mean, Sd) UCL	0.26	UCL
Avian DL-PCB TEQ (ND=0)	µg/kg	0-0.5	28	/	28	100	0	19.75	--	--	0.984	--	--	3.773	4.093	95% Chebyshev (Mean, Sd) UCL	4.093	UCL
Avian DL-PCB TEQ (ND=1/2DL)	µg/kg	0-0.5	28	/	28	100	0.246	21.2	--	--	1.607	--	--	4.041	4.936	95% Chebyshev (Mean, Sd) UCL	4.936	UCL
Avian DL-PCB TEQ (ND=FullIDL)	µg/kg	0-0.5	28	/	28	100	0.492	22.65	--	--	2.23	--	--	4.425	5.875	95% Chebyshev (Mean, Sd) UCL	5.875	UCL
Avian Total TEQ (ND=0)	µg/kg	0-0.5	28	/	28	100	0.000186	20.23	--	--	1.076	--	--	3.879	8.371	99% Chebyshev (Mean, Sd) UCL	8.371	UCL
Avian Total TEQ (ND=1/2DL)	µg/kg	0-0.5	28	/	28	100	0.249	21.68	--	--	1.702	--	--	4.165	5.134	95% Chebyshev (Mean, Sd) UCL	5.134	UCL
Avian Total TEQ (ND=FullIDL)	µg/kg	0-0.5	28	/	28	100	0.495	23.13	--	--	2.329	--	--	4.562	6.087	95% Chebyshev (Mean, Sd) UCL	6.087	UCL
Mammalian PCDD/PCDF TEQ (ND=0)	µg/kg	0-0.5	28	/	28	100	0.000578	0.121	--	--	0.0189	--	--	0.0293	0.0389	95% H-UCL	0.0389	UCL
Mammalian PCDD/PCDF TEQ (ND=1/2DL)	µg/kg	0-0.5	28	/	28	100	0.000751	0.122	--	--	0.0204	--	--	0.0305	0.0408	95% H-UCL	0.0408	UCL
Mammalian PCDD/PCDF TEQ (ND=FullIDL)	µg/kg	0-0.5	28	/	28	100	0.000924	0.123	--	--	0.0219	--	--	0.0317	0.0337	95% Adjusted Gamma UCL	0.0337	UCL
Mammalian DL-PCB TEQ (ND=0)	µg/kg	0-0.5	28	/	28	100	0	4.41	--	--	0.368	--	--	1.106	1.279	95% Chebyshev (Mean, Sd) UCL	1.279	UCL
Mammalian DL-PCB TEQ (ND=1/2DL)	µg/kg	0-0.5	28	/	28	100	0.0917	4.64	--	--	0.564	--	--	1.137	1.5	95% Chebyshev (Mean, Sd) UCL	1.5	UCL
Mammalian DL-PCB TEQ (ND=FullIDL)	µg/kg	0-0.5	28	/	28	100	0.183	4.87	--	--	0.76	--	--	1.223	1.768	95% Chebyshev (Mean, Sd) UCL	1.768	UCL
Mammalian Total TEQ (ND=0)	µg/kg	0-0.5	28	/	28	100	0.000578	4.531	--	--	0.387	--	--	1.13	1.721	97.5% Chebyshev (Mean, Sd) UCL	1.721	UCL
Mammalian Total TEQ (ND=1/2DL)	µg/kg	0-0.5	28	/	28	100	0.0936	4.762	--	--	0.584	--	--	1.163	1.543	95% Chebyshev (Mean, Sd) UCL	1.543	UCL
Mammalian Total TEQ (ND=FullIDL)	µg/kg	0-0.5	28	/	28	100	0.186	4.993	--	--	0.782	--	--	1.251	1.813	95% Chebyshev (Mean, Sd) UCL	1.813	UCL
Fish PCDD/PCDF TEQ (ND=0)	µg/kg	0-0.5	28	/	28	100	0.000243	0.0876	--	--	0.0151	--	--	0.0214	0.0238	95% Adjusted Gamma UCL	0.0238	UCL
Fish PCDD/PCDF TEQ (ND=1/2DL)	µg/kg	0-0.5	28	/	28	100	0.000417	0.0886	--	--	0.0172	--	--	0.0231	0.0267	95% Adjusted Gamma UCL	0.0267	UCL
Fish PCDD/PCDF TEQ (ND=FullIDL)	µg/kg	0-0.5	28	/	28	100	0.000591	0.098	--	--	0.0193	--	--	0.0253	0.0297	95% Adjusted Gamma UCL	0.0297	UCL
Fish DL-PCB TEQ (ND=0)	µg/kg	0-0.5	28	/	28	100	0	0.233	--	--	0.0198	--	--	0.0594	0.0687	95% Chebyshev (Mean, Sd) UCL	0.0687	UCL
Fish DL-PCB TEQ (ND=1/2DL)	µg/kg	0-0.5	28	/	28	100	0.00434	0.241	--	--	0.0289	--	--	0.0602	0.0784	95% Chebyshev (Mean, Sd) UCL	0.0784	UCL
Fish DL-PCB TEQ (ND=FullIDL)	µg/kg	0-0.5	28	/	28	100	0.00868	0.249	--	--	0.038	--	--	0.0634	0.0902	95% Chebyshev (Mean, Sd) UCL	0.0902	UCL
Fish Total TEQ (ND=0)	µg/kg	0-0.5	28	/	28	100	0.000243	0.31	--	--	0.0349	--	--	0.0777	0.0989	95% Chebyshev (Mean, Sd) UCL	0.0989	UCL
Fish Total TEQ (ND=1/2DL)	µg/kg	0-0.5	28	/	28	100	0.00507	0.32	--	--	0.0461	--	--	0.0804	0.112	95% Chebyshev (Mean, Sd) UCL	0.112	UCL
Fish Total TEQ (ND=FullIDL)	µg/kg	0-0.5	28	/	28	100	0.											

Table AD-31-4. Soil Summary Statistics by Assessment
Area Anniston PCB Site, Anniston, Alabama

Constituent	Units	Depth (ft bgs)	Summary Statistics												Exposure Point Concentration			
			Detects	/	Total	FOD	Minimum Detect	Maximum Detect	Minimum Nondetect	Maximum Nondetect	Mean	Median	Variance	Standard Deviation	95% UCL	95% UCL Method	Selected EPC	Basis
Miscellaneous																		
Moisture, percent	%	0-0.5	17	/	17	100	7.18	23	N/A	N/A	16.48	18	21.2	4.604	18.43	95% Student's-t UCL	18.43	UCL
Solids, percent	%	0-0.5	252	/	252	100	42	97.45	N/A	N/A	87.78	88.1	40.33	6.351	88.43	95% Modified-t UCL	88.43	UCL
TOC by lloyd kahn	mg/kg	0-0.5	288	/	288	100	1100	55300	N/A	N/A	14296	12550	67468462	8214	15080	95% Approximate Gamma UCL	15080	UCL

Notes:

%: percent
CDD: chlorodibenzo-p-dioxin
CDF: chlorodibenzo-p-furan
DL: dioxin-like
DL-PCB: dioxin-like polychlorinated biphenyl
EPC: exposure point concentration
FOD: frequency of detection
ft bgs: feet below ground surface
HpCDD: heptachlorodibenzo-p-dioxin
HpCDF: heptachlorodibenzofuran
HxCDD: hexachlorodibenzo-p-dioxin
HxCDF: hexachlorodibenzofuran
KM: Kaplan-Meier
mg/kg: milligram per kilogram
N/A: not applicable

ND: nondetect
ng/kg: nanogram per kilogram
PCDD: polychlorinated dibenzodioxin
PCDF: polychlorinated dibenzofuran
PeCDD: pentachlorodibenzo-p-dioxin
PeCDF: pentachlorodibenzofuran
RPD: relative percent difference
Sd: standard deviation
TCDD: tetrachlorodibenzo-p-dioxin
TCDF: tetrachlorodibenzofuran
TEQ: toxic equivalent
TOC: total organic carbon
UCL: upper confidence limit
µg/kg: microgram per kilogram

**Table E-5. Summary Statistics for COPCs in OU-4 Surface Water
Anniston PCB Site, Anniston, Alabama**

Reach or AA ¹	COPC	Total Sample Size (n)	Detects	NumNDs	% FOD	Minimum (mg/L)	Maximum (mg/L)	Mean (mg/L)	Median	SD	CV	UCL ^{1,2} (mg/L)	EPC ³ (mg/L)	EPC Basis
C1	Barium	4	4	0	100%	0.0241	0.201	0.086	0.059	0.083	0.97	--	0.20	Maximum
C1	Chromium	4	4	0	100%	0.002	0.0329	0.012	0.0065	0.015	1.2	--	0.033	Maximum
C1	Cobalt	4	2	2	50%	0.005	0.0122	0.0086	0.0086	0.0051	0.59	--	0.012	Maximum
C1	Lead	4	4	0	100%	0.0042	0.0964	0.034	0.017	0.043	1.3	--	0.096	Maximum
C1	Vanadium	4	4	0	100%	0.0041	0.0339	0.015	0.011	0.014	0.94	--	0.034	Maximum
C1	Mercury	4	2	2	50%	0.00015	0.00043	0.00029	0.00029	0.00020	0.68	--	0.00043	Maximum
C1	Total Homolog PCBs	3	3	0	100%	0.000175	0.000498	0.00036	0.00040	0.00017	0.46	--	0.00050	Maximum
UAA	Barium	4	4	0	100%	0.0251	0.0319	0.030	0.031	0.0030	0.10	--	0.032	Maximum
UAA	Chromium	4	4	0	100%	0.000575	0.0017	0.0011	0.0011	0.00046	0.42	--	0.0017	Maximum
UAA	Cobalt	4	0	4	0%	NA	NA	NA	NA	NA	NA	--	--	ND
UAA	Lead	4	4	0	100%	0.00048	0.00084	0.00063	0.00060	0.00016	0.26	--	0.00084	Maximum
UAA	Vanadium	4	4	0	100%	0.000495	0.0013	0.0010	0.0012	0.00036	0.35	--	0.0013	Maximum
UAA	Mercury	15	0	15	0%	NA	NA	NA	NA	NA	NA	--	--	ND
UAA	Total Homolog PCBs	15	11	4	73%	0.000016	0.000132	0.000068	0.000064	0.000036	0.53	0.000083	0.000083	UCL
MAA	Barium	2	2	0	100%	0.0248	0.0428	0.034	0.034	0.013	0.38	--	0.043	Maximum
MAA	Chromium	2	1	1	50%	0.004	0.004	0.0040	0.0040	NA	NA	--	0.0040	Maximum
MAA	Cobalt	2	1	1	50%	0.0022	0.0022	0.0022	0.0022	NA	NA	--	0.0022	Maximum
MAA	Lead	2	2	0	100%	0.00058	0.0048	0.0027	0.0027	0.0030	1.1	--	0.0048	Maximum
MAA	Vanadium	2	2	0	100%	0.00057	0.0031	0.0018	0.0018	0.0018	0.98	--	0.0031	Maximum
MAA	Mercury	12	0	12	0%	NA	NA	NA	NA	NA	NA	--	--	ND
MAA	Total Homolog PCBs	12	12	0	100%	0.0000476	0.000172	0.000087	0.000085	0.000032	0.37	0.00011	0.00011	UCL
LAA	Barium	1	1	0	100%	0.0244	0.0244	0.024	0.024	NA	NA	--	0.024	Maximum
LAA	Chromium	1	1	0	100%	0.00067	0.00067	0.00067	0.00067	NA	NA	--	0.00067	Maximum
LAA	Cobalt	1	0	1	0%	NA	NA	NA	NA	NA	NA	--	--	ND
LAA	Lead	1	1	0	100%	0.00034	0.00034	0.00034	0.00034	NA	NA	--	0.00034	Maximum
LAA	Vanadium	1	1	0	100%	0.00039	0.00039	0.00039	0.00039	NA	NA	--	0.00039	Maximum
LAA	Mercury	13	1	12	8%	0.000069	0.000069	0.000069	0.000069	NA	NA	--	0.000069	Maximum
LAA	Total Homolog PCBs	13	13	0	100%	0.000024	0.000309	0.000073	0.000054	0.000072	1.0	0.00016	0.00016	UCL
Sitewide	Barium	11	11	0	100%	0.0241	0.201	0.050	0.030	0.054	1.1	0.12	0.12	UCL
Sitewide	Chromium	11	10	1	91%	0.000575	0.0329	0.0057	0.0019	0.010	1.8	0.018	0.018	UCL
Sitewide	Cobalt	11	3	8	27%	0.0022	0.0122	0.0065	0.0050	0.0052	0.80	--	0.012	Maximum
Sitewide	Lead	11	11	0	100%	0.00034	0.0964	0.013	0.00084	0.029	2.2	0.067	0.067	UCL
Sitewide	Vanadium	11	11	0	100%	0.00039	0.0339	0.0061	0.0013	0.010	1.7	0.017	0.017	UCL
Sitewide	Mercury	44	3	41	7%	0.000069	0.00043	0.00022	0.00015	0.00019	0.88	--	0.00043	Maximum
Sitewide	Total Homolog PCBs	43	39	4	91%	0.000016	0.000498	0.00010	0.000069	0.00010	1.0	0.00016	0.00016	UCL

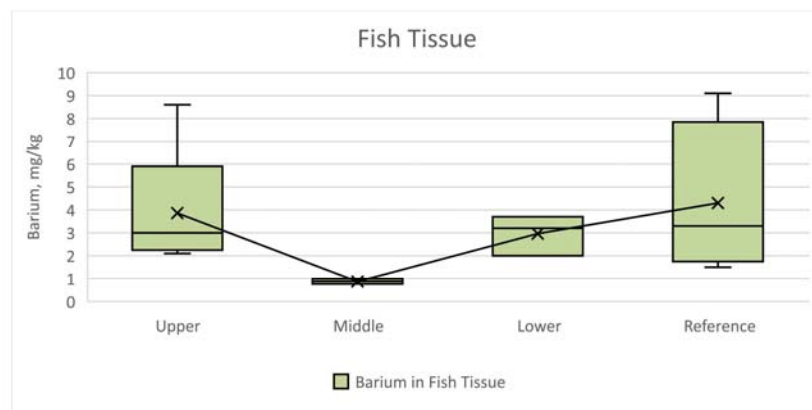
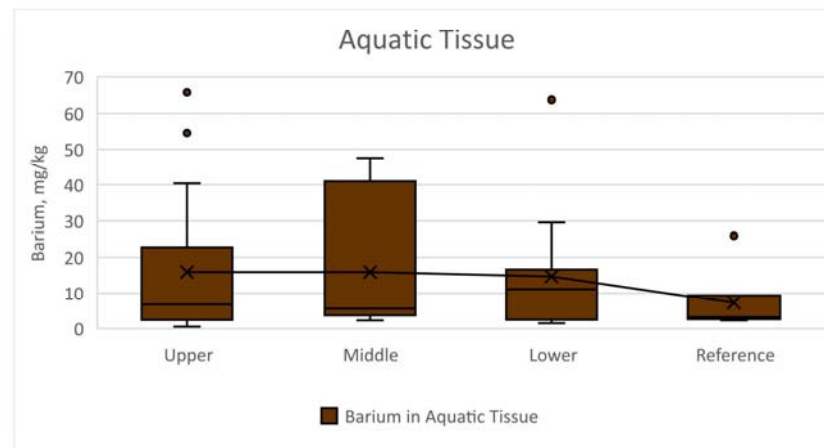
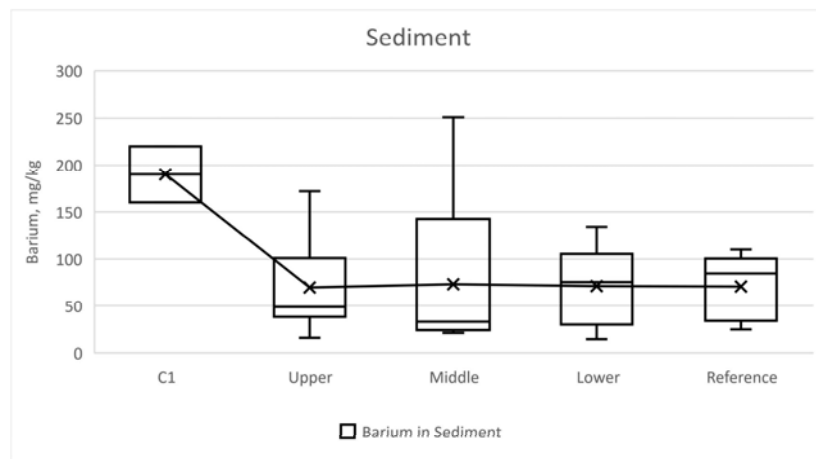
**Table 4-14. Summary Statistics for COPCs in OU-4 Surface Water
Anniston PCB Site, Anniston, Alabama**

Notes:

- ¹ Datasets with "NA" for UCL did not have enough samples for ProUCL to calculate a UCL.
- ² ProUCL 5.1 (USEPA 2016) was used to calculate summary statistics and UCL values.
- ³ EPC based on the UCL when available, otherwise based on the maximum detected concentration.
- Datasets with "NA" for UCL did not have enough samples for ProUCL to calculate a UCL.
- ProUCL 4.1 (USEPA 2011) was used to calculate summary statistics and UCL values.
- EPC based on the UCL when available, otherwise based on the maximum detected concentration.
- COPC: constituent of potential concern
- CV: coefficient of variation
- EPC: exposure point concentration
- LAA: lower assessment area
- MAA: middle assessment area
- MAD: median absolute deviation
- MAD/0.675: Robust estimate of variability (standard deviation)
- Maximum: Maximum value
- Mean: Sample average value
- Median: Median value
- mg/L: milligram per liter
- Minimum: Minimum value
- n: sample size
- NA: not available
- ND: nondetect
- Num Obs: Number of Observations
- NumNDs: Number of Nondetects
- SD: Classical sample standard deviation
- UAA: upper assessment area
- UCL: 95% upper confidence limit
- USEPA: United States Environmental Protection Agency
- % FOD: Frequency of Detection

Reference:

USEPA. 2016. ProUCL 5.1.A Statistical Software for Environmental Applications for Data Sets with and without non detect observations. National Exposure Research Lab, EPA, Las Vegas Nevada, May 2016. <http://www.epa.gov/osp/hstl/tsc/softwaredocs.htm>



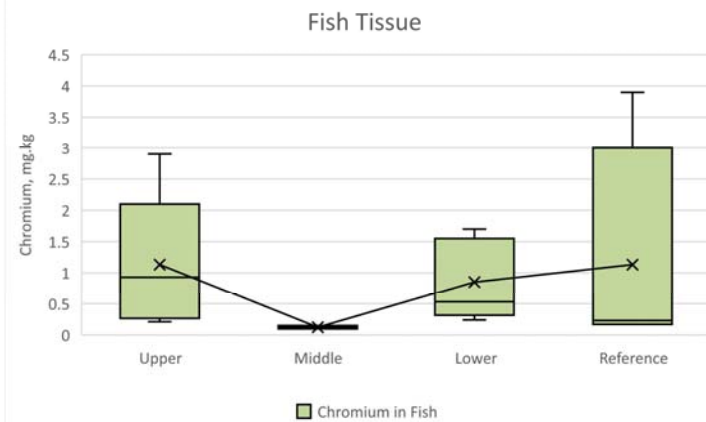
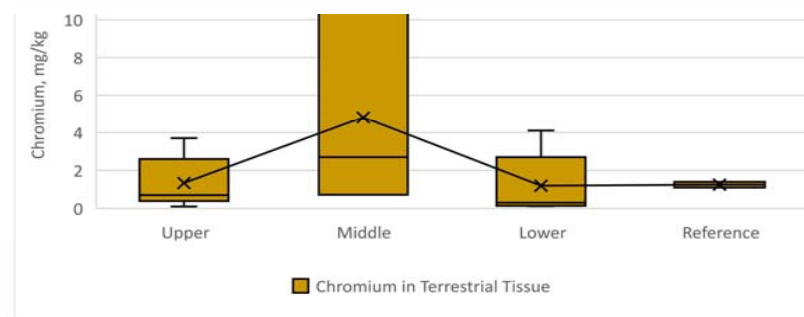
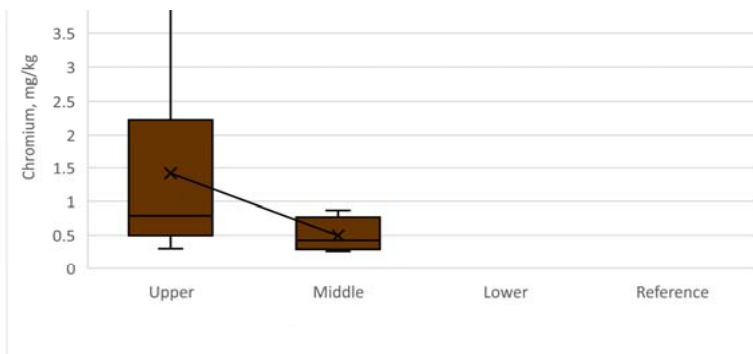
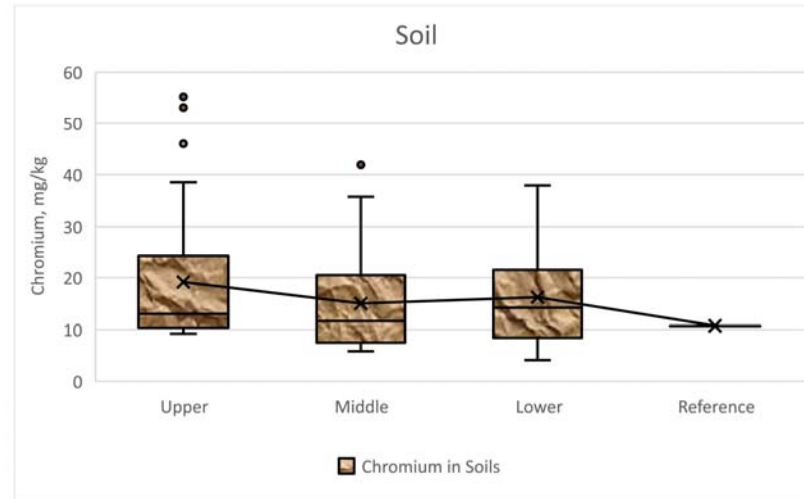
Notes:

Tissue data are in wet weight.

Non-detected concentrations are excluded.

Upper, middle, and lower refer to assessment area.

Anniston PCB Site Anniston, Alabama Baseline Ecological Risk Assessment for OU4	
Mean Barium Concentrations for Tissue Data by Ecological Area	
	FIGURE AD3-1



Notes:

Tissue data are in wet weight.

Non-detected concentrations are excluded.

Upper, middle, and lower refer to assessment area.

Anniston PCB Site

Anniston, Alabama

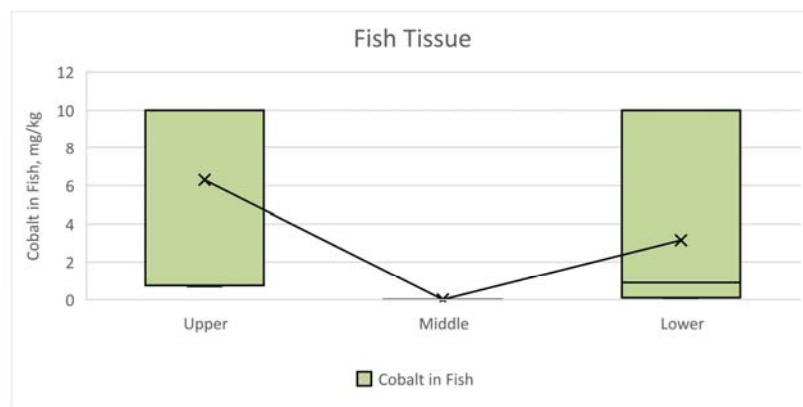
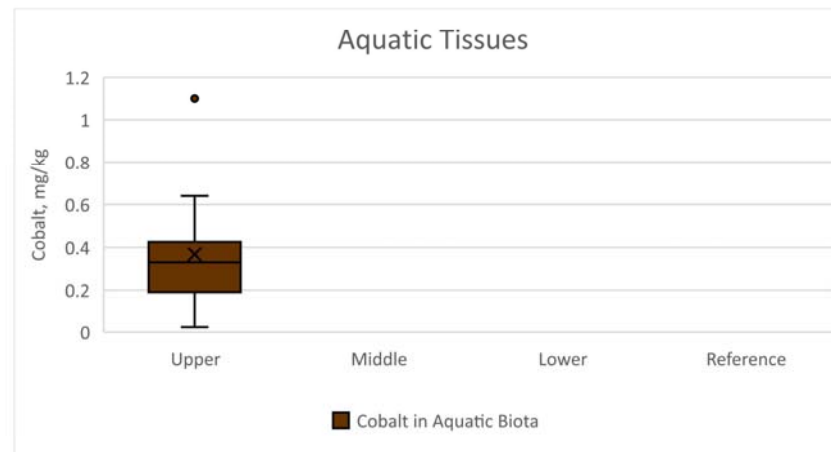
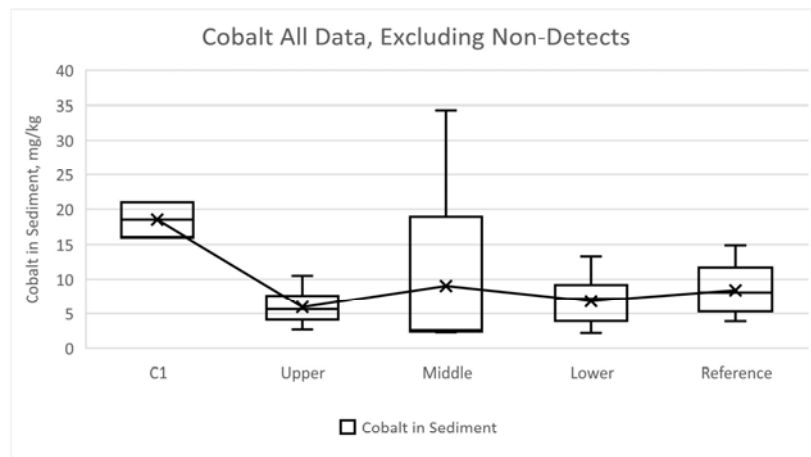
Baseline Ecological Risk Assessment for OU4

Mean Chromium Concentrations for Tissue Data by Ecological Area



FIGURE

AD3-2



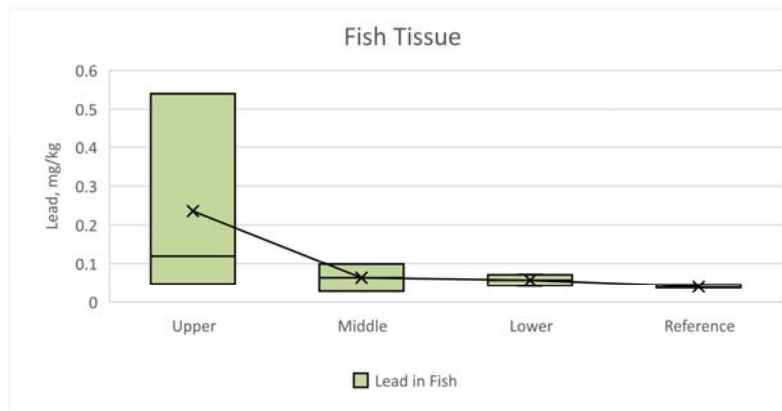
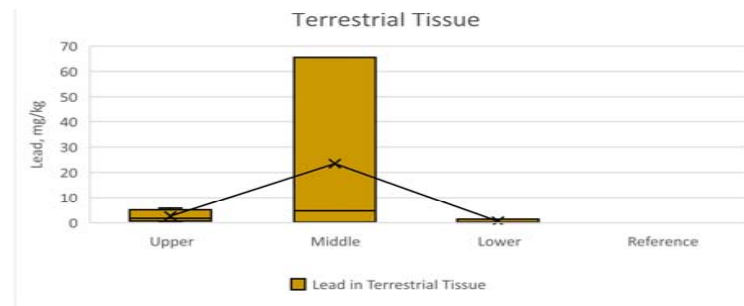
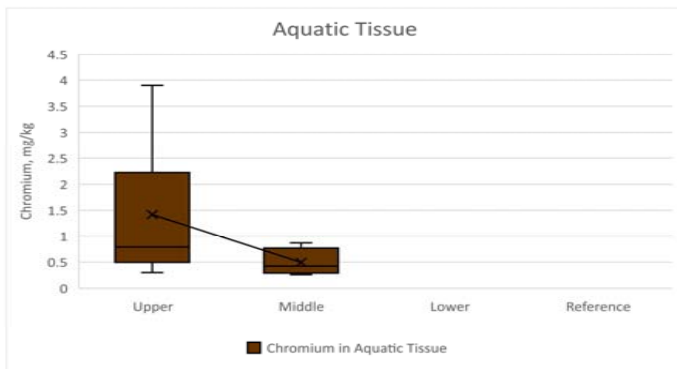
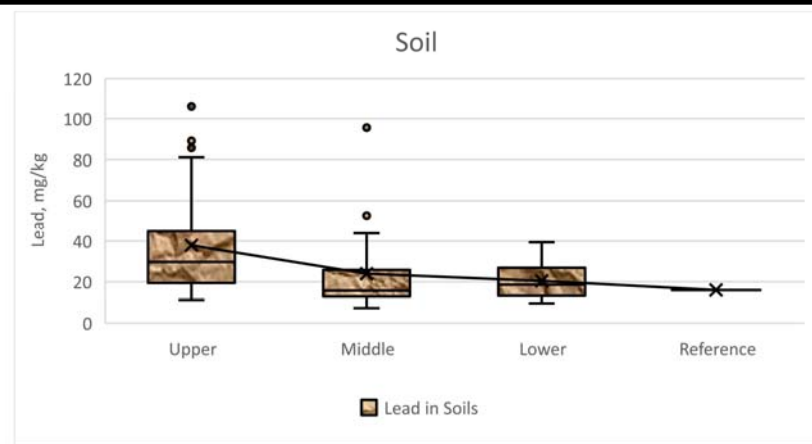
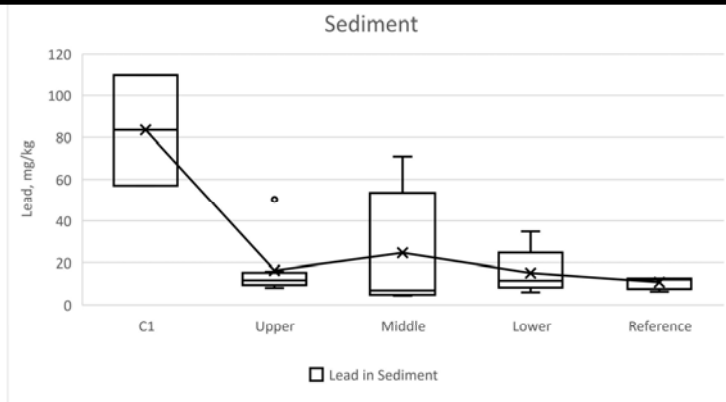
Notes:

Tissue data are in wet weight.

Non-detected concentrations are excluded.

Upper, middle, and lower refer to assessment area.

Anniston PCB Site Anniston, Alabama Baseline Ecological Risk Assessment for OU4	
Mean Cobalt Concentrations for Tissue Data by Ecological Area	
	FIGURE AD3-3



Notes:

Tissue data are in wet weight.

Non-detected concentrations are excluded.

Upper, middle, and lower refer to assessment area.

Anniston PCB Site
Anniston, Alabama

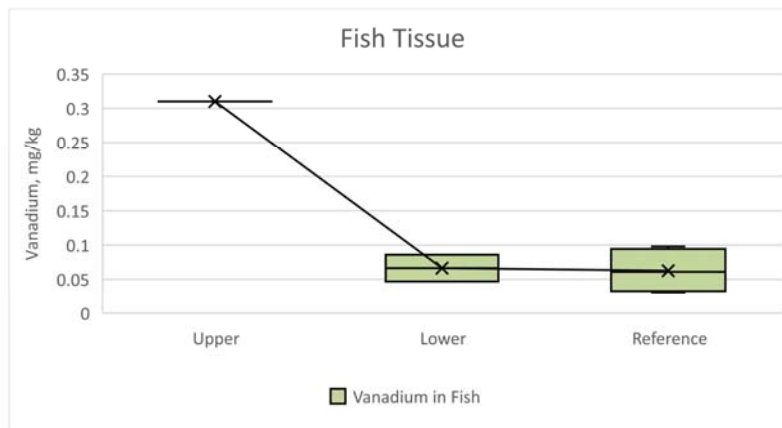
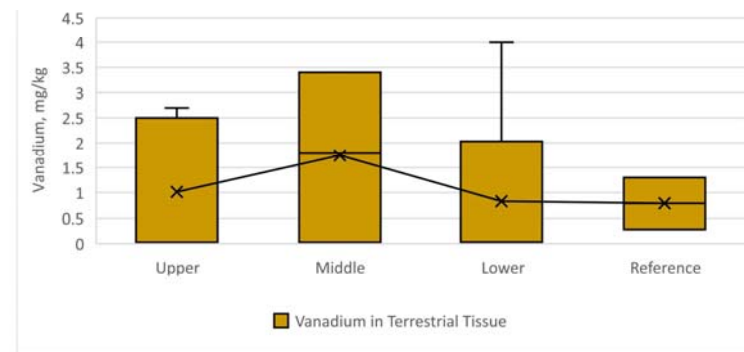
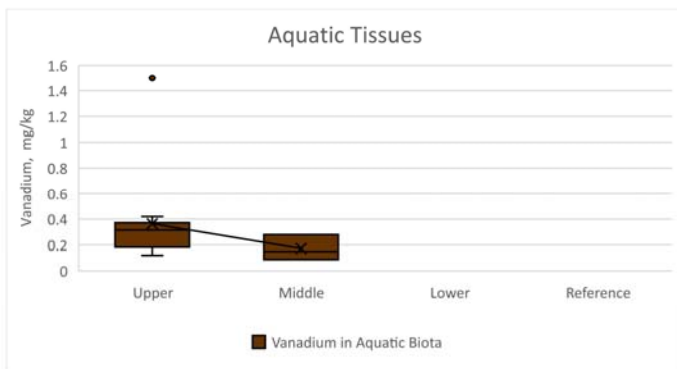
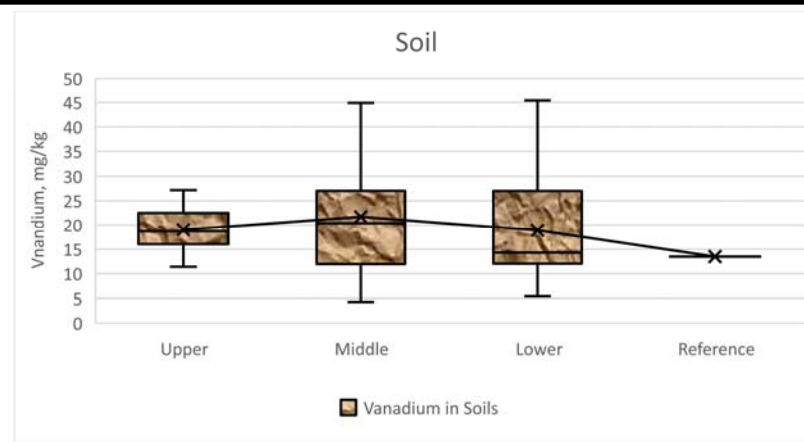
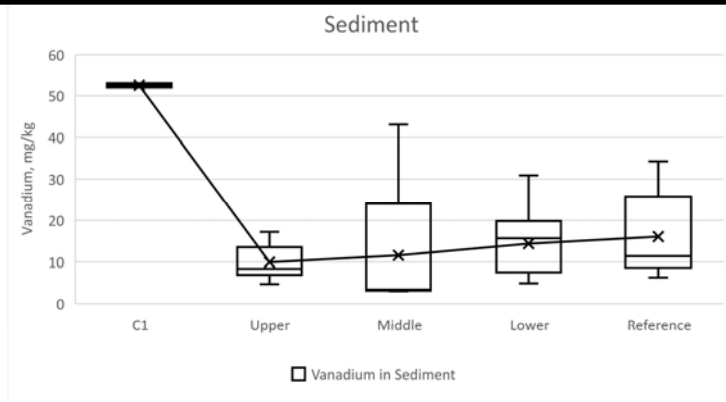
Baseline Ecological Risk Assessment for OU4

Mean Lead Concentrations for Tissue Data by Ecological Area



FIGURE

AD3-4



Notes:

Tissue data are in wet weight.

Non-detected concentrations are excluded.

Upper, middle, and lower refer to assessment area.

Anniston PCB Site
Anniston, Alabama

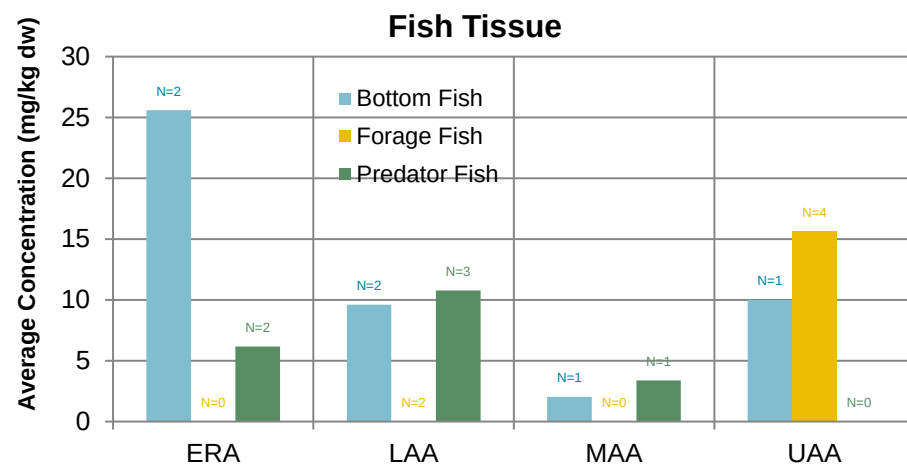
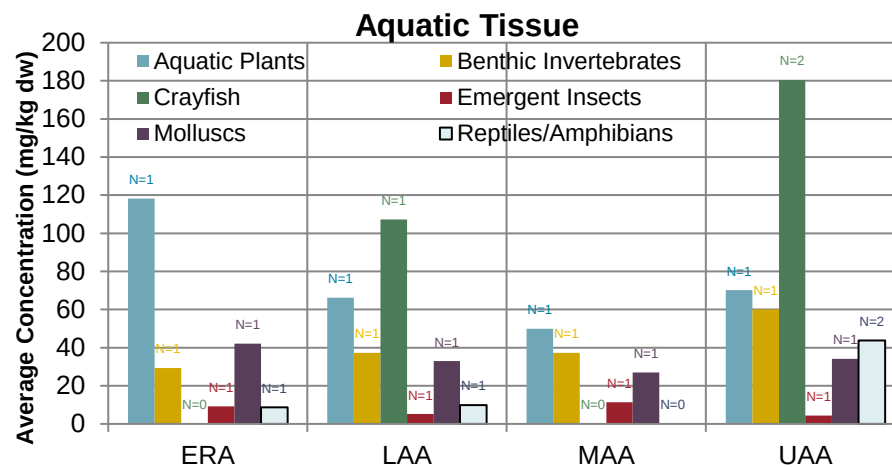
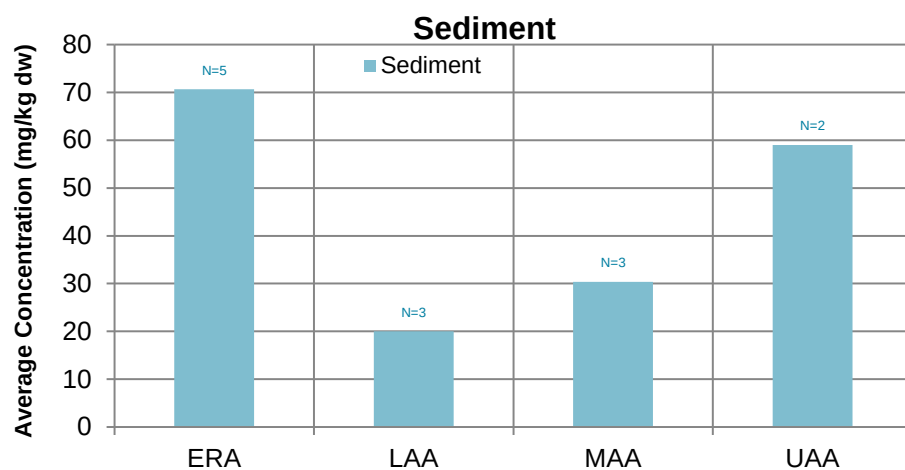
Baseline Ecological Risk Assessment for OU4

**Mean Vanadium Concentrations for Tissue
Data by Ecological Area**



FIGURE

AD3-5



Notes:

1. Averages are Kaplan-Meier estimates of the mean.
2. If results are all non-detect in a given media/tissue for a given location, concentration is plotted as zero.

COPC: constituent of potential concern

dw: dry weight

ERA: ecological reference area

LAA: lower assessment area

MAA: middle assessment area

mg/kg: milligrams per kilogram

N: sample number

UAA: upper assessment area

Anniston PCB Site

Anniston, Alabama

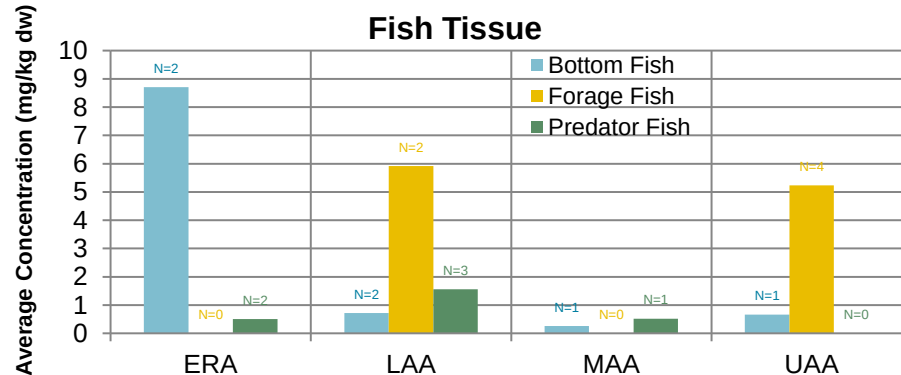
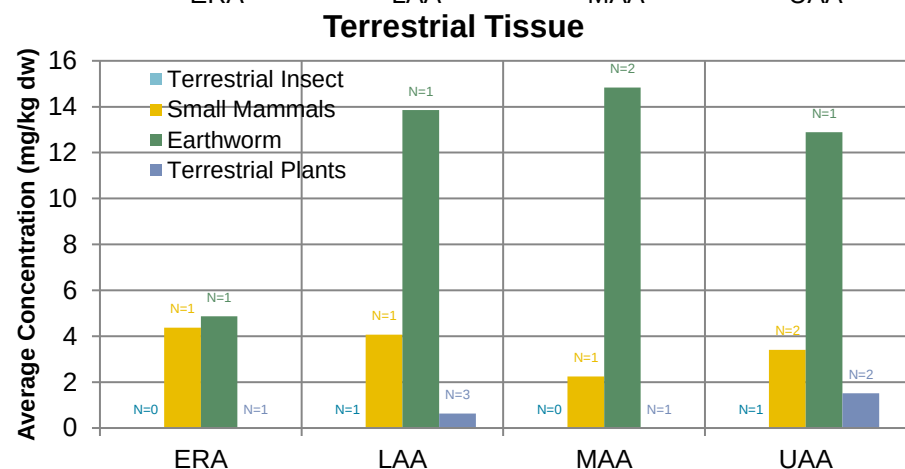
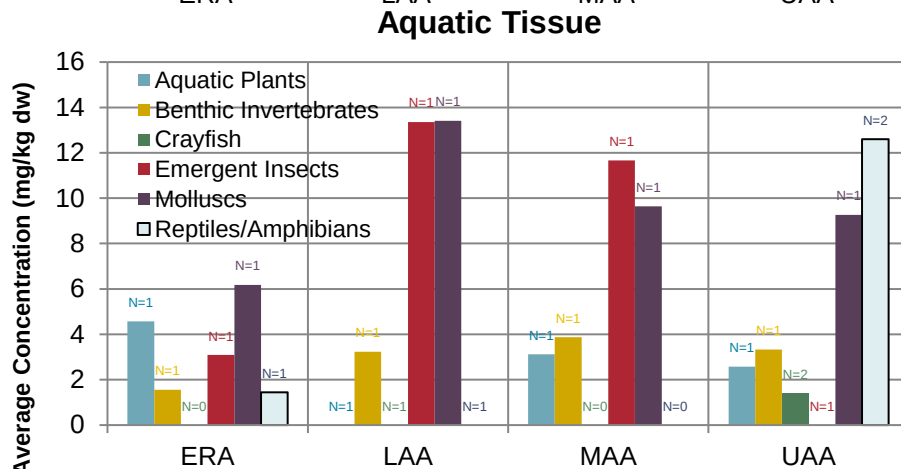
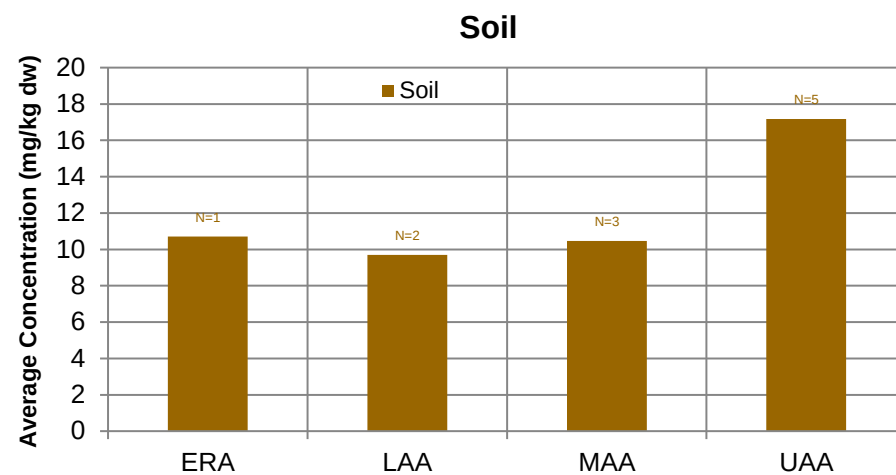
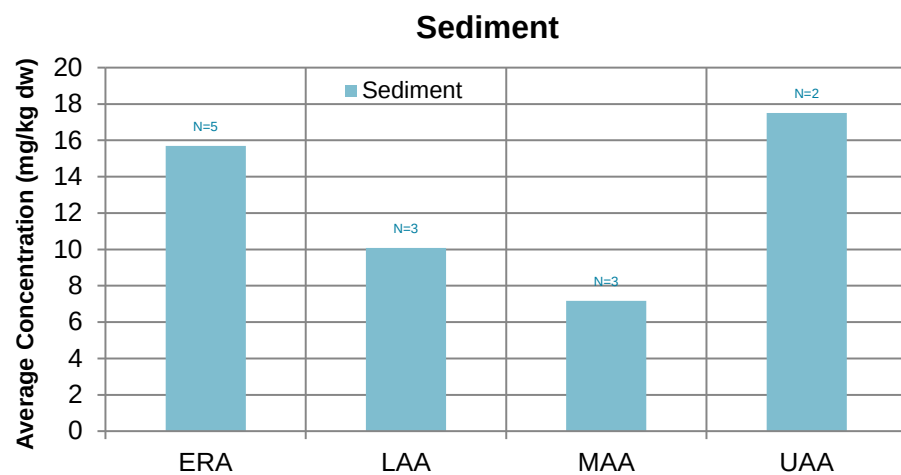
Baseline Ecological Risk Assessment for OU-4

Mean Barium Concentrations for Tissue Data by Ecological Area



FIGURE

AD3-6



Notes:

1. Averages are Kaplan-Meier estimates of the mean.
 2. If results are all non-detect in a given media/tissue for a given location, concentration is plotted as zero.
- COPC: constituent of potential concern
 dw: dry weight
 ERA: ecological reference area
 LAA: lower assessment area
 MAA: middle assessment area
 mg/kg: milligrams per kilogram
 N: sample number
 UAA: upper assessment area

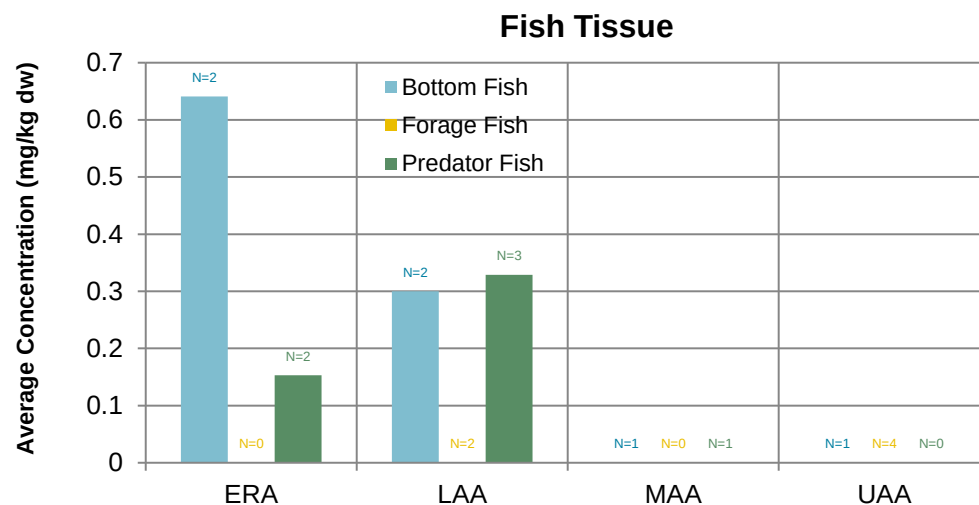
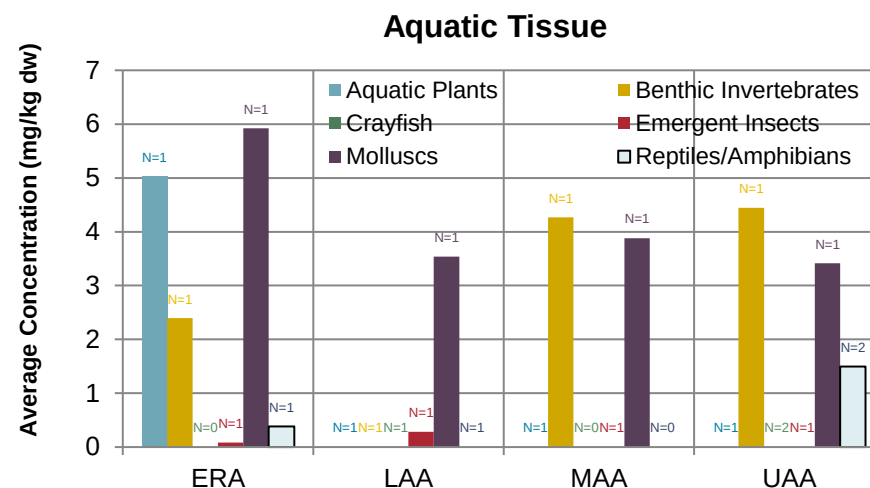
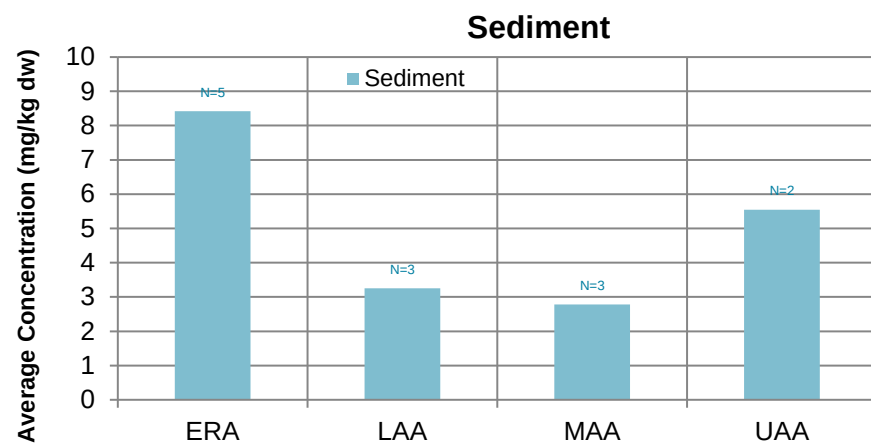
Anniston PCB Site
 Anniston, Alabama

Baseline Ecological Risk Assessment for OU-4

Mean Chromium Concentrations for Tissue Data by Ecological Area



FIGURE
AD3-7



Notes:

- Averages are Kaplan-Meier estimates of the mean.
 - If results are all non-detect in a given media/tissue for a given location, concentration is plotted as zero.
- COPC: constituent of potential concern
 dw: dry weight
 ERA: ecological reference area
 LAA: lower assessment area
 MAA: middle assessment area
 mg/kg: milligrams per kilogram
 N: sample number
 UAA: upper assessment area

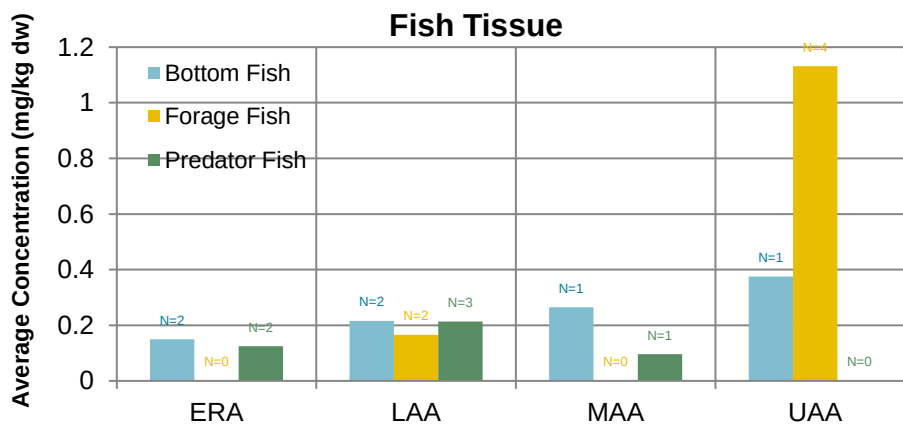
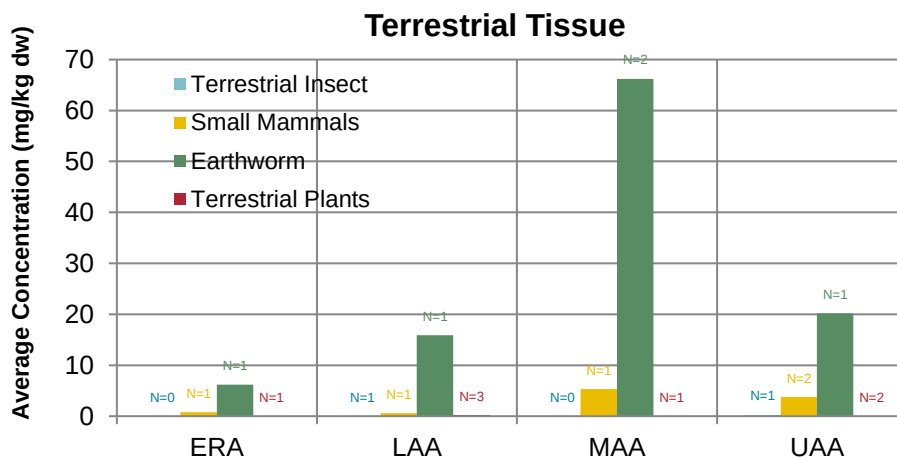
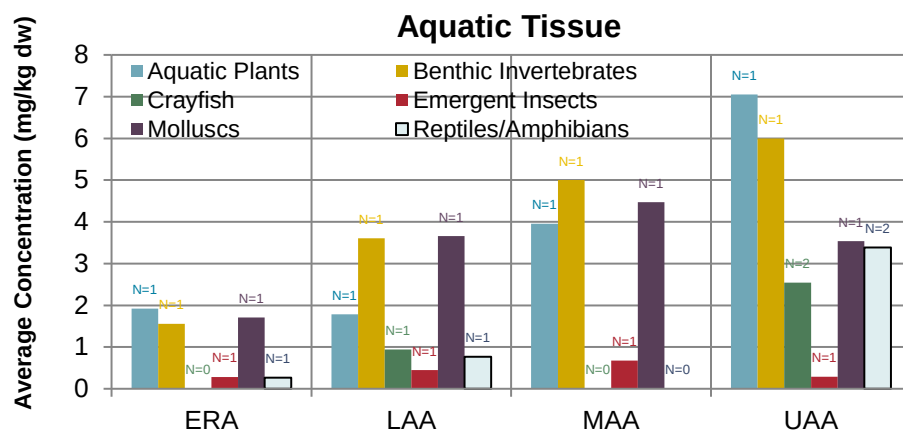
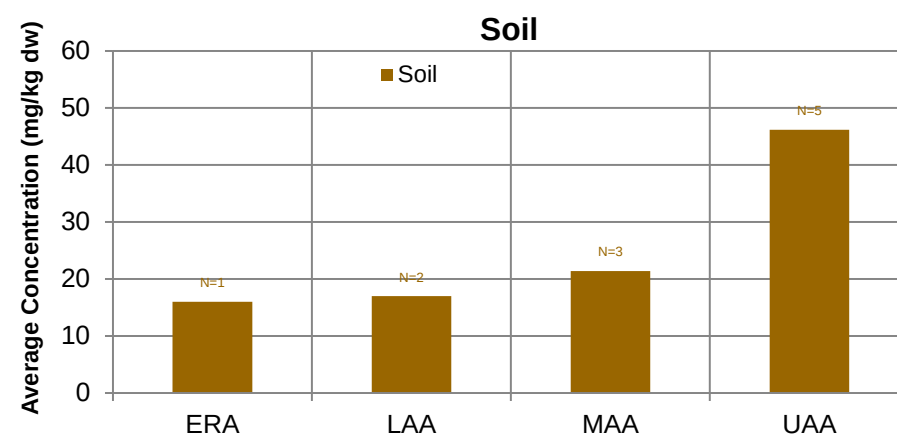
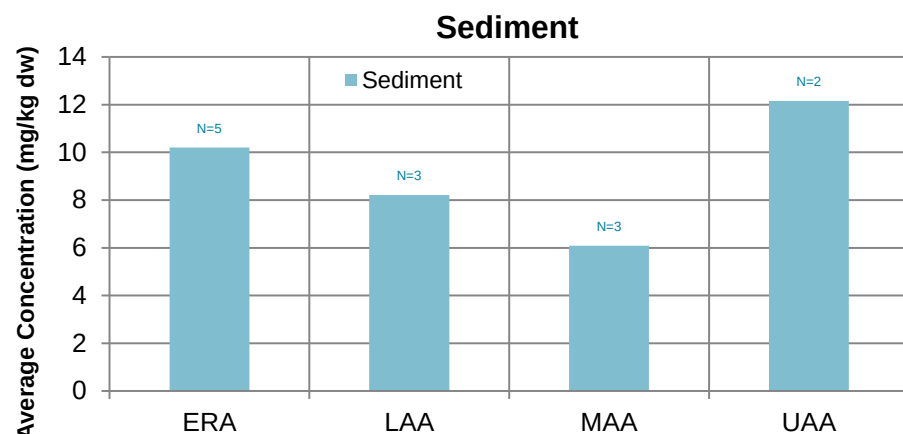
Anniston PCB Site
Anniston, Alabama

Baseline Ecological Risk Assessment for OU-4

Mean Cobalt Concentrations for Tissue Data by Ecological Area



FIGURE
AD3-8



Notes:

- Averages are Kaplan-Meier estimates of the mean.
 - If results are all non-detect in a given media/tissue for a given location, concentration is plotted as zero.
- COPC: constituent of potential concern
 dw: dry weight
 ERA: ecological reference area
 LAA: lower assessment area
 MAA: middle assessment area
 mg/kg: milligrams per kilogram
 N: sample number
 UAA: upper assessment area

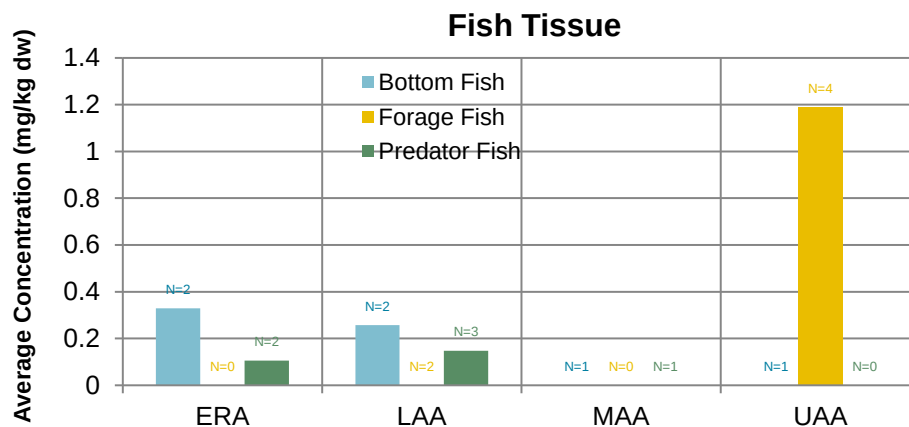
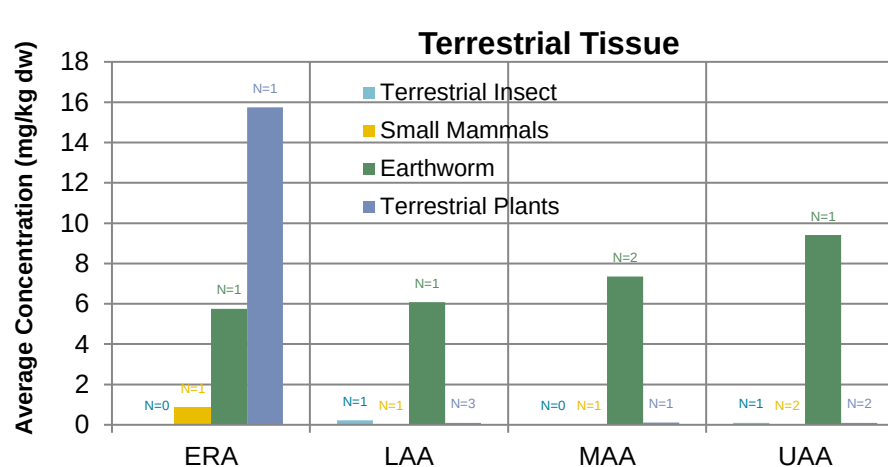
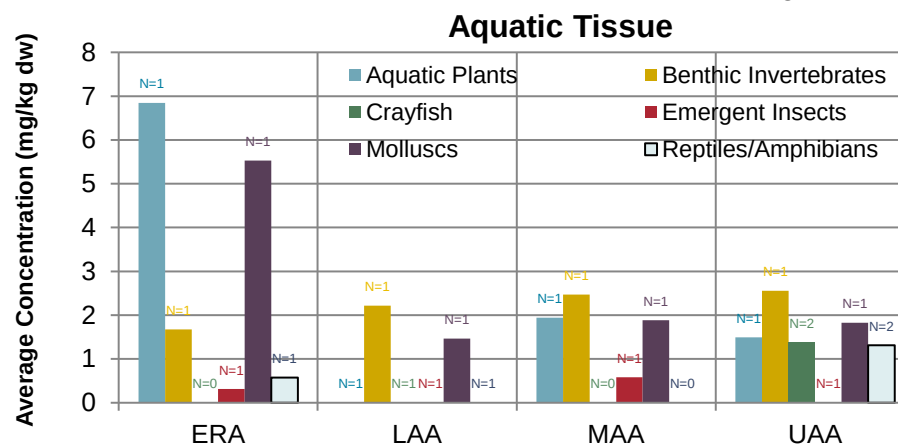
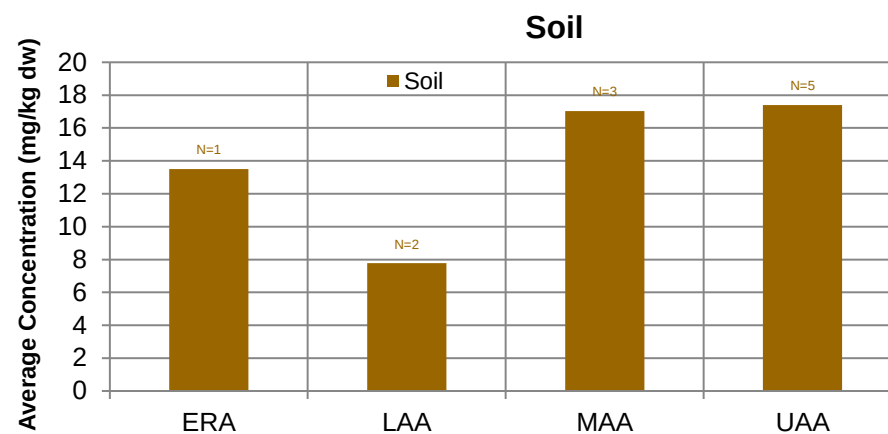
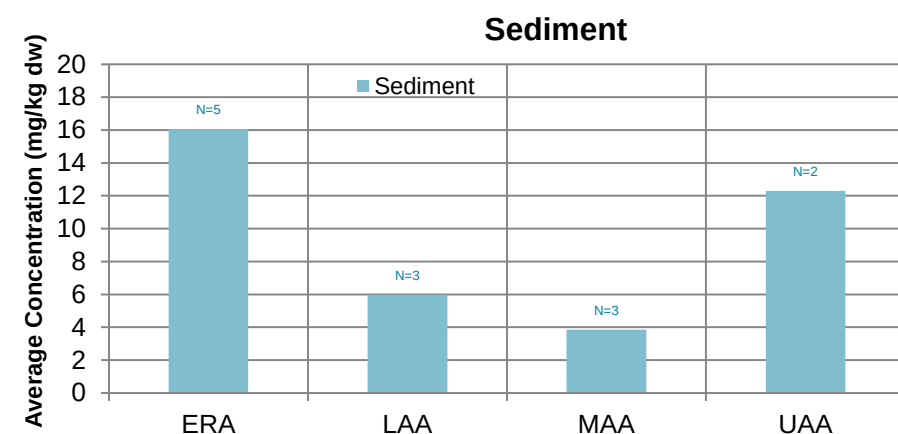
Anniston PCB Site
 Anniston, Alabama

Baseline Ecological Risk Assessment for OU-4

Mean Lead Concentrations for Tissue Data by Ecological Area



FIGURE
AD3-9



Notes:

1. Averages are Kaplan-Meier estimates of the mean.
 2. If results are all non-detect in a given media/tissue for a given location, concentration is plotted as zero.
- COPC: constituent of potential concern
 dw: dry weight
 ERA: ecological reference area
 LAA: lower assessment area
 MAA: middle assessment area
 mg/kg: milligrams per kilogram
 N: sample number
 UAA: upper assessment area

Anniston PCB Site
 Anniston, Alabama

Baseline Ecological Risk Assessment for OU-4

Mean Vanadium Concentrations for Tissue Data by Ecological Area



FIGURE

AD3-10

Figure AD15-1. Benthic Macroinvertebrate Community Survey Indices, Riffles
2006 Data
Reference Locations and OU-4 Assessment Areas

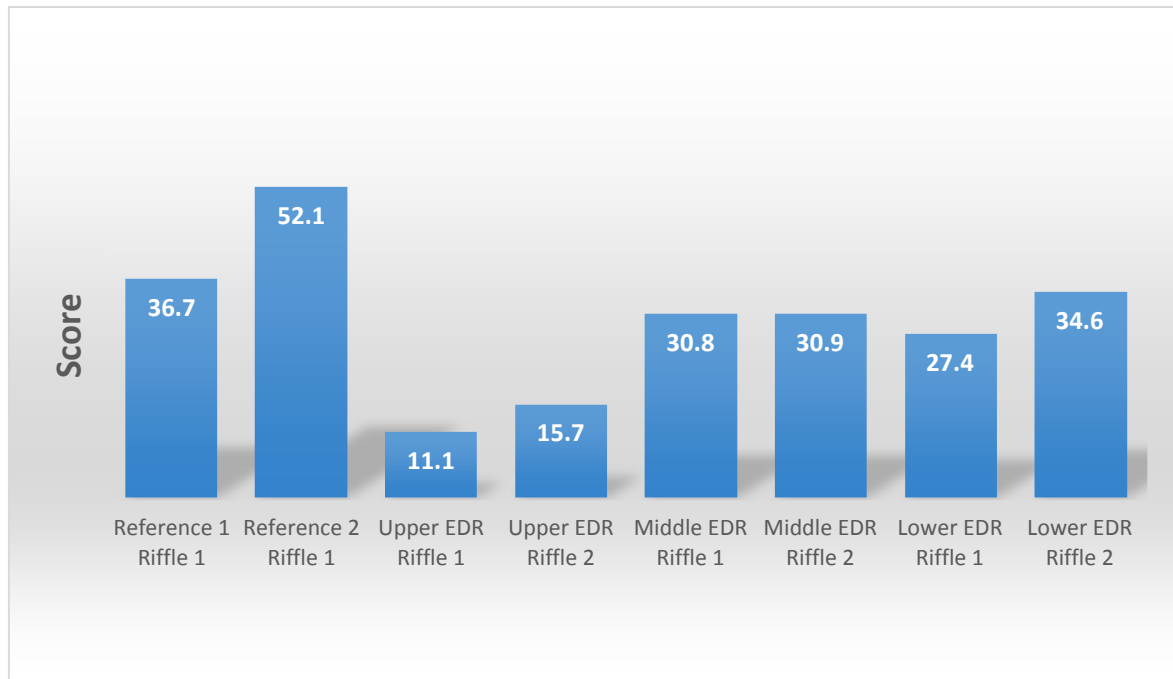


**Figure AD15-2. Benthic Macroinvertebrate Community Survey Indices, Runs
2007 Data
Reference Locations and OU-4 Assessment Areas**

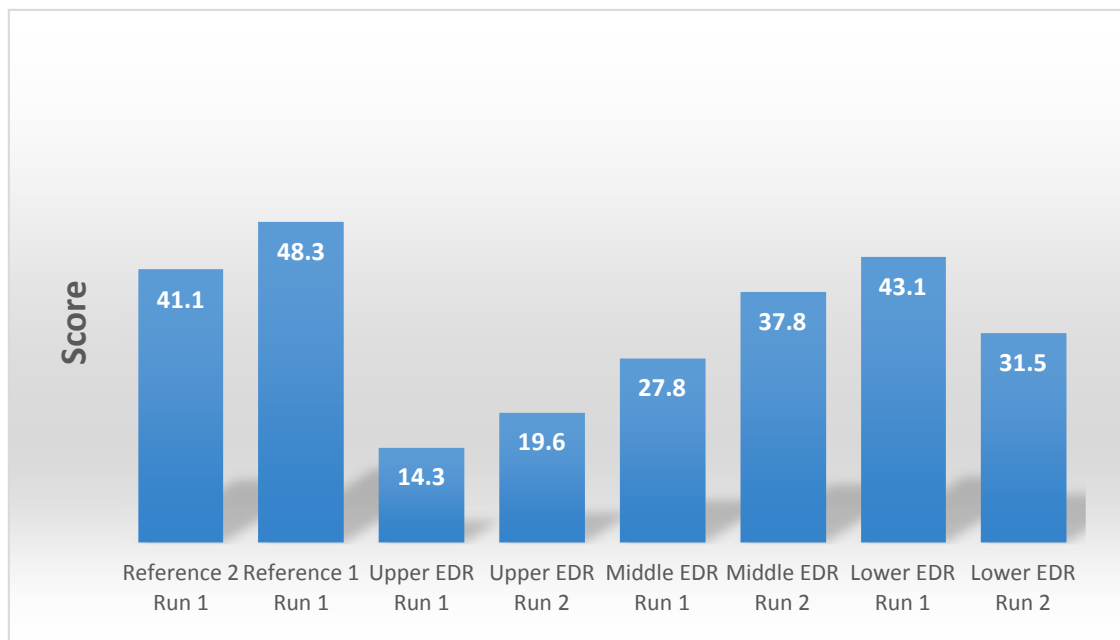


Figure AD20-1a. ECx estimates for 42d young/female (Normalised to survival and as % control).

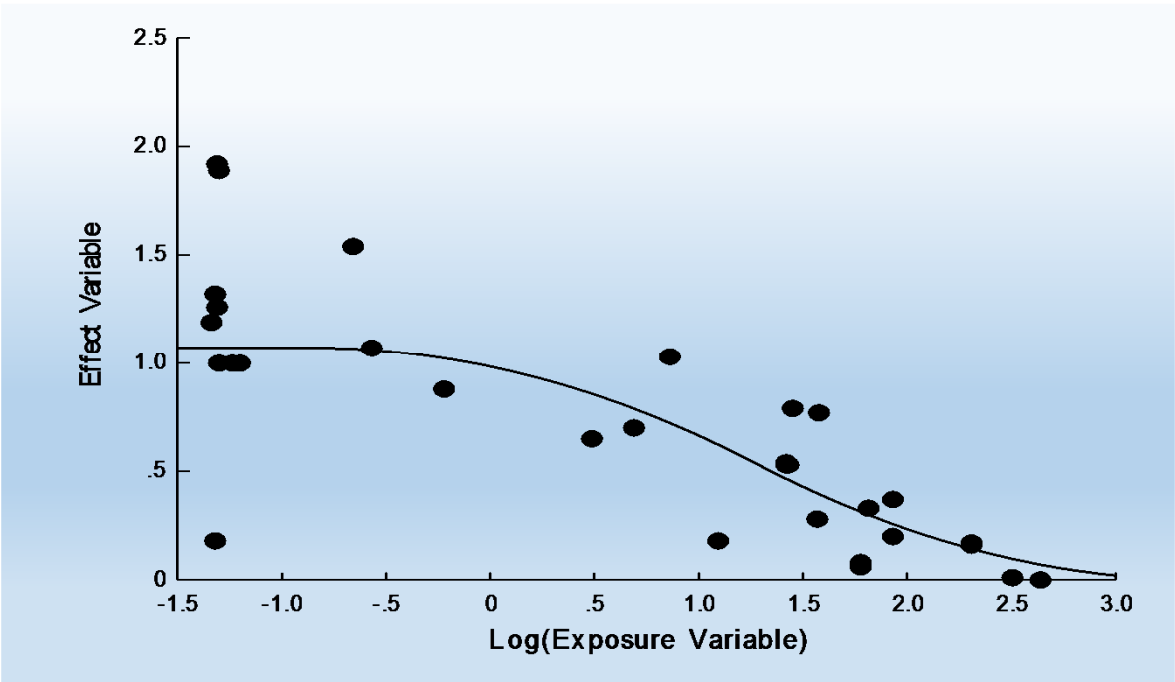


Figure AD20-1b. ECx estimates for 42d young/female (normalized to survival and as % control). Non-detect values substituted with $\frac{1}{2}$ method detection limit.

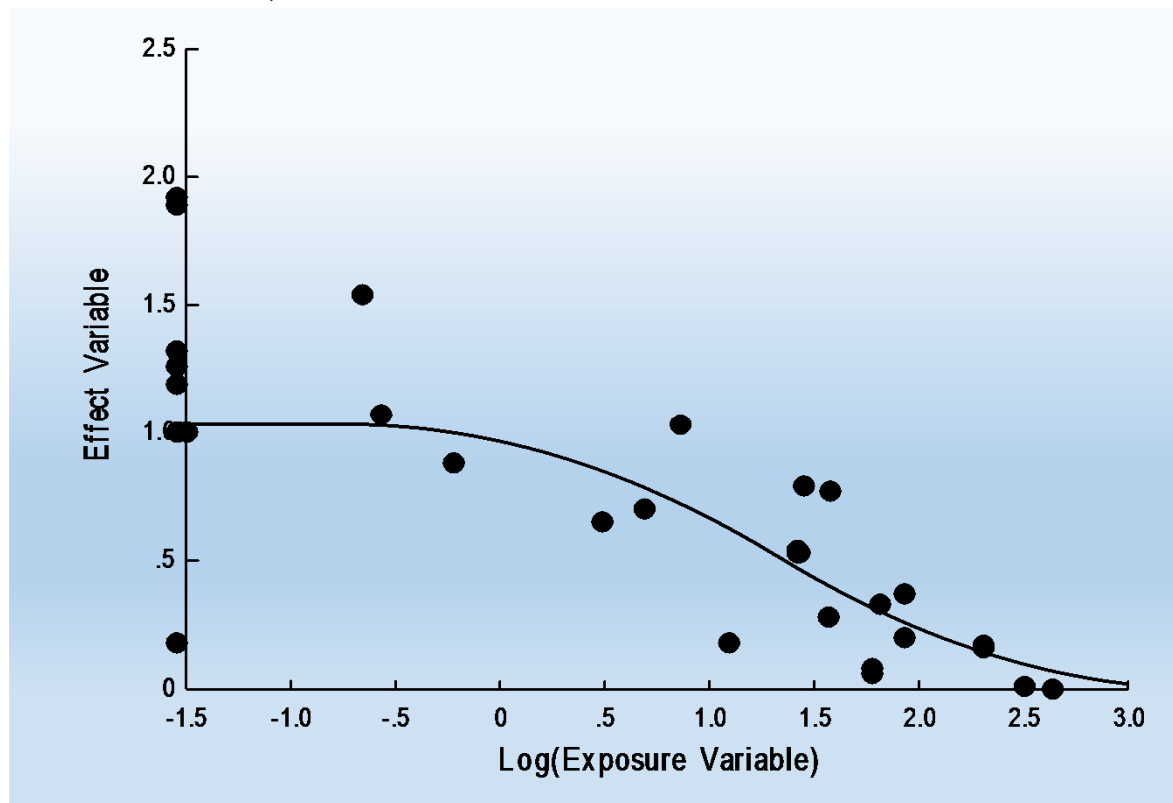


Table AD20-2a. ECx estimates for 42d Survival. Non-detect values substituted with method detection limit.

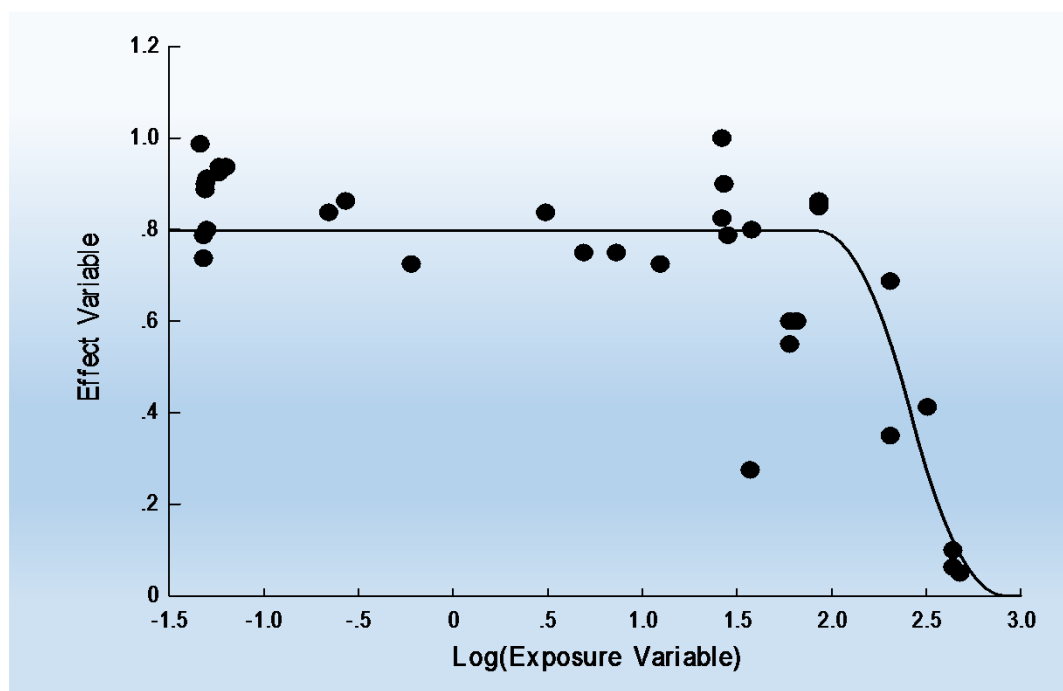


Table AD20-2b. ECx estimates for 42d Survival. Non-detect values substituted with 1/2 method detection limit.

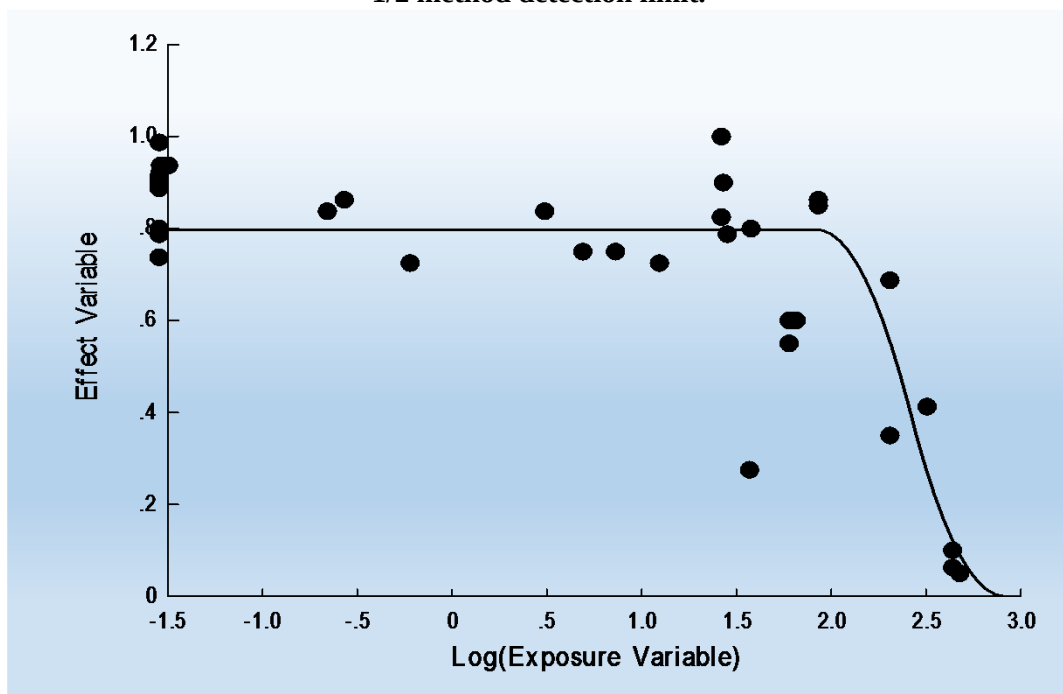


Figure AD20-3a. ECx estimates for 42d biomass per replicate chamber. Non-detect values substituted with method detection limit.

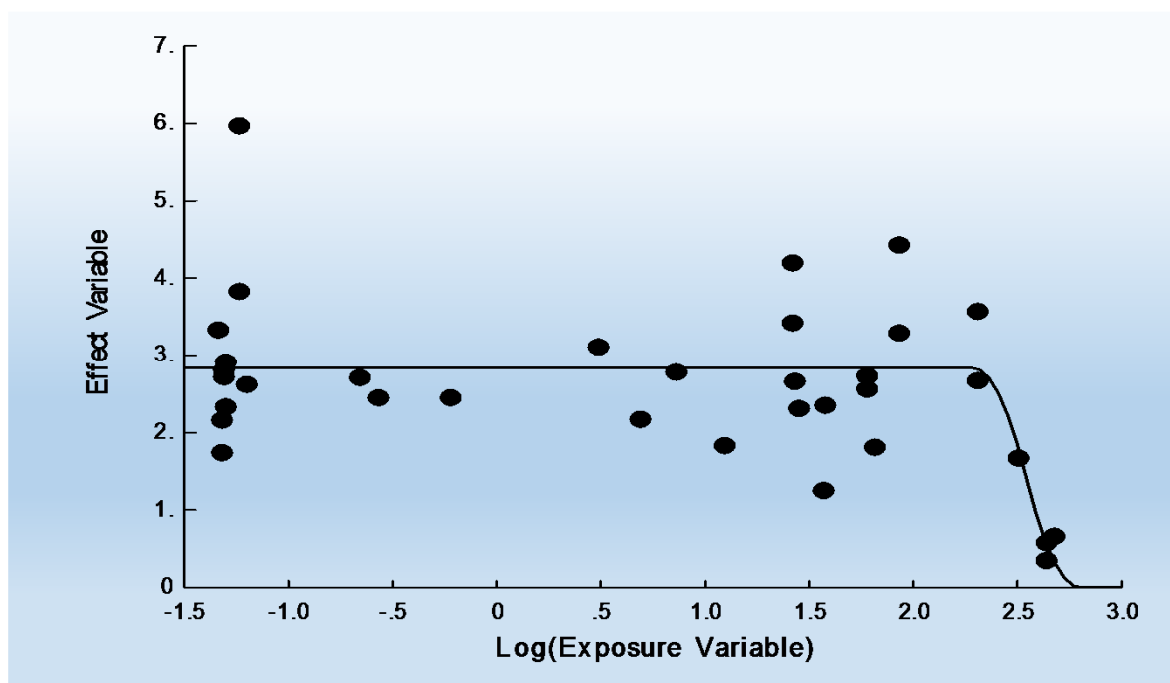
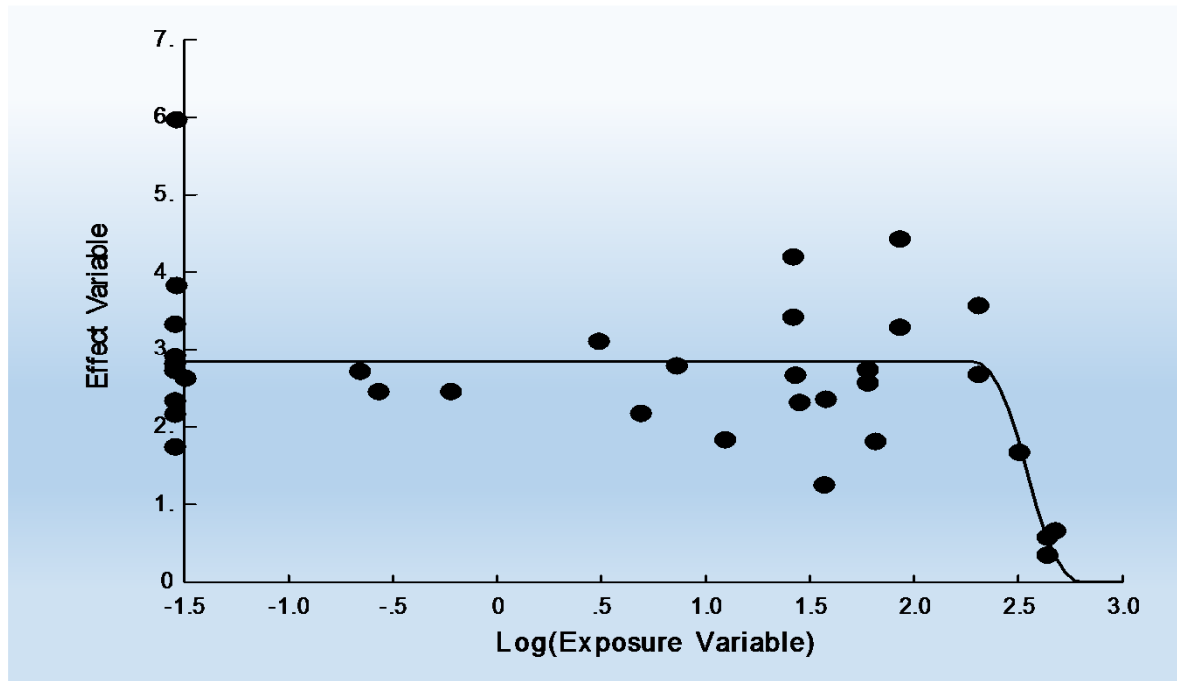


Figure AD20-3b. ECx estimates for 42d biomass per replicate chamber. Non-detect values substituted with $\frac{1}{2}$ method detection limit





June 4, 2018

Ms. Pamela J. Langston Scully, P.E.
Remedial Project Manager
United States Environmental Protection Agency, Region IV
Atlanta Federal Center
61 Forsyth St.
Atlanta, GA 30303-8960

Re: Pharmacia LLC/Solutia Inc. Comments on the Baseline Ecological Risk Assessment Addendum for Operable Unit 4
Anniston PCB Site (Docket No. 1:20-cv-0749-KOB)

Dear Ms. Langston Scully:

Pharmacia LLC and Solutia Inc. (P/S) have reviewed the Baseline Ecological Risk Assessment Addendum for Operable Unit 4 (OU-4 BERA Addendum) of the Anniston PCB Site provided by the United States Environmental Protection (USEPA) on March 5, 2018 and the remedial goal options (RGO) document provided on May 1, 2018. Technical comments from P/S on the OU-4 BERA Addendum are provided in Attachment A and focus on new information and interpretations provided in the two documents. Many of the technical issues previously discussed between P/S and the USEPA are not included in the attached technical comments as P/S and the USEPA are collectively focused on completing the ecological risk assessment process for the OU-4. Editorial comments from P/S on the OU-4 BERA Addendum are provided in Attachment B and are focused on readability and clarity related concerns.

Based on our discussions during the March 27, 2018 meeting in Edison, NJ, the process to update the OU-4 BERA Addendum will include consideration/incorporation of the attached comments and the discussions during the March 27th meeting. We look forward to the receiving the revised OU-4 BERA Addendum, and our team is available to clarify the comments provided in Attachments A and B if this would be helpful to the USEPA team revising the documents.

Please contact me if you have any questions.

Sincerely,

A handwritten signature in blue ink, appearing to read "E. Harris", followed by a horizontal line.

E. Gayle Macolly Harris
Manager, Remedial Projects
Solutia Inc.

Attachments

cc: Mr. Chip Crockett (ADEM)
Mr. Thomas Dahl

Attachment A

Comments on the USEPA Baseline Ecological Risk Assessment Addendum for Operable Unit 4, Anniston PCB Site, Anniston Alabama

Comments from Pharmacia LLC/Solutia Inc. (P/S) on the draft Operable Unit 4 Baseline Ecological Risk Assessment Addendum (OU-4 BERA Addendum) received from the United States Environmental Protection Agency (USEPA) on March 5, 2018 are provided below. The review by P/S also included an Excel file of remedial goal option (RGO) calculations that was received on March 27, 2018 and the final text and RGO files received on May 1, 2018. The OU-4 BERA Addendum provides an alternative weight of evidence (WOE)-based risk evaluation for the suite of receptors evaluated in the Baseline Ecological Risk Assessment for Operable Unit 4 (OU-4 BERA) that was submitted to USEPA in October 2016. The revised WOE is based on a number of alternative inputs to the risk calculations as well as alternative interpretation of the results. Comments on many of the elements of the OU-4 BERA Addendum have been provided to and discussed with USEPA on previous occasions as a part of the comment/response process for the OU-4 BERA and in comments provided to the USEPA by P/S on the Outline for the OU-4 BERA Addendum on July 6, 2017.

This document provides a focused set of comments on the OU-4 BERA Addendum that are intended to facilitate bringing the OU-4 BERA process to a close and does not reiterate previous comments. The OU-4 BERA Addendum and the OU-4 BERA (Arcadis 2016) employ a similar WOE-based approach and evaluate the same suite of receptors and risk scenarios. While there are some differences in the technical inputs to risk estimations, the primary difference between the two documents is with the interpretation of the lines of evidence (LOE) that are used to formulate overall WOE findings. The two documents disagree in the interpretation of three key issues: 1) assignment of risk categories based on HQs with more than one significant figure (see response to comment 134 and 135 in Appendix A to the OU-4 BERA Addendum); 2) the spatial application of toxicity value exceedances for benthic community; and 3) the weighting of LOE for mammals. Risk categories and significant figures for HQs have been addressed in previous comments and in the May 16, 2017 meeting with USEPA and are not discussed further herein. The spatial application of toxicity value for benthic invertebrates and the LOE weighting for small mammals are discussed by receptor group in Sections 1 and 2 below. Additional, secondary comments for specific receptor groups are also provided for completeness in Sections 1 and 2. Comments on the overall WOE interpretation are provided in Section 3; comments on RGOs are provided in Section 4; and comments on risk classification terminology are provided in Section 5. Attachment 1 provides a brief list of minor editorial comments.

1. Benthic Invertebrates

The primary issue of concern with the OU-4 BERA Addendum's interpretation of risk to the benthic invertebrate community (BIC) is the way in which an individual sample concentration within an entire reach was used as the basis for the risk finding for that entire reach. Secondary issues include the OU-4 BERA Addendum's interpretation of benthic community metrics and the selection and application of benthic critical tissue concentrations (CTCs). Each of these is discussed below.

1.1 Interpretation of Risk for Site Reaches and Assessment Areas

In the OU-4 BERA Addendum, USEPA classified risk in each reach for the two highest weighted LOE based on the point-by-point comparison of sediment samples to effects concentrations (ECs) based on the very conservative reproductive and growth endpoints for *Hyalella Azteca* and *Chironomus dilutus*. In the classification scheme applied by USEPA for the LOEs, if any sample in the reach exceeded the EC10* (i.e., for the reproductive endpoint, the total polychlorinated biphenyl (PCB) concentration at which 10% reduction in reproduction compared to reference is expected), the risk in the entire reach was classified as unacceptable regardless of the overall distribution of sediment concentrations. This classification scheme is misleading. For example, in reach C4, 84% of all sediment concentrations are below the EC0* (see Table 6-4a of the OU-4 BERA) indicating low risk to the BIC, but the OU-4 BERA Addendum classified the risk as "Unacceptable" in this entire reach. It is recommended that the reach classifications be changed to address this issue. As an example, the classification of reach C4 might be "generally acceptable with localized areas of unacceptable risk".

In addition to the use of individual sample comparisons to EC* values, the WOE includes assessment area (AA)-based findings based on results of the sediment toxicity testing as a LOE. While P/S agree with the overall WOE finding that risk to the benthic community in areas beyond reach C4 are not likely, the way in which the results of the individual toxicity test sample locations were applied is not supported. The toxicity test results for the three available surface samples from the toxicity testing were included as a LOE and given the same overall weight as the EC* comparisons. While it is not clear exactly how this LOE was included in the overall WOE findings, it is inappropriate to use a toxicity test result for a single manipulated surface sample to represent an entire AA of the site (i.e., multiple reaches). As noted by P/S in previous response to comment documents on the OU-4 BERA, the sediment toxicity program was designed to collect and test sediments exhibiting a range of total PCB concentrations for the express purpose of developing statistical models of effects versus PCB concentrations. The program was not designed to estimate in-situ risk in OU-4, which would have required a completely different sample design. See Attachment A to the OU-4 BERA Addendum, Comment 120 for additional details on this issue.

1.2 Interpretation of Benthic Invertebrate Community Data

As done in the OU-4 BERA, the OU-4 BERA Addendum identifies the evaluation of the benthic community data as a secondary LOE. As such, it is not included directly in the overall WOE findings. These comments summarize specific technical concerns regarding the BIC analysis included in the OU-4 BERA Addendum. The USEPA used the Wadeable Multi-Habitat Bioassessment Index (WMB-I), developed and validated by the Alabama Department of Environmental Management (ADEM) for small Wadeable streams in the Piedmont, Ridge and Valley eco-region of Alabama to evaluate the benthic community data collected in OU-4. P/S have previously commented on earlier drafts of this assessment that its use is not suitable in this assessment because none of the BIC samples in OU-4 were collected in locations that meet the stream characteristics specified in the WMB-I protocol (ADEM 2014). ADEM confirmed that the WMB-I is only valid for locations that meet the specifications outlined in the protocol (personal communication, ADEM 2017). The OU-4 BERA Addendum asserts that despite the differences in the stream characteristics of OU-4 and those specified by the protocol, the WMB-I can be used to evaluate an upstream to downstream trend. However, this assertion is based on suppositions that are inconsistent with the mathematical properties of the WMB-I calculation. The use and development of

multimetric indices are based on science and testing related to specific habitat characteristics. Guidance published by USEPA (Barbour et al. 1999) describes the process for multimetric development and use. The guidance is very clear that these approaches are meant to discriminate between impaired and unimpaired conditions by establishing percentiles of the distribution of biological metrics at reference streams with similar characteristics to the stream being tested. The guidance discusses the importance of demonstrating the performance characteristics of the multimetric indices to define the range of site classes for which they are suitable. Based on the lack of applicability of the protocol to OU-4, P/S recommend that this analysis be removed from the OU-4 BERA Addendum.

1.3 Comparison of OU-4 Tissue Concentrations to Critical Tissue Concentrations (CTCs)

In the OU-4 BERA Addendum, USEPA evaluated risk to benthic invertebrates using a single set of CTCs for all types of benthic invertebrates for which tissue concentrations are available as a secondary LOE. The use of a single set of CTCs for all types of benthic invertebrates is not supported given the clear variability in species sensitivity indicated by the site-specific toxicity testing for *Hyalella azteca* and *Chironomus dilutus* and *Lampsilis siliquoidea*. P/S recommend revising this analysis to include the more specific values for different types of invertebrates for comparison. The OU-4 BERA Addendum no observable adverse effect level (NOAEL) and lowest observed adverse effect level (LOAEL) CTCs for PCBs (0.59 and 1.4 milligrams per kilogram [mg/kg] wet weight) are based on a study where mayfly larvae were exposed to field sediments containing PCBs and other toxic constituents (Van Geest et al. 2011). As noted by USEPA, a wide range of CTCs is available for different benthic species, with NOAEL and LOAEL values for PCBs in benthic invertebrate tissue ranging from 0.2 to 290 mg/kg dry weight (dw) and 5 to 1,488 mg/kg dw, respectively. Although the toxicity data available to derive CTCs are relatively sparse and many of the available studies have shortcomings, CTCs evaluated in the OU-4 BERA are consistent with independent LOE indicating that some benthic receptor groups have lower sensitivity to PCBs than suggested by the USEPA-recommended CTCs.

In addition, the OU-4 BERA Addendum states that "The P/S-proposed receptor-specific TRVs fail to evaluate potential risk from PCBs in the benthic invertebrate group in which the highest tissue residues were measured (molluscs), and underestimate risk to benthic invertebrates in the UAA." This statement is not true. The OU-4 BERA includes mollusc-specific CTCs and includes that evaluation in Table 6-11. It is recognized based on comments and responses on the OU-4 BERA that USEPA does not agree with the mollusc CTCs. However, the mollusc CTC analysis is included in the OU-4 BERA and supports the finding of the site-specific toxicity testing that molluscs are generally less sensitive to PCBs. In addition, the OU-4 BERA Addendum bases risk conclusions for threatened or endangered mollusc species that may be present in OU-4 on tissue residue hazard quotient (HQs) using CTCs for non-mollusc species as well as general comparisons to the EC* values discussed above for non-mollusc species. These risk conclusions are not supported based on the site-specific mollusc toxicity study (USFWS 2015) and the mollusc-specific CTC comparison provided in the OU-4 BERA.

2. Bird and Mammals

The primary issue associated with the WOE for birds and mammals is associated with the way in which the LOE were weighted for small mammals. Secondary issues associated with the calculation of DLC risks were also identified. Each of these issues are discussed below.

2.1 LOE Weighting for Small Mammals

The OU-4 BERA Addendum gives highest weight to the LOE for small mammal HQs based on measured dietary exposure, while the OU-4 BERA weighted the tissue-based HQ LOE as having the highest confidence. P/S hold that the tissue-based LOE should have the highest weight and the overall WOE conclusions should be adjusted accordingly. USEPA cites a limited dataset for the small mammal CTCs and low confidence in the measured small mammal tissue as the reasons for this change. However, the CTC for small mammals was taken from the same study from which the dietary toxicity reference values (TRVs) were derived. While there was some uncertainty as to whether the concentrations measured in the study were wet weight or dry weight, review of the methods indicated that the resulting outputs were most likely in wet weight. Moreover, these values are considered conservative tissue residue estimates because only a small subset of congeners were actually measured in the study to calculate the total PCB concentrations. If additional congeners had been measured, it is likely that the CTCs would be higher based on this study.

The reason for the finding of low confidence in the measured small mammal tissue is not explained. The dataset for small mammal tissue was collected according to approved field sampling plans and the data were fully validated, similar to other tissues (such as dietary items consumed by small mammals in the dietary model selected as the LOE with the highest weight) collected for the site which are not considered to have lower confidence. Samples were collected across of a range of site soil concentrations and habitat types. As such, there is no basis to discount the small mammal CTC LOE and it should be given the highest weight as was done in the OU-4 BERA.

2.1 Revised Dioxin-Like Compound (DLC) Calculations and Finding

In the OU-4 BERA Addendum, USEPA states risk associated with exposure to DLCs is underestimated because uptake of PCB 126 was not evaluated in the OU-4 BERA. In fact, PCB 126 was evaluated in the OU-4 BERA using an earthworm BAF to estimate uptake of PCB 126 to terrestrial invertivores. The PCB 126 BAF (0.031; OU-4 BERA Table F-7) used by P/S is a literature-derived value based on the median of polychlorinated dibenzo-*p*-dioxin / polychlorinated dibenzofuran congeners (Fagervold et al. 2010). Because PCB 126 was primarily not detected in OU-4 soil, sediment, and tissues, a site-specific bioaccumulation factor (BAF) could not be calculated (OU-4 BERA Table F-6).

USEPA conducted a limited evaluation for Carolina wren, assuming a diet of earthworms and assuming only exposure to PCB 126 at the maximum detected concentration in earthworms (0.043 mg/kg; 26,875 nanograms toxic equivalent per kilogram [ng TEQ/kg] dw). The OU-4 BERA Addendum predicts unacceptable risk based on this evaluation. However, this evaluation likely overestimates risk to the Carolina wren. PCB 126 was detected in only three out of five samples in OU-4, and the other two detected concentrations were lower (0.0047 mg/kg, 0.011 mg/kg) than the maximum. Additionally, PCBs were not detected in any other soil invertebrate tissues (i.e., grasshopper, cricket). The modeled concentrations of dioxin like (DL)-PCBs (including PCB 126) predicted using the P/S BAFs were lower (OU-4 BERA Table F-8). Based on the limited number of tissue samples analyzed for DL-PCBs, the small number of detected concentrations of PCB 126 in OU-4 biotic and abiotic media, and much lower predicted risk using literature-based BAFs for DLCs, risk to Carolina wren from DLCs is considered to be

overestimated and highly uncertain in the USEPA analysis for Carolina wren included the OU-4 BERA Addendum. P/S recommend including this evaluation in the uncertainty analysis.

3. Overall WOE Findings

In concept, the OU-4 BERA and the OU-4 BERA Addendum are in agreement that the LOE with the highest weight would be considered as the primary LOE and that the remaining LOE would be considered secondarily to formulate overall conclusions for each Assessment Endpoint (AE) or receptor group. While each LOE employed for each AE is clearly defined and the results are summarized in the OU-4 BERA Addendum, the way in which the LOE were combined to formulate overall WOE conclusions is not clear in some cases. It is recognized that professional judgment is required to integrate different LOE. A description of the decision-making rationale would aid in understanding the overall WOE findings for each AE. There are a number of cases where the overall WOE conclusions do not match up with a specific LOE for an AE/receptor group. Additional clarification on the rationale for overall WOE findings would be useful for the following receptor groups:

• Terrestrial Invertebrates	• Aquatic insectivorous bird: tree swallow
• Benthic Invertebrates	• Herbivorous bird: morning dove
• Carnivorous mammal: weasel and red fox	• Terrestrial insectivorous bird: Carolina wren – 1
• Mixed diet mink 1	• Omnivorous bird: blue jay
• Piscivorous bird: great blue heron and king fisher	• Carnivorous bird: red-tailed hawk
	• Mixed diet insectivorous bird: Carolina wren -2

4. Remedial Goal Options

Both the OU-4 BERA and the OU-4 BERA Addendum provide RGOs only for receptors for which risk was indicated. Differences in values calculated are based on some of the revisions to receptor inputs and to a change in the calculation inputs. Specific comments on RGOs and methods presented in the OU-4 BERA Addendum are:

- RGOs are provided from non-mustelid species using mink TRVs – these values should be removed.
- No value is provided for small mammals based on CTCs, which should be the LOE with the highest weight (See Section 2.1 above). Since no risk is indicated based on this LOE, P/S would recommend removing small mammal-based RGOs from the Table.
- In footnote 1 of Table 7-3a, it is specified that risk was not indicated for terrestrial plants and invertebrates so no RGOs were calculated. However, this table presents literature-based benchmarks for soil. These should be removed from the RGO table.
- In the RGO calculation for DLCs in fish, the sitewide BAF of 0.028 kg dw/g lipid employed cannot be reproduced. The OU-4 TEQ sediment data were collected from 13 total locations (10 of which had both dioxin/furan and PCB congener data; 7 of those 10 were located within 50 feet of a biological sampling area) and represent a small proportion of OU-4 sediments. Any resulting

BAFs are considered highly uncertain and not useful for calculation of RGOs. In the OU-4 BERA Addendum, USEPA also calculated tissue HQs using CTCs from Tillett et al (2017; published after the OU-4 BERA was submitted), and no unacceptable risk is predicted for DLCs (Table AD-34). Based on this finding of no risk, P/S recommend removing fish-based DLC RGOs.

5. Inconsistent Risk Classification Terminology

The OU-4 BERA and the OU-4 BERA Addendum use different approaches for classifying or categorizing the calculated risks levels. While both documents classify HQ values relative to the NOAELs and LOAELs, the difference in risk classification terminology is more than semantical. The risk categories used in the OU-4 BERA (negligible, low, moderate and high) are different from those used in the OU-4 BERA Addendum (acceptable, indeterminant, unacceptable and high unacceptable). The differences are two-fold and will result in risk communication difficulties for the project. The first difference is the OU-4 BERA Addendum's use of risk management terminology in contrast to the risk assessment terminology used in the OU-4 BERA. While risk assessments can provide conclusions regarding the level of risk that may be present in an area, risk management conclusions such as the acceptability or unacceptability of these risks are traditionally presented in the feasibility study (FS) as part of the preliminary remedial goals process. The OU-4 BERA Addendum is not the appropriate document to make and communicate risk management decisions that can only be made by the USEPA as part of the FS process. The second difference is related to transparency and risk communication. Presenting risk assessment information and findings to the public is challenging even when a consistent set of risk categories is used. The communication of the ecological risks assessment process and results for OU-4 will be made unnecessarily complicated by using two different classification approaches. An example challenge is describing how risks calculated in the OU-4 BERA as being low are presented as indeterminant risks in the OU-4 BERA Addendum. P/S recommend that the OU-4 BERA Addendum be revised to use the same risk assessment classification terminology used in the OU-4 BERA.

References

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Attachment B

Editorial Comments on the USEPA Baseline Ecological Risk Assessment Addendum for Operable Unit 4, Anniston PCB Site, Anniston Alabama

- The pdfs of WOE Tables AD-42 through AD-44 have a few cells where words are cut off.
- RGO Table 7-1b shows values for fish in the top two tables that are titled Critical Tissue Concentrations. These appear to be RGOs. Title on the top two tables should be revised.
- RGO Tables 7-2 and 7-3 (Wildlife RGOs for DLCs) need units that specify media (e.g., mg/kg dw sediment, etc).
- In-text summary table AD-58 shows U for all fish types in all reaches but WOE table AD-42 shows forage fish should be I for UAA and LAA.
- The text description of risk categories on pages 23 and 24 appear to be missing the "equal to" element.
- The text in section 4.1 calls out the percentages that SWAC 95 UCLs are lower than the standard 95 UCLs. The way in which these differences were estimated is confusing. P/S would recommend simply removing the call outs to specific percentages from the text and referring to tables AD-1 and AD-2 for all values and differences.
- The value cited as the upper end of the range of benthic invertebrate CTVs on page 19, 2nd paragraph of 290 mg/kg dw is not consistent with the upper range shown on Table AD-30 of 382 mg/kg dw.
- The summaries of the OU-4 BERA WOE in Table AD-43 had a few transcriptional errors in the section presenting the OU-4 BERA WOE as follows:
 - a. Aerial Invertivores (Tree swallow): The OU-4 BERA has a line item for HQs based on measured diet and high sensitivity TRV for C7-C10, but the EPA table does not.
 - b. Herbivores (Mourning dove): For the HQ for the modeled egg and high sensitivity egg TRV, C1 West potential risk is 'moderate' in OU4 BERA, but the Addendum shows 'negligible'.
 - c. Terrestrial Insectivores/Invertivores (Carolina Wren -1): For the HQ for modeled diet and mid-sensitivity TRV, the second row needs to be expanded (missing some EUs - C7 South, C8 North and South, C9). Also, C6 south is shown twice and should be in the row for the low risk category only.
 - d. Terrestrial Omnivores (Blue jay): For the HQ for the modeled diet and mid- sensitivity TRV, C3 north is shown twice. It should be in the line for moderate risk only.

Appendix F - Data Summary Tables and Risk Estimates Calculated for OU 4

The tables in Appendix F of the BERA have been revised to include the data validation qualifiers and the pore water data. An electronic copy of Appendix F is included below.