UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS TX 75202-2733

JUL 28 2010

Mr. David Keith
Project Coordinator
Anchor QEA
2113 Government Street
Building D, Suite 3
Ocean Springs, MS 39654

RE: Comments on Draft Sampling and Analysis Plan: Tissue Study
Comments on Draft Technical Memorandum on Bioaccumulation Modeling
San Jacinto River Waste Pits Superfund Site

Dear Mr. Keith:

The U.S. Environmental Protection Agency (EPA) has completed its review of the *Draft Sampling and Analysis Plan: Tissue Study* (dated June 2010) and the *Draft Technical Memorandum on Bioaccumulation Modeling* (dated June 2010) for the San Jacinto River Waste Pits Superfund Site.

Enclosed with this letter are EPA review comments for the purpose of the Unilateral Administrative Order for Remedial Investigation/Feasibility Study for this site.

Please address each review comment and feel free to contact me at (214) 665-8409, or by email at tzhone.stephen@epa.gov, if there are any questions or comments.

Sincerely,

Stephen L. Tzhone
Remedial Project Manager

Enclosure

cc: Ms. Ludmila Voskov, TCEQ
Ms. Jessica White, NOAA
Ms. Herminia Palacio, HCPHES

9186302

008635

EPA Comments on *Draft Sampling and Analysis Plan: Tissue Study* (dated June 2010) and *Draft Technical Memorandum on Bioaccumulation Modeling* (dated June 2010)

Draft SAP: Tissue Study:

1. p 14-15, Section 1.6.3: Statistical models described can not account for duration of exposure to any of the media. Nor can they account for physiological changes that may occur over time (dioxins and furans do bioaccumulate, but not without some degree of biotransformation over time). This is understandable because such data were not available to analyze. We should not forget that these analyses are merely a snapshot in time. For example: Some models comparing sediment to tissue concentration explained 50% of the variation. This does not necessarily mean only 50% of the tissue concentration is due to sediment concentration (because correlation analyses are not proof of cause and effect), especially over time. Sediment concentration may have explained 80% of the variation in tissue concentration at a different life stage. Of course, it is true that other sources of dioxins/furans also exist, however, we can not assume the other 50% of the variation in tissues is explained by those other sources. This comment is not asking for changes to be made other than it to be noted that there are uncertainties associated with even the best of statistical models. It should be made clear that these statistical analyses alone are not conclusive in regards to cause or source of tissue concentration.

2. p 23, Section 1.8.3.4: Please explain why both probability and likelihood tests will be performed, and what types of data are actually more appropriate for each. Describe the decision process if probability tests and likelihood tests do not agree? Which test carries more "weight" and why?

3. p 24, Section 1.8.3.5: Further describe use of measures of proximity. Which measures pertain to which species? Are multiple measures of proximity used for each species?

4. Table 2: Last page of Table 2 – bottom rows are cut short.

5. Section 1.4.2.1: "…total PCBs (as sum of Aroclors)." Aroclor fingerprints do not remain findable when mixed in the environment. DSHS now uses the sum of 43 specific PCB congeners.

6. Section 1.4.2.1: "…the available data on both TEQ_{DF} and total PCB concentrations on the Site and upstream are not adequate to characterize these populations, indicating that additional data are needed for valid comparisons." Additional data should assess PCBs based on total of 43 congeners. Aroclor data is not adequate.

7. Section 1.4.3, page 11: "Chemistry data for sediment collections from within the area of the impoundments (Table 1) show that dioxins and furans are present in sediments…" Table 1 in this document is about fish tissue data, nothing in it about sediment chemistry or quality. Is this referring to a table in another document, or maybe to Table 6 in this document?

8. Tables 10 and 11: PCB Aroclors as a parameter is outdated. PCB congener data is limited to "dioxin-like" congeners, which is a small number of the 209 total congeners. This is not appropriate for this study. Should analyze for all 209 PCB congeners, and use a set of 43 to represent "total PCBs". The 43 PCB congeners used by TDSHS for tissue analyses are listed below:

PCB-8	PCB-81	PCB-128	PCB-177

008636

PCB-18	PCB-87	PCB-138	PCB-180
PCB-28	PCB-99	PCB-151	PCB-183
PCB-37	PCB-101	PCB-153	PCB-187
PCB-44	PCB-105	PCB-156	PCB-189
PCB-49	PCB-110	PCB-157	PCB-194
PCB-52	PCB-114	PCB-158	PCB-195
PCB-66	PCB-118	PCB-167	PCB-201
PCB-70	PCB-119	PCB-168	PCB-206
PCB-74	PCB-123	PCB-169	PCB-209
PCB-77	PCB-126	PCB-170	

9. General comment - A true background needs to be determined, which is a background that is unaffected by the site contamination.

10. Section 1.5 Chemicals of Potential Concern and Tissue Analytes: Previous comments submitted still apply here. From the Sediment SAP Comments, whether or not a secondary COPC will not be evaluated in the BLRA will depend on the relative concentrations between the secondary COPC and dioxins and furans for each sample. TD refers determination of whether this is appropriate to TCEQ staff who have expertise in this area.

11. Section 1.8.3.1 Characterization of Exposures to Human Receptors: According to this section, exposure parameters will be calculated and will be used in probabilistic calculation of risks. Probabilistic risk assessment is not approved by the Texas Risk Reduction Rule. Deterministic risk assessment needs to be done using the calculated exposure parameters.

12. Sections 1.8.3.3 and 1.8.3.4 Comparison of Site and Background Data and Integration of Weight of Evidence for Risks: The TD defers to other TCEQ staff who have expertise in this area to make sure the background calculations and maximum likelihood calculations are appropriate.

13. Section 1.8.3.4 Integration of Weight of Evidence for Risks: The use of the weight of evidence approach to calculate the likelihood ratio for each risk assessment is not an approved Texas Risk Reduction Rule approach. Please also do deterministic risk assessment calculations (i.e., representative fish tissue concentrations to get risk/hazard).

14. Section 1.8.3.4 Integration of Weight of Evidence for Risks: The TD defers to EPA, but the draft cancer slope factor (SF_o) and reference dose (RfD) for dioxin may need to be considered here.

15. Section 1.8.3.5 Analysis of Tissue:Sediment Relationships: Is the proposed method for tissue:sediment relationships considered a standard methodology? Please provide references for this as a methodology for tissue:sediment relationships.

16. Section 1.8.3.5 Analysis of Tissue:Sediment Relationships: The calculation of site-specific BSAFs is important in order to be able to determine the acceptable sediment concentration to be protective of the human consumption of edible fish and shellfish. While the proposed methodology may be appropriate to determine tissue:sediment relationships, the TD considers the use of BSAFs a standard methodology. This Tissue SAP needs to also consider relevant state and federal guidance on the calculations and uses of BSAFs in determining acceptable sediment concentrations for a comparison to the proposed method. For example, the TCEQ Regulatory Guidance RG-366/TRRP-24 suggests the determination of the acceptable sediment concentration ($^{Sed}Sed_{Fish}$ PCL) by dividing the acceptable fish tissue concentration ($RBEL_{Fish}$) by the appropriate site-specific or literature-derived BSAF [$^{Sed}Sed_{Fish}$ PCL (mg/kg) = ($RBEL_{Fish}$/BSAF)].

008637

17. Section 1.4.3 Problem Definition - The discussion on page 11 explains that tissue data will be used to evaluate the contribution of COPCs to exposure and risks to ecological receptors and people who ingest organisms collected at the Site, and to the collected organisms themselves. Will any tissue concentrations be modeled/estimated for use in risk assessments, or will all of the risk calculations be based on actual tissue data?

18. Section 1.5 Chemicals of Potential Concern and Tissue Analytes - The discussion explains that validated chemistry data for secondary COPCs will be evaluated for frequency of detection in sediments and for statistical correlation with dioxins and furans in sediment that are representative of the wastes in the impoundments (i.e., one or more of the most common congeners in waste-related sediments). The discussion continues that those secondary COPCs that are detected at least once and that statistically correlate with representative dioxin and furan congeners will not be evaluated in tissue, because any risk associated with a secondary COPC that correlates with representative dioxins and furans is likely to be addressed by sediment remediation performed to address risk due to dioxins and furans. We re-reviewed this particular discussion in the sediment SAP and Appendix C of the RI/FS. For those documents and in this Tissue SAP, there are no particular details that describe how the "correlation" will be determined. We conceptually understand the idea that secondary COPCs that correlate with dioxins and furans will occupy the same footprint, and therefore will be addressed by any action proposed to address risks posed by the dioxin/furan risk drivers. However, we believe this rationale can be flawed. The relative risks associated with these secondary COPCs and the pattern and magnitude of their occurrence could certainly differ from those exhibited by dioxins/furans. These secondary COPCs should first be evaluated in the risk assessments; the appropriate risk management decisions can follow.

19. Section 1.6.3 Sediment-Tissue Relationships - The plan explains (page 15) that new tissue data that can be aggregated with existing data are preferred as this adds statistical power; therefore the same species, tissues, and methods for tissue processing that have been used in development of existing data sets are preferred for new data. We agree. Given the uncertainty in the collection of biological tissue and the understandable limitations on the level of effort for tissue collection (Section 1.2, FSP), this document or the Bioaccumulation Technical Memorandum should briefly, explain the statistical approach envisioned if the species of fish collected are not the same as those already represented in the historical data sets.

20. Section 1.7 Task Description - According to the proposal, sampling of biota will take place in September through October, 2010. The sampling should not be conducted following a storm event such that there is "unusual" freshwater flow into the system. In other words, sampling when the Site may be dominated by an unusually high percentage of largely freshwater fish should be avoided as these fish would not normally be expected to be found near the Site. The discussion should be expanded to indicate that sampling will be performed when the flow conditions (and the resulting salinity) are relatively stable. A rationale to ensure this should be added to the discussion.

21. Section 1.8.1 Statement of the Problem - One goal of this study is described as a characterization of concentrations of COPCs in edible tissues of fish and shellfish that are eaten by people. Throughout this plan, it is clear that edible tissue from blue crabs will be collected to support the HHRA. It is not clear from the discussion if crabs will also be collected to support the BERA (although they are indicated as such in Table 8), both as receptors themselves and prey for higher predators. Juvenile and adult blue crabs are important dietary items for sport and commercial fish as well as avian predators (Guillory, et al., 2001). We suggest that whole body blue crabs

008638

(including smaller crabs that could be consumed by avian predators) also be collected and analyzed to support the BERA.

Reference: Guillory, V., H. Perry, P. Steele, T. Wagner, W. Keithly, B. Pellegrin, J. Petterson, T. Floyd, B. Buckson, L. Hartman, E. Holder, and C. Moss. 2001. The blue crab fishery of the Gulf of Mexico, United States: A regional management plan. Published by the Gulf States Marine Fisheries Commission, Ocean Springs, MS. Number 96, October 2001. http://www.gsmfc.org/publications/GSMFC%20Number%20096.pdf

22. Section 1.8.2 Information Inputs - According to the plan, tissues will be evaluated within the San Jacinto River upstream of the Site, to provide an estimate of upstream background conditions for the risk assessment and to extend the range of tissue and sediment concentrations used for development of tissue–sediment relationships. The respondents and regulators have had a continuing discussion regarding the appropriate location for background for sediment; the concern being that the Site may have had a more widespread influence than represented by the sampling proposals. This concern remains with the selection of background tissue sampling locations, particularly as it relates to the mobility of larger fish. First we suggest that the proposed upstream sample locations for small fish/clams/crabs be moved further upstream (north of the railroad bridge). For the collection of larger fish (and possibly blue crabs), we believe there is no reasonable locale "upstream" of the Site that represents an acceptable background location. Any estuarine fish sampled "upstream" could reasonably be expected to forage upstream and at the Site. When more saline conditions prevail, estuarine fish are common all the way up to the Lake Houston dam (Seiler and Broach, 2010). As an alternative location, we suggest that the respondents collect larger fish (for representation of background) from Cedar Bayou. Accordingly, contemporaneous surface water and sediment samples should also be collected from this location. Cedar Bayou is located east of Baytown, is a tributary to Tabbs Bay, and can be described as a tidal stream with estuarine marsh along the lower reaches. The TMDL project sampled Station 11111 Cedar Bayou at Roseland Park twice for sediment, where the average TEQ was 5.5 ng/kg dry weight. Tissue samples from Station 11111 ranged from 0.62 to 3.16 ng/kg-dw for catfish, and 0.82 to 1.13 ng/kg-dw for crabs (based on Texas TEF scheme).

Reference: R. Seiler and L. Broach. 2010. Personal communication, July 22-23, 2010.

23. Section 1.8.3.2 Characterization of Exposures to Ecological Receptors - This section indicates that groups of tissue samples will be analyzed to determine if they represent a single population, using the same methods described for humans. In that discussion the first step is described as a determination whether the data from the several locations within the Site represent statistically different exposure conditions, or whether the data can be pooled. The discussion continues that if distinct and consistent variations are found between the groups of samples, further analyses may be carried out to determine if those variations are the result of differences in physical characteristics of the samples (e.g., sample location) or of possible other sources in the background area. Statistical analyses (such as regressions) and other relevant information will be used for this evaluation. In this analysis we agree that it is important to determine if the tissue sample locations represent different statistical populations. Recognize, however, that another consideration is whether the modeled predator would conceptually forage across all or a combination of these sample areas, or whether a modeled predator would reasonably forage (physical or ecological reasons, habitat preferences) within a subset of the tissue sample areas. In other words, the analysis should distinguish between different exposure/habitat conditions for the prey, and the predator.

008639

24. Section 1.8.3.2 Characterization of Exposures to Ecological Receptors - The text states that to evaluate exposure of ecological receptors, exposure point concentrations (EPCs) will be calculated as the arithmetic averages of COPC concentrations in tissues and 95% UCL (upper confidence limit) values will be calculated for the uncertainty analysis element of the ecological risk assessment. We prefer that the 95% UCL (or maximum) be used as the exposure point concentration, where the sample size is adequate.

25. Section 1.8.3.3 Comparison of Site and Background Data - How will background and Site tissue concentrations be compared if the species of fish collected differ?

26. Section 1.8.3.4 Integration of Weight of Evidence for Risks - The discussion indicates that the weight of evidence approach to be used will be to calculate the likelihood ratio for each risk assessment (i.e., for each COPC and exposure scenario, and possibly sub-area), and that for the ecological risk assessment, maximum likelihood calculations will be carried out for alternative hypotheses that, 1) the true mean concentration is no greater than the no observed adverse effect level; and 2) the true mean concentration is greater than the lowest observed adverse effects level. We are not familiar with this type of statistical evaluation. We suggest the respondents organize a conference call with the intent of presenting an overview of this statistic, the assumptions, and significance level assumed. The overview should also discuss the rationale for selection of this approach contrasted with other statistical comparison techniques. The overview should also explain how this statistical analysis will be folded in with the comparisons to background.

27. Section 1.8.3.5 Analysis of Tissue: Sediment Relationships - Please describe the Akaike information criterion value in more detail.

28. Section 1.8.3.5 Analysis of Tissue: Sediment Relationships - Sediment data will be matched to tissue data based on proximity. For fish species, several different measures of proximity will be used to group the sediment data. The text continues that these alternative pairings of sediment and tissue data will be evaluated to determine which has the greatest explanatory power, using the multiple R-square statistic. This type of analysis was performed in the evaluation of historical data as detailed in the Bioaccumulation Technical memo. Please provide more details how the data pairings will be evaluated and the statistical results will be interpreted. Will similar analyses be performed for crab and clam data?

29. Section 1.8.3.5 Analysis of Tissue: Sediment Relationships - The text should provide more discussion of the approach for deciding if the site-specific data collected by TCEQ and TDSHS will be combined with the new data in the regression analysis.

30. Section 1.8.5.1 Selection of Target Taxa - Blue catfish are the targeted “large fish” for tissue collection. The discussion indicates that this species has a strong association with sediment and existing data show spatial variations indicating a relatively small home range or foraging range within the San Jacinto system. Compared with the blue catfish, hardhead catfish and Atlantic croakers may be more successfully collected (Seiler and Broach, 2010) and are more tolerant of higher salinity levels (> 6 ppt). Hardhead catfish are the preferred target catfish because the blue catfish is basically a freshwater fish; it would only be expected at the site part of the time and would not have high Site fidelity. Although they can be found in the area when conditions are favorable (i.e. salinities less than 8 ppt, they are highly migratory (Graham, 1999).

    Reference: Graham, K. 1999. A Review of the Biology and Management of Blue Catfish. American Fisheries Society Symposium. 24:37–49.

008640

Reference: R. Seiler and L. Broach. 2010. Personal communication, July 22-23, 2010.

31. Section 1.8.5.1 Selection of Target Taxa - Target molluscs (*Rangia cuneata*) soft tissue will be analyzed both to evaluate risk to molluscs and to support the human health risk assessment. Will the mollusk data also be used to evaluate risks to predators that consume mollusks? We note that Table 8 indicates the purpose of the tissue collection includes the BERA.

32. Section 1.8.5.2 Selection of Sampling Locations and Collection Methods - The discussion explains that sample sizes for tissue to be used in the BERA are lower because risk estimates will be based on mean concentrations rather than UCLs or maximum values. Similar to our previous comment (comment 8), the UCL as the exposure point concentration is preferred for the ecological risk assessment. Rather than plan on a smaller sample size, we suggest that the sampling effort attempt (within the limits set on the level of effort for tissue collection described in the FSP) to arrive at a sample size large enough to support calculation of the 95% UCL for the different exposure areas.

33. Section 2.1 Sampling Design - Regarding the uses of remainder (i.e., carcass) composite samples to support the BERA, the discussion explains that a whole-fish concentration will be calculated using the fillet and remainder (i.e., carcass) data. Mathematically, how will this calculation be performed? Is it based on a weighted average?

34. Section 2.1 Sampling Design - Blue crab sampling will target male crabs (125–200 mm), presumably because of their site fidelity compared to females. The FSP also explains that non-egg bearing females will be retained and used for tissue analysis, if needed, to reach the target tissue mass for analysis. Our understanding is that the crabs collected in the University of Houston/Parsons and the Texas Department of State Health Services evaluations included males and females. Given this, will the historical crab data be combined with the new crab data if the tissue concentrations using male crabs only appear to differ from the historical results?

35. Section 2.4 Laboratory and Analytical Methods - The discussion indicates that all tissue data will be reported on a wet-weight basis. All data summary tables and any relevant discussions in the BERA should also indicate if the tissue concentrations are lipid normalized.

36. In the sixth paragraph of Section 2.5.2 "Laboratory Quality Control" of the June 2010 draft tissue study SAP, the definition of the "U" variable following the formula (1-2) for calculating the percent recovery of the laboratory control sample or reference material should be deleted, as this formula does not require the measured concentration in the unspiked sample.

37. In the tenth paragraph of Section 2.5.2 "Laboratory Quality Control" of the June 2010 draft tissue study SAP, data completeness is defined. Is there a laboratory contractual completeness requirement being proposed? If so, what is it?

38. Appendix A Tissue Field Sampling Plan, Section 2.2.10.4 Blue Crab Compositing Procedures - The text states (pages A-40 and A-41) that clam and crab wet weight (edible tissue) will be determined by preparing a correlation curve between shell length and wet tissue prior to sampling. The discussion continues that several clams and crabs (with as large a size range as possible) will be collected, measured, and weighed to derive a correlation equation that will accurately determine the wet tissue weights of collected clams or crabs that will be sent for COPC analyses. The text in the following paragraph indicates each crab will be weighed. This is unclear. The text should explain why edible tissues will not be weighed for each sample. Why is this extrapolation necessary?

008641

Draft Tech Memo on Bioaccumulation Modeling:

1. Section 3.3, page 11: "…Significant relationships between surface water and crab tissue were observed only for TCDD and TCDF (Table 5)…." and "… However, even the best fitting models left approximately 45 percent of the variance unexplained. Both TOC and tissue lipid content were significant covariates. Interestingly, the best-fit models for both TCDD and TCDF do not contain the sediment concentrations as first-order terms, but rather only their interactions with sediment organic carbon, tissue lipid content, and season (Table 6). This suggests that sediment dioxin and furans cannot be directly related to concentrations in crab tissue (i.e., as a ratio) with this data set, potentially because tissue concentrations are significantly modulated by additional factors. …" The TCDD and TCDF in surface water are an "additional factor". Similar statements occur about fish (Section 3.4). So there is reason to consider and simulate the dissolved/colloidal and suspended sediment phases in transport and bioaccumulation models. Transport and fate model should consider TOC as well as non-organic sediment.

2. Section 3.5, page 13: "…Smith Point (10 ng/kg ww), and further downstream, Vingt-et-un (14 ng/kg ww)." These must be the reference sites. Smith Point and the Vingt-et-un Islands are virtually the same place, the islands are just a couple hundred meters off the north shoreline of Smith Point. Vingt-et-un is not significantly "further downstream" if any at all. Both are approximately 24 miles southeast of the SJR site (straight line distance), across Trinity Bay on the east shore where Trinity and Galveston Bays join.

3. Section 5, pages 27-28: There is no clear, simple, single-sentence statement of what the approach will be. If accurate, text should be revised to say that the approach will use empirical models in the form of statistical regression analysis for individual congener concentrations in sediment and tissue. Also, ext is not clear in this summary section on what type of regressions are contemplated, for example: multiple-parameter regressions?

4. Section 5, page 28: The last sentence suggests that empirical measurements should be used to verify whatever type of modeling is done to predict tissue concentrations. Would that be empirical measurements made long after remediation, to see if effects were as planned? Or during remediation? Not clear when this verification would be expected or done, or whether it would affect remediation planning.

5. Section 6, References, page 33: "University of Houston and Parsons Water and Infrastructure, 2002. Total Maximum Daily Loads for PCBs in the Houston Ship Channel. Draft Final Report. Texas Commission on Environmental Quality and U.S. Environmental Protection Agency. Austin, TX. 125 pp." Not clear which progress report this means. The HSC PCB project did not begin quarterly reports until 2006; first with this title would have been in 2007. The HSC Dioxin project was producing reports in 2002. Either the date or the title is incorrect.

6. General Comment: The closing discussion cautions that although empirical models (e.g., regression analysis) have greater potential Site applicability than mechanistic models, that the use of empirical models (to predict tissue concentrations of dioxin and furan congeners) should generally be verified with empirical measurements because of the inherent uncertainty in the use of these models. We support this qualification and suggest that the submittal be expanded to suggest specific ways to address this uncertainty. This could include the use of tissue preliminary remediation goals protective of human and ecological receptors. The discussion should also recognize that a "site-wide multiple linear regression (MLR)" may not be the best approach in general; more focused "area-specific" MLR models may be appropriate to address the variability in the bioaccumulation and bioavailability of dioxins and furans throughout the Site.

008642

7. General Comment: The respondents should discuss other superfund sites or research in the literature where MLR has been used to predict tissue concentrations of dioxins and furans.

8. General Comment: Using different extractions solvents and methods can cause a significant difference (up to 3.5 x) in lipid concentrations measurements (Randall, et al., 1991). The differences in lipid concentrations measurements from different studies could negatively impact the reliability of any correlations between tissue concentrations in weight per gram fat when multiple historical data sets are used. We suggest that the respondents evaluate the proposed methods for lipid analysis and compare them with the methods used by the University of Houston/Parsons and the Texas Department of Health Services. In the evaluation, solvent types/extraction systems, tissue types, and tissue masses should be considered. If the methods are different, the plan should discuss this source of variation in the tissue data, the impact the variation may have on the use of the data, and any proposed action to minimize or compensate for the variation.

   Reference: Randall, R.C., H. Lee II, R.J. Ozretich, J.L. Lake, and R.J. Pruell. 1991. Evaluation of selected lipid methods for normalizing pollutant bioaccumulation. Environmental Toxicology and Chemistry. 10(11):1431-1436.

9. General Comment: In the discussion of birds and bird eggs (Section 4.2), the text indicates that methods to predict concentrations in bird eggs from concentrations in other tissues (or in prey) can lead to significant error in predicted egg tissue chemistry but that egg concentrations are an important means to evaluate risk to birds, and an approach recommended by U.S. EPA. The text also states that the assumptions and methods involved when predicting concentrations of dioxins and furans in tissues of birds should be well supported by the literature, and clearly acknowledged. We don't disagree. This technical memorandum provides extensive discussion of the proposed approach for evaluating uptake of dioxins and furans in fish and crabs and methods to relate tissue concentrations with corresponding PRGs for sediment. A similar discussion of the proposed approach for assessing risks to birds based on modeled or measured concentrations of dioxins and furans congeners in eggs was not presented. We note that the revised RI/FS (July 2010) states (in part) that concentrations of dioxins and furans, as TEQs, in bird eggs will be estimated from concentrations in the birds' food, and that "methods to perform this estimation are under review, and will be addressed in the Bioaccumulation Technical Memorandum." We suggest that the respondents provide such a discussion and also provide a discussion that considers collection of eggs from the site.

10. Section 3.0 Analysis of Site-Specific Data - The discussion indicates that 2 primary sources of existing data on dioxin and furan concentrations in tissues (Total Maximum Daily Load (TMDL) program data and the Texas Department of State Health Services (TDSHS) monitoring data) were used to evaluate patterns in the relative concentrations of dioxin and furan congeners in tissues, and to determine whether statistical regression could be used to develop useful empirical models for the congeners and tissues represented in these data sets. Since these historical data were used in combination for this analysis, were the analytical methods used to determine percent lipids in tissue equivalent? Also, were the surficial sediment samples contemporaneous with the tissue samples?

11. Section 3.1 Data Treatment and Analysis Methods - In this evaluation, dioxin and furan patterns (fingerprints) were calculated for each sample by dividing the concentration of each individual congener by the total concentration of all congeners to arrive at "congener fractions" or the proportion of the cumulative total congener concentration for each sample. The comparison of

008643

congener fractions in sediment and biota at the Site and nearby is an important part of this analysis. The respondents should discuss the consistency of this approach for fingerprinting dioxin and furan data in general.

12. Section 3.1.1 Characterization of Exposure Units - In this analysis, spatially averaged sediment concentrations were determined to evaluate sediment-tissue relationships, and the size of the exposure unit with the highest correlation coefficient for each organism was used for subsequent analyses. The discussion indicates that the strongest relationship between dioxins and furans in tissue and sediment was found with an exposure area (radius) of 100 m for blue crab and 1,000 m for catfish. For transparency, the memorandum should be revised to include summary tables that show how this relationship was determined.

13. Section 3.1.1 Characterization of Exposure Units - The discussion indicates that the calculated exposure unit of 1,000 m for catfish is consistent with home ranges of closely related catfish species reported by Daugherty and Sutton (2005). This paper evaluated the seasonal variability in the home range and movement distance of the flathead catfish in a freshwater riverine system. Since the TMDL and TDSHS fish tissue data were collected from an estuarine system, home range information for the hardhead and blue catfish would be more suitable for comparison.

14. Section 3.2 Relative Concentrations of Dioxins and Furans in Exposure Media and Tissue - The discussion states that in each exposure medium and tissue, the concentration fraction of each congener was calculated. This sounds simple; nevertheless for clarity the text should describe how this was done. For instance for any one sediment, water or tissue sample, was the concentration of any one of the 17 congeners divided by the total concentration of all 17 congeners? Or, was there a separate calculation for dioxins and furans each as a group?

15. Section 3.2 Relative Concentrations of Dioxins and Furans in Exposure Media and Tissue - Tables 2 and 3 display the range of dioxin and furan congeners in sediment, water, and tissue. To support the discussion in this section, summary tables displaying the relative percent of each congener (range, mean) would be helpful.

16. Section 3.3 Relationships of Blue Crab Tissue with Sediment and Surface Water - Looking at the information in Table 6, the best fit models include multiple interaction terms. Table 6 should be revised to explain the interaction terms and the dependent variable along with any transformations.

17. Section 3.4 Relationships of Catfish Fillet Tissue with Sediment and Surface Water - Looking at the information in Table 9, the best fit models include multiple interaction terms. Table 9 should be revised to explain the interaction terms and the dependent variable along with any transformations.

18. Section 3.5 Dioxin and furan Concentrations in Bird Eggs - This discussion summarizes a study (Frank et al., 2001) of persistent organic compounds in water bird eggs in the Galveston Bay area. Among other locations, eggs were collected from Alexander Island, a location on the lower portion of the Houston Ship Channel, relatively close to this site. The intent of this discussion here and elsewhere is unclear. How does it relate to the proposed statistical approach for modeling bioaccumulation, and the evaluation of the bird/egg uptake pathway in the future BERA?

19. Section 3.6 Conclusions of Site-Specific Data Analyses - The text summarizes that the proportions of the total dioxin and furan concentrations (consisting of TCDD and TCDF) were

008644

higher than those of other congeners in crab and fish tissue, even in locations where their proportions were not high in sediment or surface water. We agree with the generalization about the proportions of congeners in tissue differing from the proportions in sediment and water. It appears that the proportions of OCDD and OCDF to a lesser extent were also high. Again a summary table of the relative proportions of congeners by species would be helpful.

20. Section 3.6 Conclusions of Site-Specific Data Analyses – The discussion on page 15 states that the dioxin and furan patterns in fish and crab tissue, as well as their differences relative to sediment and surface water, suggest that the concentrations of these compounds in tissue may be more dependent on biological factors than environmental factors and exposure conditions. We believe this statement is too general. We agree that overall the proportions of the various congeners may be more dependent biological factors. However, the tissue concentrations of 2,3,7,8-TCDD/F in particular, appear to be strongly related to the sediment concentrations (see Figures 3, 10, 20, and 27).

21. Section 3.6 Conclusions of Site-Specific Data Analyses - The text generalizes that the dioxin and furan patterns in fish and crab tissue for the historical data, as well as their differences relative to sediment and surface water, are consistent with literature for sites in other geographic areas. Since the historical tissue data was based on edible crab and filet concentrations, is there any reason to believe the trends would be different for whole body dioxin and furan congeners (relationship between sediment and water)? In the literature reviewed for comparison, were the tissue studies based on whole body or edible tissue? We did not review all papers; those reviewed were based on whole body concentrations.

22. Section 3.6 Conclusions of Site-Specific Data Analyses - Summarizing the Alexander Island bird egg data (Frank, et al., 2001), the text states that the variation of 2,3,7,8-TCDD concentrations in bird eggs could not be explained by differences in diet (i.e., trophic level) among the birds, but variation in total PCBs was explained by differences in diets. We agree with this statement regarding PCBs, but are less confident in this generalization for PCDDs/PCDFs due to the low sample number (3 eggs per species).

23. Section 4.3 Food Web Biomagnification - There is a statement (referencing 4 papers) that research at multiple locales has demonstrated that concentrations of dioxins and furans do not increase with increasing trophic level. There does appear to be variability in the biomagnification patterns exhibited by the various congeners. Although the Broman et al., 1992 paper indicated that the total concentrations of the 2,3,7,8-substituted PCDD/Fs decreased with increasing trophic level, they state that the summed concentrations of the three most toxic isomers of PCDD/F increased with increasing trophic level. It did not appear, however, that these data were expressed on a lipid weight basis. Similarly, Naito et al., 2003 found that 2,3,7,8- substituted PCDD/DF congeners exhibited the characteristics of both non-2,3,7,8-substituted PCDDs/DFs and PCBs; the 2,3,7,8-substituted PCDDs/DFs congeners with less chlorination showed increasing concentrations with an increase in trophic level (similar to PCBs), and those PCDDs/DFs with more chlorination demonstrated decreasing concentrations with an increase in trophic level. Upon review of these papers, we generally agree with the initial statement (top of page 23), but suggest that this statement be clarified to reflect that there are exceptions.

24. Section 4.4.4 Uncertainties - The discussion on page 26 restates that bioaccumulation in birds is particularly poorly described in the published literature; and process rates for many of the congeners are lacking or poorly described. The discussion goes on to say that empirical data and analyses may provide more reliable guidance to risk managers than mechanistic modeling. It is not clear whether this last statement was intended to reflect the approach for evaluating fish and

008645

crab tissue, bird (egg) tissue, or both. Similar to general comment 4, we recommend that the technical memorandum provide more discussion regarding the intended approach for estimating or measuring tissue concentrations in birds, and the rationale for the approach selected.

25. Section 4.4.4 Uncertainties - As indicated here and elsewhere, the text indicates that the uncertainties associated with estimating tissue concentrations (and bioaccumulation) of dioxins and furans support the selection of empirically based, regression modeling as the appropriate means for bioaccumulation modeling. As there are inherent uncertainties associated with regression modeling as well, we request that any regression models be compared with appropriate marine-based BSAFs (site-specific and literature values) as a way to provide a more robust uncertainty analysis. See specific comment 17 and general comment 1.

26. Section 5.0 Approach to Modeling Tissue - The document concludes with the statement that the evaluation of site-specific multivariate statistical correlations, and development of regression models using site and regional data, is the most appropriate means for identifying and characterizing relationships between dioxin and furan concentrations in sediment and tissue. The discussion adds that the use of empirical models should generally be verified with empirical measurements. We agree (see general comment 1). As already mentioned, MLR models indicated that variation in dioxin and furan concentrations in tissue is only partially explained by variation in sediment concentrations within the data set evaluated. The best fitting models left approximately 45 percent (2,3,7,8-TCDF, for crab tissue) or 40 percent (TCDD, for catfish fillets) of the variance unexplained. There seems to be a predetermined assumption that a MLR model will be the only way that a quantitative relationship will be developed between COPC concentrations in tissue and sediment. The discussion should be expanded here or elsewhere to indicate a decision threshold for using a MLR model. In other words, is a there an adjusted R2 below which (assuming the relationship is statistically significant) MLR will not be used for a particular congener? Will some congeners (that “better” explain the variability) be used as a surrogate for others? If so, how will this be determined?

27. Appendix A (Dioxin and furan Profiles for All Crab and Fish Samples Collected within the Houston Ship Channel) - This appendix should be accompanied by a figure that depicts the various sample location

008646