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Via Delivery as Email-attachment to (Prashant.gupta@honeywell.com) and Certified Mail

Mr. Prashant K. Gupta
Honeywell, Inc.
4101 Bermuda Hundred Road
Chester, VA 23836

Re: Draft Feasibility Study Report for the Estuary, Operable Unit One: LCP Chemicals Superfund Site, Brunswick, Glynn County, Georgia

Dear Mr. Gupta:

The purpose of this letter is to provide comments on the draft Feasibility Study (FS) Honeywell International, Inc. (Honeywell), the Atlantic Richfield Company (ARCO) and the Georgia Power Company submitted to the U.S. Environmental Protection Agency for Operable Unit 1 (OU1) of the LCP Chemicals Superfund Site (Site) in Brunswick, Georgia.

As indicated in the EPA's October 1988 "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA", the objective of the Remedial Investigation/Feasibility Study (RI/FS) process is not the unobtainable goal of removing all uncertainty, but rather to gather information sufficient to support an informed risk management decision regarding which remedy appears to be the most appropriate for a given site. Although this draft of the FS for OU1 does provide a significant amount of information for evaluating several remedial alternatives, it must be supplemented and/or revised in numerous areas in order to enable the EPA to select an appropriate remedy. The EPA is therefore providing general comments on several deficiencies identified throughout the FS, as well as specific comments, which all must be addressed in the final FS for OU1.

For clarity, these comments are divided into five categories.

1. Additional Analysis Required for Selection of a Preferred Alternative;
2. Alternative Analysis and Achievement of RGOs;
3. Thorough Analysis of Threshold Criteria and Balancing Remedial Alternatives;
4. Correction or Elimination of Technical Inaccuracies and Unsupported or Subjective Statements; and
5. Editorial Corrections and Clarification in Presentation.

On July 11 and 12, 2013, representatives from the EPA, Georgia Department of Environmental Protection, Honeywell, ARCO and Georgia Power will meet to discuss the comments contained in Attachments A and B of this letter and any questions related to those comments. Following

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this meeting, pursuant to paragraph VIII(A) of the Administrative Order by Consent for Remedial Investigation/Feasibility Study (AOC for RI/FS), Docket No. 95-17-C (AOC), the responsible parties should revise the draft FS as indicated below and submit it to the EPA within 45 days of July 12, 2013.

Should you have any questions regarding the next steps for concluding this FS, please contact me at (404) 562-8937.

Sincerely,

Galo Jackson, P.G.
Remedial Project Manager
South Superfund Remedial Branch

Attachments (2)

ATTACHMENT A

No. 1 Additional Analysis Required for Selection of a Preferred Alternative

1. *General*: Chapter 2 should be reorganized to start first with a summary of the Remedial Investigation (RI) and an updated Conceptual Site Model (CSM) which describes the setting, the problems, the sources, the extent of contamination, contaminant release mechanisms, fate/transport processes, assumptions, uncertainties, exposure pathways, and risks. A discussion of operable unit 1 (OU1) and its relationship to the rest of the Site is needed to minimize confusion. More explanation early in the FS would provide a better context for understanding important information such as the source of the surface water and sediment contamination. Discuss potential for areas outside of OU1 to act as continued sources of contaminants.

2. *General*: Conclusions regarding risk reduction and protectiveness appear to hinge upon the CSM with respect to where and how the contaminants enter the food chain, specifically mercury and Aroclor-1268. While the FS does not specifically state this, it is evident that the CSM for the bioaccumulation of mercury and polychlorinated biphenyls (PCBs) assumes that the sediment which is the exposure media to the food chain is primarily the in-channel bed sediments, which are the sediments with the highest contaminant concentrations. While this may be true, there is no evidence within the draft FS that conclusively demonstrates this assumption. It is plausible that a substantial amount of bioaccumulation of Site contaminants actually occurs in the vegetated marsh surface. The draft FS should explain why in-channel exposure is the dominant mechanism for bioaccumulation at the Site. That is, whether or not the high contamination level in localized areas dominates the bioaccumulation of contaminants in the system or if large areas of low concentrations dominate the bioaccumulation.

3. *General*: Although it is reasonable to use surface-weighted average concentrations (SWACs) to parcel the OU into manageable units for the purpose of remedial implementation, hazard quotient risk reduction estimates based on SWACs do not account for spatial variability of contamination in sediment/biota or for habitat considerations and primary exposure pathways. As a result, the incremental risk reduction of the various alternatives is minimized, making alternatives appear to result in nearly identical risk reduction in spite of varied footprints.

4. *General*: No estimates have been provided for how long it will take for remedial goals and risk assessment endpoints to be reached, aside from the 10-year monitoring value in the cost estimate.

5. *General*: The document does not assess risk reduction to humans from consumption of fish, shellfish and clapper rail; it should reflect the results of the final human health baseline risk assessment (HHBRA) and baseline ecological risk assessment (BERA). At a minimum, the remedy effectiveness evaluation should estimate reduced risks from

human consumption of contaminated biota. Furthermore, combining exposure areas (e.g., domain-wide, creek-wide and estuary-wide) is not relevant for many exposure scenarios, and serves to dilute the calculated risks and appearance of unacceptable exposure.

6. *Section 2.3.2, page 11.* There is a statement that implies that contaminant exposure is a function of organism residence rather than activity time. Since dietary exposure is a substantial component of the exposure to fish and shellfish, the short period of time they are feeding in the marsh is more important than the residency time. The sampling at the Site indicates that feeding primarily occurs in the marsh surface for at least some of the species, including mummichogs. Further, shellfish, such as fiddler crabs, also spend much of their time on the sediment during low tide. A thorough discussion of these CSM issues is essential to the review of remedy alternatives which reduce exposures during the tidal cycle.

7. *Section 2.2.4, page 8.* It appears that statements in this section are based on the hydrodynamic model and assumptions made within the model, as well as inferences from studies on similar marsh systems, as opposed to site-specific data. Discussion of net sediment accretion rates and sediment material origin would aid in assessing how monitored natural recovery (MNR) will reduce residual contamination levels in the marsh. The same page of the section discusses "cohesive sediments" and "bed armoring processes". How are these statements to be reconciled with the concept that the remaining contamination in the marsh was transported to its current locations through sediment re-suspension and deposition? This concept must also be reconciled with the results of a literature review, which shows deposition rates in the area to be on the order of 2.5-3 mm/yr.

8. *Section 2.2.4, page 8.* The section states that, "Sediment transport processes within the site are controlled by tidal circulation and rare storm events (Appendix B). The dominant source of suspended sediment to the estuary is the Turtle River because no tributaries flow directly into the estuary." The EPA cannot find the information in Appendix B which supports these two statements and found no data on water column sediment load, evaluations of sediment source material, or sediment core dating. While the EPA is confident the water movement via tidal action and storms is the dominant transport mechanism, it is not convinced there is a net sediment movement from the Turtle River into the LPC Marsh.

9. *Section 2.4.1, page 14.* Add a discussion of contaminants of concern (COCs) in biota from the Site, relative to the reference areas. The contamination is not limited to sediment and surface water.

10. *Section 2.5.2, page 31.* This section discusses mercury and Aroclor 1268 contamination distribution as being, "consistent with the surface water CSM." However, this section conflates historic and current contaminant distributions. The current distribution may be

related to reworking of previously-contaminated sediments, but historic sources of contamination included overland transport, direct discharge of waste and wastewater to the marsh, and contaminated groundwater. This section should explicitly discuss removal and non-removal areas, pre- and post-removal.

11. *Section 3.4, page 439.* This section develops sediment management areas (SMAs) that include risk management decisions which result in reducing areas that exceed RGOs. Development of SMAs in this chapter is premature as alternatives have not yet been developed. Detailed discussions will be needed in Sections 5 and 6 to explain how risk management decisions will achieve a remedy that meets the threshold criteria of protection of human health and the environment.

12. *Section 4.2.3, page 49.* MNR is a remedial technology that relies on natural processes to reduce the concentrations, toxicity, or bioavailability of contaminants in sediments. MNR is discussed in Section 4 and last mentioned in Section 4.3. Continue the discussion of MNR in Section 5.2 on elements common to all remedial alternatives. MNR should also be discussed in Sections 6 and 7. Include a conceptual model for how MNR takes place in the estuary. The FS should discuss the suspended sediment concentration and whether there is sufficient sediment supply to provide the unconsolidated material necessary to cover contamination by natural processes. MNR could perhaps be enhanced by placement of erodible clean sediments in the marsh creeks on top of the armoring layer to be carried up onto the marsh flats by tides to foster marsh accretion. Discuss the fate of sediment in the creeks and whether placement of clean sediments in the creeks or marsh might enhance marsh flat recovery by natural processes. Additional discussion of MNR is provided in Attachment B of this letter.

13. Regardless of the remedy selected, the long term monitoring plan (LTMP) must include a bio-monitoring component, as there are critical assumptions made within the CSM regarding the relative strength of the source of contaminants into the food chain. While a detailed discussion of the LTMP is not critical to the FS, it is clear the LTMP is necessary, particularly for bio-monitoring of mercury and Aroclor-1268 in biota. The FS should add more information on bio-monitoring of mercury and Aroclor-1268 in biota.

14. *Section 4.2.4, pages 49, 50 and 51.* How a thin cover can achieve remedial action objectives (RAOs) should be discussed because many of the sediment invertebrates are burrowing organisms (e.g., fiddler crabs) which will still be exposed to the subsurface contamination. While the depth of contamination in the vegetated marsh is relatively limited, it should be expected to be at least on the order of 10 cm. This would suggest a layer of 10 cm would be required if the sediment chemical specific goal was half of the current concentration. It follows that the amount of material placed onto the marsh surface will substantively impact the marsh elevation. A more thorough evaluation of the amount of material needed and the consequences should be conducted and presented for those areas for which thin layer capping is proposed.

15. *Section 5, starting on page 61.* Consider removing all references to SMAs in this draft FS, including in Table 5-1 and in Figures 5-1 through 5-5, to eliminate confusion in relating SMAs and the 6 different alternatives. Suggest renaming the alternatives to include the extent of acreage the alternative would remediate (i.e., Alternative 3: Sediment Removal, Capping and Thin-Cover Placement of 48 Acres).

16. *Section 6.2.2, page 93.* This section assumes that all of the alternatives (except No Action) will achieve chemical-specific applicable relevant and appropriate requirements (ARARs), (presumably water quality standards [WQS] for surface water). Add a discussion in this section which compares the footprint of each remedial alternative to the locations of known ARAR exceedances.

17. *Section 6.2.6, Page 100.* In the discussion about Domain 1A and Domain 2 Marsh, it is unclear why Alternative 4 is substantially different than Alternatives 5 and 6 with respect to earthmoving equipment, temporary roads, staging areas, and short-term impacts. Revise to be more consistent with Alternatives 5 and 6.

18. *Section 7, page 106.* Explain how each alternative with different clean up goals can all achieve the threshold criteria. The conclusion regarding risk reduction and protectiveness appears to hinge upon the CSM with respect to where and how the contaminants enter the food chain, specifically mercury and PCBs.

19. *Section 7.1, page 107.* Text on Page 107 indicates that Alternatives 2 through 6 will each reduce ecological risks to benthic organisms exposed to contaminated sediment to levels that will result in self-sustaining benthic communities with diversity and structure comparable to that of the reference areas. No information is provided to back up this statement. Only three locations were sampled for benthic community structure (Figure E2-5) and these areas were not located in portions of the Site where contamination would be left in place by any of these alternatives. The text in this section should be modified or removed. The reason no adverse benthic effects were observed was because there was only a very limited study of this type of measurement. The limitations of the study are so severe that the only statement that can be supported is that there are effects on benthic communities in the most contaminated portions of the Site. Nothing can be concluded about portions of the Site where contaminant levels are relatively low. No benthic community studies were conducted in areas of the Site with concentrations in the range where risk management decisions are being considered. Add the information to support that Alternatives 2 through 6 will reduce the risk to benthic organisms or delete the statement.

20. *Section 7.1, Figures 7-1A through 7-1C.* The figures show the decline in the lowest observed adverse effect level (LOAEL)-based hazard quotient based on the estuary-wide average SWAC. The figures do not adequately distinguish between the alternatives. The median hazard quotients shown in the box as whiskers plots on Figure 7-1A do not make sense because they do not capture the varying sizes of management areas. Figure

7-1A is misleading in that Alternative 1 has a hazard quotient of roughly 3 for the LCP Ditch, but cleaning up the ditch was a portion of the costs. Costs in Figure 7-1A are presented as the total cost for the entire alternative, while the hazard quotients refer to specific creeks or domains of the Site that have separate costs to clean up. The figures should start out with the vertical bars for Eastern Creek, LCP Ditch, Domain 3 Creek, Domain 1, and Domain 4 East on the left for Alternative 1. Then the itemized cost to address the Eastern Creek portion of the alternative should be presented with a shortened bar to represent the decrease in the hazard quotient for the Eastern Creek after the remedy is completed. The same should be done for the other areas and alternatives. Figure 7-1A should be redrawn to show the itemized costs in this manner.

21. *Section 7.2, page 108.* Text indicates that remediation of the largest areas utilizing Alternative 2 or 3 does not provide a significantly greater overall risk reduction than using Alternatives 4, 5 or 6. However, the FS provides no information or evaluation to support the statement that risk reduction is essentially the same for all active alternatives. The FS should make a clear distinction between the levels of effectiveness achieved by each alternative. In addition, the FS should discuss the uncertainty associated with the risk reduction for each alternative and compare them. Attachment B of this letter develops one aspect of the uncertainty that should be discussed.

22. *Appendix C.* The coordinates of sampling station 5-NOAA in the LCP database place the sample location above the LCP Ditch in the Domain 3 marsh. The table in Appendix C has different coordinates that place 5-NOAA in the LCP Ditch. The location of the station 5-NOAA should be discussed in the uncertainty section. Evidence that places the station in the LCP Ditch should be provided.

    Appendix C is a table in Microsoft Access® data base which includes the location identifier, domain name, coordinates, and COC concentration in sediment. The table in Appendix C is used to generate the figures in the FS and to calculate the SWACs. EPA identified certain samples in the LCP database that were not included in Appendix C. These should be added unless justification for omission can be provided. Explain why the following sample locations were not included on the figures showing the distribution of mercury and Aroclor-1268 in OU1 sediments (Figures 2-11 and 2-12). None of these samples were analyzed by the TEG laboratory. Include the top four stations (1011, 75, 77, and 82) in the averages in Appendix C. The other stations in the table do not need to be incorporated in the averages, but the rationale for their exclusion should be presented in the FS.

Location	Domain	Easting	Northing	Concentration, mg/kg	
				Mercury	Aroclor-1268
1011	1	860257.1	432038	34	–
75	1	860560.1	431723	29	5.2
77	1	860636.1	431297	55	27
82	1	860251.1	431507	39	5.9
94207-01	3 NS Ditch	861654.1	433097.9	15.3	–
94207-02	3 NS Ditch	861460.1	432744.9	6.4	–
94207-03	3	861116.1	432724.9	4.23	–
94207-04	3 NS Ditch	861737.1	433251.9	1.57	–

94207-05	3 NS Ditch	861790.1	433348.9	3.38	–
94207-08	Main Canal	860086.1	432454	6.27	–
97269-21	Main Canal	860380.4	432395.9	11.6	31
97269-43	Main Canal	860776.3	432364.5	36.1	230
97269-47	2A	860156.5	432414.4	10.6	11
97270-02	Main Canal	860724.8	432358.6	43.5	68
98106-RW-03	1	860896.1	430909	39.3	33
98142-MED-16	1	860776.31	432364.5	8.64	1.2
98142-MED-20	1	861240.06	431557.94	2.5	2.43 U
98153-MED-24	1	861203.56	431481.44	8.67	9.5
98153-MED-27	1	861235.06	431557.94	2.55	2.1
98153-MED-29	1	861241.06	431575.94	18.3	5.72
98153-MED-31	1	861247.06	431596.94	0.56 U	2.26 U
98156-MED-47	1	861259.06	431638.94	0.56 U	2.24 U
BM038	,2A	860087.06	432105.19	14	4.2
BR069	Purvis Creek	858198.44	430846.19	1.8	5.2
PTI-E9	1	860327.13	432062.97	43.3	52
FS-AREA1	3	861513.75	434105.69	0.68-1.1	0.63-1.3
M-38	3	860957.44	432984.44	1.89-3.58	0.62-1.2
M-D3-6A	3	860352.88	432776.41	–	13
M-D3-6B	3	860343.13	432777.5	–	8.1
M-D3-6C	3	860362.31	432775.47	–	6.6

The average concentrations shown in Figure 2-11 are averages over the years of sampling when a station was sampled more than once. Station PTI-E9 is essentially the same as Station E-9. The concentrations detected in June 1996 when the location was referred to as PTI-E9 should be averaged with the concentrations detected in 2002 at Station E-9. The location known as FS-AREA1 is the same location as Station C-200. When averaging data over all monitoring years, three sampling events at FS-AREA1 should be averaged with the data for Station C-200. Station C-31 is the same location as Station M-38. This comment was written because although some locations were included, not all the data at that location was included in the average concentration. Sample location M-D3-6A was collected in August 2012. The intention may have been to plot the three M-D3-6 samples as an average, but they did not get assigned correct coordinates in Appendix C. These samples should be located just north of the Main Canal in the Domain 3 marsh.

No. 2 Alternatives Analysis and Achievement of RGOs

1. *General*: The remedial goals options (RGOs) presented at the low end of the RGO range in EPA's November 30, 2011 letter were determined in the HHRA and BERA for this OU to be the concentrations which are protective of human health and the environment. The EPA included some higher RGOs in the February 20, 2013 and subsequent letters in order to provide the responsible parties with an opportunity to justify why such numbers would be more appropriate. However, the draft does not sufficiently evaluate alternatives which would achieve the lower ends of the RGO ranges. The FS should include an analysis of residual risks (those areas not meeting the low end SWAC and benthic RGOs). There appears to be a broad assumption throughout the draft FS, that simply addressing the upper range of the SWAC RGOs would be sufficiently protective of all receptors, which is not scientifically supported. As the FS is currently written, the potential benefits of a mid-

range alternative cannot be properly assessed. In addition, the extent of potential residual risks within the entire RGO range is not clear.

Furthermore, CERCLA specifies that a range of alternatives should be developed, including at least one alternative which does not leave contaminants on-site above cleanup levels. At least one alternative that addresses the entire footprint of RGO exceedances through active remedies (not including MNR or "Risk Management Areas") should be developed and carried through the analysis. Inclusion of a comprehensive alternative will assist in determining whether the cost and short-term risks out-weigh the overall risk reduction. The revised FS will also need to describe how each remedial alternative meets the RGOs and ARARs or if exceedances of RGOs would remain. For example, Alternatives 4, 5 and, to a lesser extent, Alternative 6 leave contaminants in place in Purvis Creek above the RGO ranges. Describe how these residual COC concentrations may or may not be protective of Purvis Creek.

2. *Section 3.3, page 38 and 39.* Revise this section to address the following comments:
   - In the first bullet on page 38, it is stated "SWAC RGOs are concentrations that are protective for humans that consume fish, shellfish, and wild game from the Site. In addition, SWAC RGOs are protective of the mammals, birds, and fish that nest, forage, and breed in the Site." Provide a definition of surface-weighted average concentration and explain how SWACs are protective, in spite of the fact that SWACs tend to dilute any localized high contaminant concentrations when averaged across a unit with a large area with lower concentrations.
   - The benthic community RGOs reported in the draft FS are greater than the "threshold for estimated adverse ecological effects" established by EPA in the OU1 BERA (Black & Veatch 2011) as shown below. For three of the COCs (mercury, PAH, lead), the lower range of the FS RGOs exceed the highest BERA values in the "thresholds".

COC	BERA RGOs (mg/kg)	FS RGOs (mg/kg)
Mercury:	1.4 - 3.2	4 - 11
Aroclor 1268:	3.3 - 12.8	6 - 16
tPAH:	0.8 - 1.5	4
Lead:	41 - 60	90 – 177

   The five RGO letters should be included in an appendix to aid in transparency for public review and the technical basis of the RGOs should be summarized in Section 3.3.

   - Develop and present RGOs for surface water regardless of whether surface water samples collected to date exceed the RGOs because State WQS are relevant and appropriate and RAO 6 refers to meeting and sustaining "WQS for protection of aquatic life".

3. *Section 3.4, pages 39-41.* This section discusses various remedial footprints prior to development of any alternatives and is therefore premature. In addition, risk management applies only to alternatives that have been developed. It appears the purpose of this section is to show those areas that exceed the RGOs ranges and introduce the SWAC concept.

    - Change the title of the Section 3.4 to "Extent of Media Exceeding RGOs." Replace the term Sediment Management Areas Areas (SMAs) with "Extent of Sediment Exceeding RGOs." Add a Section to discuss Surface Water RGO exceedances.
    - Eliminate in its entirety the bullet labeled Risk Management Decisions and adjust the affected figures, tables, and volume calculations. It is premature to assume that "cleanup will cause more ecological harm than the current Site contamination" before technologies have even been screened or alternatives selected. The purpose of this section should be to document baseline conditions and should include all areas with RGO exceedances regardless of future accessibility issues or potential for habitat damage.
    - Table 3-5 shows that most of the domains exceed the low end of the SWAC RGOs for mercury (1-2 mg/kg) and Aroclor-1268 (2-4 mg/kg). Include discussions or maps showing those areas that exceed the low or high SWAC RGOs. The focus of the discussion and the development of alternatives in Section 5 is on protection of the benthic community, which is of lesser concern than bioaccumulation of mercury and Aroclor-1268 through the food web to top-level consumers. Add discussions and maps showing those areas that exceed the low and high ends of the SWAC RGOs.
    - Replace Figure 3-5 with a figure titled "Areas Exceeding the Low Benthic Community RGOs" and use one color to depict all 81 acres. Include separate figures showing the extent of area exceeding the low end of the range and the high end of the range.
    - Replace Figure 3-6 with a Figure titled "Areas Exceeding the High Benthic Community RGOs" and use one color to depict all 25 acres. Show separate figures showing the extent of area exceeding the low end of the range and the high end of the range.
    - Delete Figure 3-7 and all of Section 3.4.3 because this is a SMA and is premature in this section.
    - In Table 3-5, delete the three columns associated with post-remediation SWACs and their associated footnotes. Highlight those SWAC areas that exceed the low end of the range with one color and those SWAC areas that exceed the high end of the range with a different color. Also, add the other two COCs (lead and total polynuclear aromatic hydrocarbons [PAHs]).
    - Modify the text of Sections 3.4.1 and 3.4.2 accordingly with the above comments.

4. *Section 4.2, page 45.* Include a brief discussion of the following technologies: 1) In-situ treatment such as reactive barriers and enhanced biodegradation; and 2) Immobilization/stabilization where sediment and chemicals are mixed to make COCs less mobile.

5. *Section 6, General.* This section should be rearranged in light of the above comments. A modified version of Table 3-5 can be presented in this section. However, those post-remediation areas that exceed the low and high ends of the SWAC RGO ranges must be highlighted to help the reader understand where potential residual risks occur. For example, mercury levels in Domain 3 Creek and the Western Creek Complex remain above the high end SWAC RGO under Alternatives 4, 5, and 6. Similarly, the levels of Aroclor 1268 in Purvis Creek, Domain 3 Creek and the Western Creek Complex ($\geq$ 3 mg/kg < 4 mg/kg) remain above the lower SWAC RGO under Alternatives 4, 5, and 6. The overall impacts from these residual RGO exceedances need to be evaluated in greater detail.

6. *Section 6.2.1, page 92.* The FS should include alternatives which will achieve RGOs at the lower end of the range presented in the EPA's letter of November 30, 2011. While the EPA and Georgia Department of Environmental Protection (GA EPD) agreed that alternatives which achieve the higher end of the RGO range could be presented for consideration, the selections of such remediation goals would only be acceptable if they are adequately justified. The risk management criteria that can be used to support a selection of an RGO at the upper end of the range can be considered only after the threshold requirements are met. Furthermore, sole reliance on such consequences as habitat destruction to justify use of the high end of the RGO range is not sufficient justification.

   The last sentence of the first paragraph should be modified because the upper end of the range is not understood to be protective according to the BERA. As indicated above, the EPA and GA EPD agreed to consider higher numbers where justification is provided. Other arguments presented in this section regarding the indigenous grass shrimp test and the benthic community studies were already rejected by EPA during the development of the BERA and should be deleted from Section 6.2.1. They can be discussed in the uncertainty section. Since the sediment cleanup goal of 11 mg/kg for mercury is equal to the apparent effects threshold (AET) for grass shrimp embryo development endpoint, all sediments above this concentration are expected to be toxic to grass shrimp.

7. *Appendix E2.* The FS remedy alternative evaluation methods focus on incremental SWAC reduction for reduction of risk to finfish and the green heron. However, these reductions seem to rely on a linear model based on a percent SWAC reduction to predict effectiveness (Appendix E2) and a human health evaluation based on SWAC reductions for total domains, total creeks and total estuary (Table 6-3). The FS omits an adequate demonstration and supporting information as to how these incremental SWAC reductions, and thus progress toward remedial goals and risk assessment endpoints, were determined. Add this analysis in the revision.

8. Appendix E2. Risk reduction analyses were conducted only for mercury and Aroclor 1268, despite there being elevated sediment lead concentrations in the Dillon Duck, Domain 3 Creek and other areas. The risk reduction and remedy effectiveness evaluation should address all four COCs, including "hot spot" areas and where a particular COC is a remedial "driver."

No. 3 Thorough Analysis of Threshold Criteria and Balancing Remedial Alternatives

1. *General*: CERCLA and the NCP require that all of the alternatives except the No Action Alternative meet the threshold criteria, protection of human health and the environment and compliance with ARARs. Once the threshold requirements are met, or an ARAR waiver is approved, then it is appropriate to assess each alternative against the primary balancing criteria and against each other to determine their relative performance. The draft FS appears to state that incidental impacts to the environment or implementation difficulties can justify the selection of an alternative that fails to meet the threshold criteria. Further, risk management assumptions were used before analysis of any alternatives and with minimal supporting documentation. The premature risk management assumptions impacted the development of an objective FS. The revision to the FS should adhere to CERCLA and the NCP, as described above.

2. *Section 3.2, page 35.* Simplify this section by removing the NCP criteria regarding each RAO. The NCP criteria are applied to the development of alternatives, not to RAOs. Also, remove all text associated with how the RAOs will be evaluated (e.g., references to monitoring of sediment and biota) as these become components of specific alternatives to be developed later in Sections 5 and 6.

3. *Section 3.2, page 36.* RAO2 needs to include the threshold criteria of being protective of human health and the environment. The final remedy for OU1 must ensure protection of human health and the environment. Practicability, short term risks (e.g. incidental impacts to the marsh), or other justifications do not substitute or replace the requirement to ensure protection of human health and the environment.

4. *Section 3.2, RAO 4 and RAO 5, pages 36 and 37.* As with the other RAO descriptions, the threshold criteria for protection of human health and the environment need to be stated.

5. *Section 3.2, RAO 7, page 37.* The description in this section suggests that thethreshold criterion for protection of human health and the environment may be balanced against the other criteria.These statements are inconsistent with CERCLA, NCP, and existing EPA Superfund guidance. This RAO should be deleted. CERCLA provides two statutory requirements for the analysis of remedial alternatives, protection of human health and the environment and compliance with ARARs, unless they are waived. A remedial alternative must satisfy these two requirements before it is even eligible for further evaluation against the balancing and modifying criteria. Risk reduction, sustaining resources, practicability, implementability, and short term risk (e.g. incidental impacts to the marsh),

considerations can not supplant the requirement for protection of human health and the environment. FS language should not suggest they may be used as a reason for not meeting this statutory and NCP requirement for a final remedy.

6. *Section 5.1.1, pages 62 and 63.* The section reads, "In some marsh areas, potential short and long term ecological impacts may significantly outweigh environmental benefits of remedy implementation." If the statement is meant to refer to a management decision to leave "isolated contamination" within the marsh complex, this should be clearly stated. If however, the intent is to state that short and long term risks (balancing remedy criteria) may be used to substitute for meeting the threshold criteria, the statement must be removed as the threshold criteria must be meet as noted above.

7. *Section 5.1.2, page 65.* The section states, "...and in some areas potential short and long-term ecological impacts significantly outweigh environmental benefits of remedy implementation." This statement should be removed, as it implies that the balancing criteria may be used to substitute for meeting the threshold criteria, as noted above.

8. *Section 6.1.1, page 85.* There are several statements in this section that refer to achieving the balancing and/or modifying criteria. These criteria do not substitute or replace the requirement to ensure protection of human health and the environment, and the FS language should not suggest that they can be a reason for not meeting this statutory and NCP requirement for a final remedy. The text should be modified.

No. 4 Correction or Elimination of Technical Inaccuracies and Unsupported or Subjective Statements

1. *General:* There are several statements in the FS emphasizing that Aroclor-1268 is less toxic than Aroclor-1254 because it contains less dioxin-like PCB equivalents and dioxin/furan toxicity equivalents than other PCB Aroclors. Based on the information presented in Attachment B, EPA believes the particular type of weathered Aroclor-1268 that ended up in OU1 sediments is only about one-third as toxic as Aroclor-1254 instead of ten or more times less toxic, contrary to description on page 20 of the draft FS. The uncertainty discussed in the FS should state that Aroclor-1268 may be less toxic than Aroclor-1254 by a factor ranging between 1/3- to-1/10 as toxic. Supporting Information for this comment is provided in Attachment B of this letter. Use the 1/3-to-1/10 as a range, rather than solely the 1/10 used throughout the document.

2. *Figure 2-5.* The figure's caption reads "Healthy Marsh." Delete the word "healthy" from the text associated with photos F, G, and H because a visual representation of habitat does not equate to a healthy habitat. Delete the phase "...located at the LCP marsh..." associated with photo K and replace it with the location of the place where the photo was taken.

3. *Section 2.2.1, page 5.* The section states that, "...marsh sediments provide confined conditions." This is contradicted by the draft groundwater remedial Investigation (RI) and

addendum, the thermal infrared study and the seep study. Revise the sentence to read "semi-confined."

4. *Section 2.2.1, page 5.* The 1997 unapproved draft Groundwater RI is cited. However, it appears the language was taken from the also unapproved 2002 Groundwater RI Addendum. The latter report describes the cemented sandstone as having a hydraulic conductivity of 10E-4 centimeter per second (cm/sec) or less, not the 10E-5 cm/sec mentioned in the draft FS report, including page A-3 of Appendix A. There is ample documentation of hydraulic communication and contaminant migration across the cemented sandstone. Note that Figure 2-2 diagrammatically shows leakage through the sandstone. Revise the discussion.

5. *Section 2.2.2, page 6.* The flowpath description in the section suggests that groundwater follows discrete horizontal paths; however, there is a known upwards component to groundwater flow in the marsh. Figure 2-3 shows upwards flow paths. Text should be modified.

6. *Section 2.2.4, page 8.* The major sediment fate and transport properties should include physical mixing and bioturbation, both of which may affect contaminant distribution. The assertion that marsh areas are "net depositional" is frequently used throughout the FS despite the fact that many areas of the marsh are subject to erosion. This assertion is not relevant in determining remedial response actions for individual areas and the text should be revised.

7. *Section 2.3.1, page 9.* This section reads, "An undisturbed community and species diversity are characteristic of a healthy marsh. Based on visual observations from a January 2012 visit, the Site appears to be a functioning habitat with an undisturbed plant community." This statement is irrelevant because Site COCs are not phytotoxic. See comment #2 above. Therefore, it is not anticipated that the Site plant community would be affected by the marsh contamination. Additionally, observational evaluations are not a rigorous means of assessing ecological risk or ecosystem health. Delete this statement.

8. *Section 2.3.2, page 12.* The final paragraph of the section states that seeps only flow after heavy rainfall events and are "diffuse", and are a "small discharge." The data does not support any of these characterizations. Remove this sentence.

9. *Section 2.4.1, OU1 -Surface Sediment COC Concentrations, Page 15.* Lead is present in Dillon Duck sediments at concentrations above 100 mg/kg in most locations and is present in concentrations above 1,000 mg/kg in some locations. The text should be modified to reflect these numbers instead of "greater than 50 mg/kg."

10. *Section 2.3.4, page 13, last paragraph.* Clarify that the BERA did not evaluate marsh grass function or the microbiotic community as assessment endpoints and that no lines of evidence were presented. It is not known whether there are any differences between functions in OU1 and in other marsh habitats. Clarify that the BERA focused on the

potential effects to fish and wildlife because the primary COCs (Aroclor 1268 and mercury) are known to be more bioaccumulative and toxic to upper-level consumers in the food web.

11. *Section 2.4.1, page 15.* Describe the three historical sampling locations which were re-sampled in 2012 and provide rationale for excluding these or any other historical sampling results.

12. *Section 2.4.1, page 16.* The text states that beyond a depth of one foot below the estuary surface, Aroclor-1268 concentrations typically were non-detect. Sixteen of the 62 vertical profiles presented in the RI report show Aroclor-1268 data deeper than one foot below the surface of the estuary. Of those 16 plots, four did not show non-detect concentrations at depths greater than one foot below the surface of the estuary. Please refer to Section 4.3.3 of the approved RI for a full discussion of the location, depth profiles and contaminants identified to date below one foot. Revise the text to reflect this.

13. *Section 2.4.1, page 17.* The section reads, "Whereas the toxicity studies that are the basis for the NRWQC are readily available, the basis of the Georgia WQS is not readily available. Therefore, the exceedances of the Georgia WQS are difficult to interpret." Delete this statement. The Georgia WQS should be included as chemical-specific ARARs.

14. *Section 2.4.2, page 18.* Delete the word "very" from each of bulleted paragraphs since their use may be misinterpreted to be dismissive of the risk assessment exposure assumptions. Also, the section says, "USEPA has not developed CSFs or RfDs specific to Aroclor 1268," which is misleading. The EPA has developed CSFs for PCB/Aroclor mixtures instead of for a specific Aroclor. Modify the language. Furthermore, delete the text in the fifth bullet indicating that clapper rails are not commonly consumed. The Georgia Department of Natural Resources web site indicates that they are commonly hunted.

15. *Section 2.4.2, page 19.* The second paragraph reads, "ELCR estimates greater than 1 x 10E-4 may require further characterization, but not necessarily remedial action or other risk reduction measures (USEPA 1991)." This statement should be modified or removed since cancer risk greater than 1 x 10E-4 *does* require an action.

16. *Section 2.4.4, Finfish, page 28.* In the first bullet, add that several unfiltered water samples analyzed for Aroclor-1268 exceeded the State of Georgia water quality standard of 0.03 μg/L for total PCBs. In the 3rd bullet, in the last sentence insert "methymercury" after the word "modeled," and add that modeled Aroclor-1268 tissue concentrations were within the range of measured tissue concentrations, except for the striped mullet..

17. *Section 2.5, Conceptual Site Model, page 30.* Discuss or reference sections in the RI regarding re-suspension of creek sediments as a release mechanism.

18. *Section 2.*5.3, page 32. This section suggests that the potential for sediment recontamination by groundwater was evaluated and resolved in the RI; it was not. The

OU1 RI states that the flux model results are to be reported in the FS.

19. *Table 3-1.* Make Table 3-1 (Chemical-Specific ARARs) media specific and add text to the table or the body of the document clarifying the appropriateness or applicability of the ARAR/TBC. For example, State of Georgia Water Use *Classifi*cations and Water Quality Standards 391-3-6-03 are listed as a chemical-specific ARAR applicable to surface water. Depending on how OU1 is defined, WQS may also be relevant and appropriate for groundwater discharging (i.e., seeps) to the OU. This table also lists the Safe Drinking Water Act MCLs as an ARAR, but it is not clearly stated which media or how this ARAR would apply. Neither were MCLs considered during RGO development in Section 3.3 nor are groundwater exceedances discussed in Section 3.4. These issues need to be developed so there is clarity regarding the groundwater pathway.

20. *Section 3.2, RAO 6, page 37.* Eliminate the following text from the RAO, "using total or dissolved phase mercury and PCB measures." This RAO should simply state the goal of protecting aquatic life in the estuary.

21. *Section 5.4.2, page 73.* Monitoring of chemical concentrations should not just be limited to fish. At a minimum, add shellfish to the monitoring component because they are critical in the COC food transfer to humans, fish, and herons.

22. *Section 6.2.1, page 90, 1st paragraph.* The fourth sentence of the paragraph mentions concentration reductions in most species over time. Appendix F portrays a more nuanced picture with regards to Zone H. While Figures F-3D through F-3W show decreasing mercury concentrations in six of the 10 species monitored (two species not collected in 2011), Aroclor-1268 is shown to have increased in six of the 10 species monitored (two species also not collected in 2011). Revise the text to reflect this.

23. *Section 6.2.1, page 91, and Figures 6-2A, B.* Figures were drawn that discussed the risk reduction to the green heron from exposure to mercury. Similar figures should be included that show the risk reduction to the river otter from exposure to Aroclor-1268. The river otter has a large home range and had no-observable-adverse-effect level (NOAEL) risk from exposure to Aroclor-1268 in the larger domains, such as Domains 2 – 4 and Blythe Island.

24. *Section 6.2.1, pages 91-92.* The text indicated that the hazard quotients (HQs) are below 1 for the green heron. It should be stated that the HQs below 1 were based on the LOAELs and not on the NOAELs. Figure 3-5 should show the footprint for the lower end of the range of SWAC RGOs in addition to the upper end of the range. Figure 6-2B should plot on the y-axis the estimated daily dose and draw a horizontal line to indicate the NOAEL and the LOAEL. In the alternative, a double-y plot could be used to show the NOAEL hazard quotient on the right y-axis to compare to the LOAEL hazard quotient on the left y-axis. Given that the impact is proportional to the area over which the reproductive decline occurs, the width of the bars on Figure 6-2B should be adjusted to widen the width of the bars in proportion to the total area of the creek or domain they represent.

25. *Section 6.2.1, page 92, second whole paragraph.* The third sentence states, "The need to remediate to the lower end of the RGO must be balanced against the physical impacts of the remedy, so that the remedy itself does not do more harm than good." This indeed is a management goal; however, the FS needs to explain the impact of residual risks that lie between the low and high RGO range. Also, delete the very next sentence that proclaims the benthic community is not negatively impacted by the low-range RGOs. Based on a detailed analysis of over 200 toxicity tests performed by Honeywell and its contractors, Table 7-29 in the BERA provided concentrations protective of benthic invertebrates, which indicates some negative impacts could occur at concentrations above the low-end RGO range.

    Also in the middle of the second whole paragraph it is stated that "Alternatives 2 through 6 all capture areas where differences were observed in grass shrimp and the benthic community, when comparing OU1 and reference locations; so all are protective against levels where measurable differences have been observed." Delete this sentence because the uncertainty and variability in the two "snap-shot studies" conducted over a decade ago do not indicate protectiveness relative to sediment concentrations and the studies tend to conflict with the sediment toxicity results (that should be summarized in Appendix E-2).

26. *Section 6.2.1, page 91, 5th paragraph.* Delete the first sentence that proclaims that a water quality standard would be met if dissolved-phase PCB data were considered, as filtered sample data is irrelevant. Also, in the 2nd full paragraph it is stated "However, Georgia WQS does not state that dissolved phase data are the appropriate values from comparison but rather identifies that total phase data should be used for the comparison." Delete this statement and revise to read "The No Action alternative does not meet Georgia WQS for total mercury."

27. *Section 7.2.1, page 108.* Sentence in third paragraph, "All five alternatives ..., which is well below where adverse benthic effects were observed in the marsh," should be revised because benthic community studies were conducted at only four locations and do not provide data of sufficient quality to support the absence of effects within the RGO range as shown on Figure E2-5. Also, the bioaccumulation of contaminants in the food-chain is a more serious threat.

28. *Section 7.2.1, page 108.*The text indicated that Alternatives 2 and 3 are disproportionately expensive compared to Alternatives 4, 5, and 6. However, the incremental cost of thin cover in Alternative 3 is relatively low for the risk reduction achieved.

29. *Section 7.2.4, page 110.* The first sentence states "Based on all the remedy selection criteria, including the ecosystem impact analysis, marsh recovery analysis, and cost effectiveness analysis discussed above, Alternatives 5 and 6 are the most effective remedial alternatives for OU1." While Alternatives 5 and 6 may represent the best balance between implementability and cost, it has not been adequately demonstrated to be the most effective in achieving the site-specific RGOs.

30. *General: Appendix A.* The hydrologic differences between the marsh removal area evaluated by the Appendix A Flux Model and the areas from which the model parameters were derived should be evaluated for impacts to the model. The model should be run with a range of hydrologic parameters to assess the sensitivity of the model to these parameters. In addition, the flux model does not account for the contaminant input from large-scale intermittent seeps to the marsh surface that have been witnessed by the regulators and a contactor to the responsible parties.

31. *Appendix A, pages A-10.* Contrary to footnote 2, the actual model calculations have never been provided. Remove the footnote. In addition, the data used to evaluate the levels of contamination in the remediated marsh are not provided. Identify which samples are being cited in the section.

32. *Appendix A, page A-11.* The conclusion drawn by Analysis 2 of the Flux Model is that groundwater is not a significant contributor to surface water contamination. Further, Section 2.4.1 of the draft FS provides no explanation or source for identified surface water exceedances. Provide an explanation for how surface water has become contaminated in excess of ARARs.

33. *Appendices A and B.* Varying flowrates have been used for the estuary and portions thereof that need to be reconciled (App A, pg.A-10, 1st and 5th paragraphs, App. B, pg. B-3, 4th paragraph).

34. *Appedix B.* Storm surges have been under-estimated by as much as an order of magnitude; see http://www.georgia.org/SiteCollectionDocuments/Industries/Tourism/VICs/2010/2010%20Georgia%20Hurricane%20Readiness%20Plan.pdf (pg. 9 of pdf) and http://www.chathamemergency.org/documents/EOP%20INCIDENT%20ANNEX%20A%20APPENDIX%205%20HISTORIC%20STORM%20TIDE%20ELEVATIONS%20REV0709.pdf (pg. 13 of pdf).

35. *Appendix B.* Explain the difference in estuary extent shown on Figure 2-4 of the FS and Figure B2-1 of Appendix B. Figure B2-22 of Appendix B shows measured flood velocities double those predicted by the model; explain.

36. *Appendix B.* It is unclear if the calibration applied to the marsh surface in Sections 2.4 and 2.5 of Appendix B carried over to the inundation evaluation in Section 2.3.2 and Figures 2-6A & B of the FS.

37. *Appendix B, Section 2.3, page B-4.* Since peak stream flow for the Little Satilla River was 27,000 cubic feet per second (cfs) in April 1948 and 38,000 cfs in October 1930, 20,700 cfs is not a reasonably conservative choice for the 100-year flood for stability evaluation by hydrodynamic modeling. At a minimum, the second highest recorded flood event (27,000 cfs) should be modeled. The uncertainty section should describe the results of the model for the 38,000 cfs flood event and how the results of the hydrodynamic simulation depend on the 100-yr flood event assumption. Discuss the uncertainty in this assumption and how it affects the results of the sediment cap stability analysis.

38. *Appendices E1 and E2.* There is no discussion, nor any references, in Appendices E1 and E2 regarding long-term effectiveness of thin layer capping in the reduction of COC concentrations and the attainment of remedial goals and risk assessment endpoints. The only information provided regards the recovery rate of marsh vegetation.

39. *Appendix E2, Section 2, Mammal and Bird Remedy Effectiveness Evaluation.* The SWAC calculations in Appendix E2 and Figure 6-1B in the main report do not consider the contribution to the NOAEL risks to the piscivorous mammal from Blythe Island. The NOAEL hazard quotient for piscivorous mammals (river otter) exposed to Blythe Island was 3.7 for Aroclor-1268 (Table 4-30 of BERA). Provide a rationale as to why Blythe Island was not included in the SWAC estimations or in Figure 6-1B.

40. *Appendix E2, Section 3.2, Finfish Remedy Effectiveness.* The uncertainties section should briefly discuss the estimate of the biota sediment accumulation factor (BSAF) for fish from Burkhard *et al.* (2005) for PCB180 of 10 (mg/kg lipid)/(mg/kg oc) relative to the bioaccumulation factors used in the finfish remedy effectiveness evaluation.

41. *Appendix E2, Section 4, Sediment-Dwelling Community.* There is no mention in this section about the general results of the numerous toxicity tests conducted over several years at many locations in the estuary that were presented in the BERA. Honeywell and its contractors expended substantial resources on the toxicity tests in order to evaluate a major line of evidence for COC effects on benthic test organisms. Toxicity was evident at many stations over the several-year period. Include a summary of the tests. Also, explain how the test results potentially conflict with the two *in situ* studies that were presented in this section and provide a discussion of uncertainty similar to Sections 2.3 and 3.3 of this appendix. Because benthic community monitoring was not routinely conducted over the BERA study period, no trends or effects can be predicted.

42. *Appendix H, Table H1.* The assumed value for the distribution coefficient (Kd) for Aroclor-1268 is not provided. It may be calculated from the organic carbon absorption coefficient (KOC) and the fraction of total organic carbon, but this is not explained. The higher value used in the appendix may overstate the ability of the organic carbon in sediment to bind with Aroclor-1268 and immobilize it in sediments of a cap and thereby provide an overly optimistic estimate of the long-term effectiveness of the capping remedy. EPA estimated a lower log KOC value of 6.3 L/kg (as compared to the text value of 7.4 L/kg) using the site-specific congener composition of the Aroclor-1268 found in OU1. The table below explains EPA's calculation. Also, site-specific porewater data from the TIE study can be used to estimate a site-specific log Kd value. For example the Aroclor-1268 concentration in sediments was 26 mg/kg in sediment sample C-6 and the porewater concentration of Aroclor-1268 was 1 µg/L, leading to an estimated site-specific log Kd of 4.4 L/kg. The lower log Kd could reflect colloidal transport or other vehicles for mobilizing PCBs, such as cosolvency. Given the uncertainty in the estimate of Kd, the model should be run to cover a range of Kd values and the text of Appendix H should be expanded to include a separate sub-section explaining the estimation of Kd values.

PCB Congener IUPAC_NUM	Fraction in Aroclor-1268 Mixture	E^a	S^a	V^a	Log K_{OC} (L/kg-oc)[b]
153	0.0026	2.2	1.61	1.8846	5.41
154	0.0024	2.27	1.48	1.7977	5.40
180	0.015	2.34	1.75	2.0070	5.71
187	0.053	2.42	1.61	1.9201	5.71
195	0.004	2.57	1.74	2.0425	6.02
202	0.066	2.62	1.55	1.9556	6.00
206	0.640	2.72	1.87	2.1649	6.33
207	0.046	2.78	1.66	2.0780	6.32
209	0.160	2.94	1.77	2.2004	6.65
Sum	0.989			Mass-weighted log K_{OC}	6.24 + 6×0.01=6.3

Abraham solvation parameters from van Noort *et al.* (2010). Parameters A and B are zero for PCBs.

b Log K_{OC} linear solvation energy relationship from Kipka and Di Toro (2011):

log K_{OC} = c + eE + sS +vV, where c = 0.724, e = 1.198, s = −0.080 and v = 1.155 a Abraham solvation parameters from van Noort *et al.* (2010). Parameters A and B are zero for PCBs.

b Log KOC linear solvation energy relationship from Kipka and Di Toro (2011):

log KOC = c + eE + sS +vV, where c = 0.724, e = 1.198, s = −0.080 and v = 1.155

43. *Appendix H, Table H3*. Provide the calculations for the Darcy flow velocity and run the model over a range of velocities. This will help determine whether the cap design will be effective in preventing migration of contamination through the cap.

44. Appendix H. Include model runs for at least three different scenarios with a separate table of the input parameter assumptions for each in order to evaluate the uncertainties in the model outputs. Bloom et al. (1999) reported a log Kd for mercury in sediments of Lavaca Bay as 4.89±0.43 for inorganic mercury and 2.70±0.78 for methylmercury. Since most of the dissolved mercury in porewater will likely be methylmercury, the model should be run assuming a log Kd for mercury of 3 L/kg as one of the scenarios.

45. *Appendix Table H4*. This table gives the average sorbed-phase concentration of Aroclor-1268, lead, and mercury in the bioturbation zone as 0 (zero) after 100 years. This conclusion is unreasonably optimistic. It appears as if something is missing. Provide the numbers in the table even if several places to the right of the decimal point are needed to display numbers less than 0.5.

46. *Appendix H.* Section 3.3.1.3 of Appendix H uses a hydraulic conductivity value that is inconsistent with the value used in the Flux Model in Appendix A. Reconcile these differences. Further, the infrared survey has indicates that there is significant groundwater flow through the marsh mud that is not factored into the diffusive seepage rate used in this model.

47. *Appendix H.* Section 3.3, second bullet of Appendix H shows that the cap model was run using a 10-cm. bioturbation depth; run the model using 15 cm. bioturbation.

48. *Appendix H.* All data derived from the model should be presented.

No. 5 Editorial Corrections and Clarification in Presentation

1. *General*: Reorganize Section 2 to first summarize the RI, update the CSM to discuss the setting, the problem, sources, extent of contamination, contamination release mechanisms, fate and transport processes, exposure pathways, and risks.

2. *General:* Section 2.4.3, pages 20-30. The Summary of the Baseline Ecological Risk Assessment section presents a great deal of information which is not relevant to the remedy selection and repeatedly refers the reader to the BERA. Suggest that most of the text in this section be eliminated and replaced by a concise set of risk-based conclusions and a summary table which depicts which assessment endpoints are at risk in which domains of OU 1 and sediment concentrations at which the assessment endpoint NOAEL and LOAEL HQ were calculated to equal 1. This table would contain most, if not all, of the relevant information for remedy option comparisons.

3. *Section 1, fourth bullet, page 1*. Specify that alternatives should be compared to both the CERCLA statute and NCP.

4. *Section 1.1, Objectives, page 1*. Include language "to protect human health and the environment and to comply with applicable and/or relevant and appropriate requirements (ARARs)."

5. Combine Section 2.5.2 Chemical Distribution with Section 2.4.1 and Section 2.5.4 with Sections 2.2.3 and 2.2.4 to make a smooth transition to RAOs and RGOs.

6. *Section 2.4, page 13*. The term "regulatory" in the last whole sentence should be deleted because all benchmarks with a risk assessment are not regulatory in nature. Delete the whole first sentence on page 14 since it is unnecessary and appears dismissive of involuntary incremental risk at the Site.

7. *Section 2.4.1, page 14*. In the first sentence of this section, the citation USEPA 1995 does not appear in the references section. Add "US EPA – ERT Final Report Ecological Assessment Ecological Risk Evaluation of the Salt Marsh and Adjacent Areas at the LCP Superfund Site Brunswick, GA. April 1997" to the reference section.

8. Section 2.4.1, page 17, last sentence. Change the word "detections" to exceedances.

9. *Section 2.4.2, Table 2-4*. Clarify the title of Table 2-4 to indicate that the COCs pertain only to the human health.

10. *Section 2.4.2, page 20*. Modify the 2nd bullet under Noncancer effects to read: "...since all COCs do not share the same mode of action, summing across all COCs is overly conservative. When HI values for individual chemicals are considered, there are HI values exceeding 1 both for consumption from recreational fishing and for high quantity fish consumption."

11. *Section 2.4.2, page 20.* Modify the 4th bullet under Characterization of Uncertainty to read: "...using the upper-bound CSF for high risk/persistence PCBs such as Aroclor-1254, when one published study suggests the tumorigenic potency of Aroclor-1268 may be at least 10-times lower."

12. *Section 2.4.4, page 29.* In the second sentence of the first bullet under Uncertainty Analysis, add the words "acute and" before the word 'chronic' because many toxicity tests had either 0% survival and/or reproduction.

13. *Section 3.2, RAO 1, page 35.* Delete the word "potential" since releases have been well demonstrated. Also, reword RAO 1 to include not only in-stream sediment deposits but also the contaminants in the marsh flat sediments.

14. *Table 3-3.* The following changes should be made to page 2 of the table: 1) Air Pollution Act – add "requirement" after "specific", 2) Hazardous Waste Management Act & Hazardous Site Response Act – strike 12-8-200 (not applicable to NPL sites), add 391-3-11, 391-3-19, note that 391-3-4 are rules for the Comprehensive Solid Waste Management Act, 12-8-20, and 3)Water Quality Control Act – 391-3-6-.06. The EPA will provide more thorough input on Table 3-3 in the future.

15. *Table 3-4* is not associated with RAO 3 that pertains to hazard indices and cancer risks and should be deleted from this section. If Table 3-4 is retained elsewhere, then in the table footnotes, add a statement describing the meaning of the values 0, 1, and 4.

16. *Section 4.3, page 60.* MNR is retained in the text but not in Figure 4-7. Change the MNR notation on Figure 4-7 from NR to R2.

17. *Figure 4-7.* Define "R[1]" technology in the figure.

18. *Section 6.2.1, page 91.* The paragraph that begins with "RAO 6 in Section 3.2..." should be revised to simply say that the No Action Alternative would not meet the State water quality standards.

19. *Figures 6-1A and 6-1B.* In the captions, delete the phrase "upper confidence limit estimates" as these HQs are not confidence limits. In addition, these two figures only evaluate the LOAEL or high end of the risk range. Include the NOAELs.

20. *Section 6.2.3, page 94.* The monitoring will be conducted to ensure long-term protectiveness of the remedy and compliance with ARARs, in addition to structural integrity and effectiveness. Revise text.

21. *Section 6.2.6, Page 100, Table 6-4.* In the Limitation/Constraint Column, with respect to the creeks, change the wording to refer to short-term impacts to creeks, rather than marshes.

22. *Section 6.2.7, page 103 and Table 6-5.* Costs quoted in the text are for total Capital Costs

(Indirect and Direct), but Table 6-5 presents these costs separately (plus contingency). Add a column to Table 6-5 to clearly show Total Capital Costs.

23. *Section 6.2.7 and Appendix G.* Total Estimated Recurring Costs are provided only in present day dollars and are not presented in sufficient detail to allow a reader to understand how these costs were estimated. Provide a table or tables with estimated costs for years 1, 3, 5, 10, 15, 20, and 30 broken out for each alternative. Additionally, include separate line items for major cost components (e.g., physical monitoring of capped area, physical monitoring of marsh restoration, etc.).

24. *Section 7.1, Figures 7-1B and 7-1C.* The data used to generate the graphs in Figures 7-1B and 7-1C are not correctly referenced in the figure captions. Figure 7-B is referring the reader to Section 6-3 of the FS when the FS lacks a Section 6.3. Figures 7-1B and 7-1C should be redrawn to keep the clusters of bars showing the hazard quotients for individual fish species separate to clarify how the figures show hazard quotients for different fishes. The median hazard quotient for the sundry fish species assessed is not a particularly useful indicator. Box and whisker plots should not be used in 7-1 series figures, because plots based on a "median" fish are not meaningful.

26. *Figures 6-1A through 7-3C.* The figures should specify that they refer to the LOAEL hazard quotient. Both the NOAEL and LOAEL hazard quotients should be shown on the figures. The FS needs to show that the Site risks are within a range of discretion (i.e., the NOAEL to LOAEL range or can be above the LOAEL in limited areas with sufficient justification) before a a risk management decision may be made.

25. *Table E2-2.* Curve fit types, Power equation in footnote needs the b in "y = a xb" to be made into a superscript.

ATTACHMENT B: SUPPORTING INFORMATION

Supporting Information for Comment #1 (Category 4):The EPA compiled the available information on the toxicity equivalents for the specific type of Aroclor-1268 used at the Site, based on congener analysis of OU1 sediments in 1996. The EPA estimated the number of dioxin/furan toxicity equivalents (TEQ) in the site-specific Aroclor-1268 to be roughly 2.4E-06 kg/kg. The breakdown was 2.29E-06 kg/kg in Purvis Creek and 2.47E-06 kg/kg in Domain 3. This means that the Aroclor at the Site is about 30 percent, or roughly one-third, as toxic as Arcolor-1254, which has a reported dioxin TEQ composition of 7.87E-06 kg/kg (Burkhard and Lukasewycz 2008). The BERA uncertainty section relied upon Burkhard and Lukasewycz (2008) for evaluation of the relative potency of Aroclor-1268 relative to more common Aroclors. The HHRA relied on congener composition data for Aroclor-1268 from Anderson (1991) for its analysis of relative potency. Anderson (1991) measured a laboratory standard of Aroclor-1268, as opposed to the PCBs found at the Site. Rushneck *et al.* (2004) indicated that different lots of Aroclors could have slightly different compositions. Although weathering in the environment can alter the composition of PCBs, the degree of weathering that occurred was so slight that the Aroclor-1268 at the Site did not change to another PCB Aroclor. Any changes that occurred only affected the composition of the PCB congeners by a low percent.

Among PCB congeners with dioxin-like toxicity, the toxicity equivalence factor (TEF) for PCB 126 is the greatest. A minute fraction of the total mass of PCBs is made up of PCB 126. The toxicity equivalents (TEQ) per mass of Aroclor-1268, however, are very sensitive to the exact amount of PCB 126 present. The impact of these assumptions primarily affected the uncertainty section in the risk assessments, and may have affected risk interpretation, but did not affect the calculations in the ecological risk assessment. The uncertainty section in the BERA relied on Burkhard and Lukasewycz (2008), who assumed 1.8 μg/g (0.18%) PCB 126 in Aroclor-1268, after Rushneck *et al.* (2004). The HHRA uncertainty section assumed 0.7 μg/g (0.07%) PCB 126 in Aroclor-1268, after Anderson (1991). Anderson (1991) reported 1.49 μg/g (0.149%) PCB 126/129 in Aroclor 1268, which means that the PCB126 and PCB129 were not separated from each other by Anderson's analysis. The HHRA (Table 25) assumed half of this value was PCB 126. A somewhat higher percentage of PCB 126 of 3.6 μg/g (0.36%) was reported by Kannan *et al.* (1997), who characterized Aroclor-1268 from the OU1 Domain 1 marsh excavation area. The congener analysis conducted in 1996, where the site-specific composition of PCBs was measured, detected PCB 126 concentrations in the range of 1 to 2 percent. The 1996 PTI investigation of PCB congeners in OU1 measured 18 μg/g (1.8%) of PCB 126. The average was among samples of Purvis Creek and Domain 3 sediments. The particular type of Aroclor-1268 that ended up in OU1 sediments is only about one-third as toxic as Aroclor-1254 instead of ten or more times less toxic (as described on Page 20 of the FS).

PCB 126 has been shown to affect the bone density and structural development in juvenile diamondback terrapins (*Malaclemys terrapin*) [Holliday and Holliday (2012)]. Chambers *et al.* (2012) reported that sturgeon species, such as shortnose sturgeon (*Acipenser brevirostum*) and

Atlantic sturgeon (*Acipenser oxyrinchus*), are particularly sensitive to early-life stage toxicity from exposure to PCB 126. The authors reported a minimum dioxin TEQ of 50 pg/g in tissue as inducing significant toxicities in shortnose sturgeon (22 mg/kg Aroclor-1268 in tissue for a TEQ composition of 2.4E-06 kg/kg).

Supporting Information for Comment #12 (Category 1): The natural rate of sedimentation in the marsh is governed by the gradual rate of sea-level rise. A consistent supply of sediment is necessary to nourish the marsh. As tides flood the estuary, sediments washed from marsh creeks settle on top of the marsh flats where they are deposited or trapped by vegetation. The historical sedimentation rate in the vicinity of the Site is approximately 3 millimeters per year (see web link). See the following link for information on historical sea level rise in the vicinity of the site: http://www.tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?stnid=8670870

Supporting information for Comment #21 (Category 1): The RI and FS acknowledge the limitations associated with the NOAELs and LOAELs in risk assessment. Therefore, EPA has considered dose-response curves for Aroclor-1268 and mercury. The dose-response curve for Aroclor-1268 was based on dietary exposure studies of mink fed fish from the Hudson River. The OU1 BERA used a NOAEL toxicity reference value of 0.03 mg/kg-bw/d and a LOAEL toxicity reference value of 0.3 mg/kg-bw/d for the omnivorous mammal (raccoon) and piscivorous mammal (river otter). The LOAEL toxicity reference value of 0.033 mg/kg-bw/d for total PCBs from Bursian *et al.* (2103) represents 20 percent mink kit mortality through stillbirth and within 6 weeks of birth. The LC20 LOAEL from Bursian *et al.* (2013) compares favorably with the NOAEL used in the BERA. The toxicity values used for mammals in the BERA were based on studies of Aroclor-1254.

Dioxin-like PCB Congener Abbrev or Dioxin/Furan	Congener No.	g/g in 1996 LCP Data[a]	WHO 2005 mammal TEF	Source
2,3,3',4,4',5,5'-HpCB2	189	1.50E-04	0.00003	1996 PTI Data
2,3,3',4,4',5'-HxCB2	157	3.61E-04	0.00003	1996 PTI Data
2,3,3',4,4',5-HxCB2	156	8.11E-05	0.00003	1996 PTI Data
2,3,3'4,4'-PeCB1,2	105	2.83E-04	0.00003	1996 PTI Data
2,3,4,4',5-PeCB1,2	114	1.47E-05	0.00003	1996 PTI Data
2,3',4,4',5-PeCB1,2	118	7.50E-04	0.00003	1996 PTI Data
2',3,4,4',5-PeCB2	123	9.75-E05	0.00003	1996 PTI Data
3,3',4,4',5,5'-HxCB1,2	169	1.77E-05	0.03	1996 PTI Data
3,3',4,4',5-PeCB1,2	126	3.00E-05	0.1	1996 PTI Data
3,3',4,4'-TeCB1,2	77	6.97E-05	0.0001	1996 PTI Data
3,4,4',5-TeCB2	81	1.32E-05	0.0003	1996 PTI Data
1,2,3,4,6,7,8-HpCDD	NA	1.90E-09	0.01	Falandysz *et al.* 2005
OCDD	NA	7.40E-09	0.0003	Falandysz *et al.* 2005
2,3,7,8-TCDF	NA	5.10E-09	0.1000	Falandysz *et al.* 2005
1,2,3,7,8-PeCDF	NA	1.10E-07	0.0300	Falandysz *et al.* 2005
1,2,3,4,7,8-HxCDF	NA	1.30E-06	0.1000	Falandysz *et al.* 2005
1,2,3,6,7,8-HxCDF	NA	2.60E-07	0.1000	Falandysz *et al.* 2005
1,2,3,7,8,9-HxCDF	NA	8.70E-09	0.1000	Falandysz *et al.* 2005

2,3,4,6,7,8-HxCDF	NA	3.50E-07	0.1000	Falandysz *et al.* 2005
1,2,3,4,6,7,8-HpCDF	NA	4.60E-06	0.0100	Falandysz *et al.* 2005
1,2,3,4,7,8,9-HpCDF	NA	1.80E-07	0.0100	Falandysz *et al.* 2005
OCDF	NA	3.20E-06	0.0003	Falandysz *et al.* 2005

a – Average of samples SCC03-2, SCM03-2, SCCD09-2, SCCD06-2, and SCCD08-2.

The average TEQ per gram of Aroclor-1268, including dioxin-like PCBs and dioxins and furans as contaminants of Aroclor-1268, is estimated to be 2.4E-06 kg/kg. (Compare with Section 6.2.1 in the BERA.) The EC20 toxicity reference value of 0.033 mg/kg-bw/d for mink corresponded to 281 pg TEQ/kg-bw/d (Bursian *et al.* 2013). For the site-specific composition of dioxin-like PCBs and dioxin/furans in Aroclor-1268, the 281 pg TEQ corresponds to a LC20 of 0.12 mg/kg-bw/d. The LC50 value from Bursian *et al.* (2013) of 0.78 µg total PCBs/g feed is equivalent to 0.78 * 2.6 / 0.34 * 97 g-food/day/kg-bw ÷ 1E+09 ÷ 2.4E-06 = 0.24 mg/kg-bw/d. The LC20 and LC50 toxicity reference values are similar in concept and magnitude to the values used in the BERA. However, the LC50 toxicity reference value for Aroclor-1268 for sensitive mammals is lower than the LOAEL used in the BERA.

The dose-response curve can add perspective to the discussion of the characterization of the risks to omnivorous mammals. Mink represent a sensitive species in OU1. Although mink were not chosen as a representative receptor in the BERA, the assessments of the risks to the raccoon and river otter are similar. Based on the exposure factors assumed in the BERA for the river otter, the estuary-wide grand mean Aroclor-1268 concentration in sediment (Table 4-3a in BERA) and the estuary-wide grand mean concentrations in biota from the BERA, the estimated daily dose for the river otter was 0.18 mg/kg-day for OU1 or about halfway between the LC20 dose and the LC50 dose from Bursian *et al.* (2013). The starting total estuary Aroclor-1268 conditions in Purvis Creek and the area-weighted grand means for the estuary correspond to roughly 36 percent mortality to sensitive mammals. A LOAEL HQ of 1 could represent greater than 50 percent mortality to sensitive mammals. It does not represent risk reduction to a no observable adverse effect level (NOAEL). The acceptable degree of reproductive impairment to mammals is a risk management decision.

The same can be said of the risk reduction for the piscivorous bird. The OU1 BERA used a NOAEL of 0.02 mg/kg-bw/d for the piscivorous bird and a LOAEL of 0.06 mg/kg-bw/d. The NOAEL dose to birds of 0.02 mg/kg-bw/d corresponds to roughly zero percent reduction in reproductive success. The LOAEL of 0.06 mg/kg-bw/d corresponds to about 20 percent reduction in reproductive success in birds and 0.037 mg/kg-bw/d corresponds to 10 percent reduction in reproductive success. See Jackson *et al.* (2011) for mercury dose-response curve and Custer *et al.* (2012) for diet-to-egg extrapolation. An OU1 mercury SWAC of 1.8 mg/kg represents a 38 percent decline in avian reproductive success. The SMA 1 alternative reduces the total estuary SWAC from 1.8 to 1.2 mg/kg mercury in OU1 sediment, which corresponds to 22 percent decline in reproductive success or a gain of about 16 percent reproductive success. The SMA 2 and SMA 3 alternatives both result in an estuary average mercury SWAC of 1.4 mg/kg, which corresponds to a decline in reproductive success of 27 percent. The 192 acres of

Domain 4 East has mercury SWAC of 2.0 under SMA 2 and SMA 3 alternatives, which corresponds to a 43 percent decline in reproductive success, affecting approximately 65 breeding pairs in Domain 4 East for a bird with a home range of 3 acres (Cumbee *et al.* 2008). The estimates of risk reduction used here for the green heron are based on the bioaccumulation models from sediment to biota in the BERA. The alternatives presented in the FS need careful consideration. The FS should make a clear distinction between the levels of effectiveness achieved by each alternative.

<u>Summary</u>: Comment 20 (Category1) does not not suggest that different risk model or a different receptor species should be used than was used in the OU1 BERA or that the toxicity reference values from Bursian *et al.* (2013) or Jackson *et al.* (2011) should be used for the FS. A hazard quotient of 1 for mercury represents an approximately 20 percent decline in reproductive success. A LOAEL hazard quotient of 2.3 for mercury represents a 50 percent decline in reproductive success of birds. A LOAEL hazard quotient of 0.8 for Aroclor-1268 represents an approximately 50 percent decline in offspring survival in sensitive mammals. A LOAEL hazard quotient of 0.4 for Aroclor-1268 represents approximately a 20 percent decline in offspring survival for sensitive mammals. The general shape of the dose-response curves should be about the same regardless of the species or assumptions. In summary, a LOAEL hazard quotient of 1 should not be equated with acceptable risk due to the uncertainties presented in the comment. This should be brought out in the Uncertainty Section of the FS.

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