February 7, 2011

U.S. Environmental Protection Agency
Comments on Draft Human Health Risk Assessment
And Phase II Environmental Site Assessment

Proposed Strecker Forest Subdivision
Wildwood, Missouri

The U.S. Environmental Protection Agency (EPA), Region 7, is providing the following comments resulting from EPA's review of the draft Human Health Risk Assessment (HHRA) prepared by Environmental Stewardship Concepts and Henshel Envirocomm (ESC&HE), and the Phase II Environmental Site Assessment (ESA) Report prepared by Mundell & Associates (Mundell) for the proposed Strecker Forest residential development. To some degree, both reports address physical safety hazards and geotechnical concerns for residential development. EPA comments provided below are limited to concerns relating to potential chemical contamination that could affect the proposed residential development and related health concerns. For each report, general comments are followed by specific comments. Comments that were editorial or grammatical in nature were generally excluded from the EPA review.

DRAFT Human Health Risk Assessment for the Proposed Strecker Forest Development Site, January 10, 2011

General Comments

1. EPA has identified several key miscalculations in conducting the units conversions and intake estimates. As a result, risk estimates in the HHRA are overestimated by a factor of 1,000 to 10,000-fold. Specific information on these miscalculations are provided in the Specific Comments. Miscalculation of potential cancer risk and non-cancer effects associated with dioxin levels at the site are particularly significant because the risk characterization in the HHRA identifies dioxin as the only chemical that poses elevated risks based on data from the ESA.

2. The HHRA lacks figures depicting sample locations and the sample analytical data. It also lacks tables showing all of the intakes and risk estimates for each chemical and exposure pathway evaluated in the risk assessment. Although this information is critical to all risk assessments, it is especially important to the HHRA. For example, the HHRA states that there are data gaps associated with previous sampling schemes, a figure depicting these locations is not provided. The risk assessment also asserts that a large number of chemicals have been detected at the site with "high concentrations", but there are no figures or tables provided that convey this information. In addition, several critical miscalculations of intakes and health risks have been identified. EPA is uncertain if similar mistakes were made in data/calculation tables not included in the HHRA. Given the importance of figures and data tables to risk assessments, the HHRA must contain appropriate figures depicting sampling locations and areas of contamination, as well as all analytical data used to characterize health risks and evaluate background conditions.

3. Many of the assumptions used to evaluate health risks lack supporting data and/or are technically flawed. Major assumptions used in the HHRA that lack supporting data and/or are flawed include, but are not limited to the groundwater use pathway, the depths of the stream during flooding, the duration of flooding in the ravine, erosion in the ravine (translating to stream bank erosion), dermal contact with dioxin in surface water, and inhalation modeling. Additional information regarding the necessary revisions on this topic can be found in the Specific Comments section.

4. The HHRA claims to follow EPA risk assessment guidance; however, many portions of the HHRA lack consistency with the most current EPA risk assessment guidance and policy. These inconsistencies include, but are not limited to the following elements: the conceptual site model (CSM), the methods for deriving exposure point concentrations, development of exposure units, the use of screening levels, the use of default exposure factors and toxicity values, and general report organization. Additional information regarding these inconsistencies can be found in the Specific Comments section.

5. In addition to lacking a discussion on exposure point concentrations and what they represent, the HHRA lacks justification for the concentrations used to estimate intakes. With the exception of the TEQ concentrations in surface water, results from individual wells and soil borings were entered directly into the intake equations. Data from other sampling locations, which should be accounted for in the exposure point concentration, were generally not addressed. This is of special concern for soils where the risk estimates were based on one sample, which is generally not an accepted practice when conducting a risk assessment. Given that intakes should be based on the average concentration of a chemical within a defined exposure unit, the HHRA should have derived exposure point concentrations using all samples within an exposure unit. For example, exposure point concentrations for current surface soil exposure pathways (i.e., recreational exposure) should be based on all surface soil samples collected at the site. Future residential exposure pathways should consider surface and subsurface soils (assuming excavation and surface regrading) falling within defined exposure units (i.e., residential lot). The HHRA should be revised so that exposure concentrations are based on all of the samples that fall within the defined exposure units for the exposure scenarios being addressed. EPA recommends using ProUCL, a statistical software package, to derive the exposure point concentrations (USEPA, 2007).

6. No substantive discussion is provided in the text that details the nature and extent of contamination (i.e., the sample results from the Mundell investigation and other previous investigations). Note that a significant portion of the HHRA is used to discuss data gaps in the sampling, yet the HHRA does not provide a detailed discussion on what is known about the site. Also, figures depicting monitoring well results and interpolated dioxin toxic equivalent (TEQ) concentrations are inadequate because they do not account for other contaminants. Additionally, as discussed in the HHRA, there are significant uncertainties with the interpolated dioxin data. The HHRA should include a thorough discussion of the Mundell sampling data including soil sample depths and concentration ranges of the chemicals detected in soils and groundwater. EPA's review of the soil data has indicated that there is no source of soil contamination on the proposed Strecker Forest Development Site (see comments on the Environmental Site Assessment (ESA) Report)

7. The HHRA lacks a data usability assessment. A data usability assessment is a critical piece and necessary component of a human health risk assessment. In addition to including an evaluation of the analytical data (e.g., adequate detection limits, are contaminants detected in blanks?), such an evaluation includes an analysis of the data to determine whether it is representative of potential exposures. Given that the HHRA and the EPA review of the site data have identified many data usability and quality issues, a data usability assessment should be conducted and documented in the HHRA. Per EPA risk assessment guidance, ESC&HE should evaluate the data according to the six criteria outlined in Chapter 3 of USEPA's Guidance for Data Useability in Risk Assessment (USEPA, 1992). These criteria are data sources, documentation, analytical methods (and detection limits), data quality indicators (e.g., data representativeness), data review, and data reporting. EPA recommends that a summary of the data evaluation be provided in the HHRA that is consistent with the "Data Useability Worksheets" provided in Risk Assessment Guidance for Superfund: Volume 1 – Human Health Evaluation Manual (Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments) (RAGS Part D) (USEPA, 2001).

8. Despite EPA's concerns regarding the background evaluation performed in the ESA report which was limited to dioxin, a background evaluation is warranted in the HHRA. First, the findings section of the HHRA mentions that groundwater contaminants (i.e, metals and (volatile organic compounds (VOCs)) exceeded background, yet there was no background evaluation of metals in the HHRA or ESA Report. Also, the HHRA is rather dismissive of the fact that dioxin is ubiquitous in the environment, having natural and anthropogenic sources. This is especially critical given that the levels used to evaluate exposure fall within the background range. The ESA Report concluded that the higher of the two dioxin levels used to estimate the exposure concentrations in the HHRA was determined to be representative of background. A determination on the other sample was not provided in the ESA Report, because the TEQ concentration was equal to or below health-based screening levels.

9. The HHRA routinely refers to "target organism" when discussing receptors. "Target organism" is a term not typically used to describe receptors in human health risk assessments and implies that other organisms were considered in the HHRA. EPA recommends that ESC&HE replace "target organisms" with "receptors."

10. The HHRA evaluation of the drinking water pathway assumes that an adult consumed shallow groundwater for 30 years prior to the installation of the municipal water supply. No data has been provided to show that impacted shallow groundwater was ever used as a source for drinking water, and the HHRA has not provided justification for why ESC&HE believes that the shallow groundwater is a usable source of drinking water. The HHRA does not discuss the depths of drinking water wells within the vicinity of the site which would provide insight into the usability of the shallow groundwater. As discussed in Risk Assessment Guidance for Superfund (RAGS) Part A, groundwater is deemed a suitable drinking water source if it is of sufficient quality or yield (USEPA, 1989). ESC&HE should evaluate the usability of the shallow groundwater prior to addressing it in the HHRA.

A risk assessment is intended to address current and future exposure pathways. Although no data has been provided to support that the pathway was complete, past exposures are generally not evaluated in human health risk assessments. Assuming that an exposure has occurred in the past with information to the contrary is misleading.

11. The HHRA relies solely on the data from the Mundell investigation and the groundwater data provided by MDNR. It is not clear why data from previous investigations were not used that includes on and off-site soil sampling and groundwater monitoring. Note that some of this data (i.e., results from soil sampling in 2004) was also provided in the Phase II ESA. The exclusion of this data is problematic because ESC&HE has asserted that there are data gaps across the site, which, in part, could be addressed by the previous investigation data and other historical information. The HHRA should account for all environmental sampling conducted in relation to this site. If particular data sets are not used, ESC&HE should provide the rationale and account for this information in identifying data gaps.

12. The HHRA repeatedly infers that the existence of numerous karst features occur in the area of the proposed development. Whereas conduits and caves may develop in a karst environment, there is no evidence that these structures exist in the area of the proposed development. Boring logs from the Phase II ESA indicate the presence of residuum along the silty clay/bedrock interface. These logs do not indicate limestone fractures, bedding planes/dip direction or solution cavities (although some logs indicate voids of 6 in to 2 ft). The log for MW-1 (on the Bliss-Ellisville site) indicates fracturing from 29 ft to 52 ft. Two geophysical logs from wells MW-2 and MW-6 indicate fracture zone(s) with associated weathered zones. The connectivity of these fracture zones is not known.

13. The HHRA lacks a discussion on how qualified data may affect the HHRA. A large percentage of the dioxin and furan results were qualified as estimated values ("J" or "QJ") and a couple of others were detected in the associated method blanks. Many of the VOC detections, which had exceptionally low detection limits, well below their screening levels, were also qualified. Given the uncertainties associated with the accuracy of qualified data, it is critical that the HHRA provide a detailed and balanced discussion on the data quality and how it affects potential site-related health risks. EPA also recommends that the data validation reports be referenced in the HHRA. As discussed in previous comments, data quality and usability assessments are critical elements of the risk assessment process (USEPA, 1989).

14. Throughout the report, reference is made to the Bliss-Ellisville site. The Bliss and Contiguous Properties portion of the Ellisville Site is sometimes referred to as the Bliss-Ellisville site. Historically, the Ellisville site has been considered as three separate sub sites, which include the Bliss and Contiguous Properties, the Callahan Property, and the Rosalie Investment Company Property. The extreme northeast portion of the proposed Strecker Forest subdivision is part of the Bliss and Contiguous Properties, which is defined geographically by the identified area of contamination. The Bliss and Contiguous Properties sub site is a component of the Ellisville Superfund site which appears on the National Priorities List.

Specific Comments

1. **Executive Summary (p. 6).** The final full sentence on this page refers to soil, groundwater and surface water ingestion as accidental. EPA recommends using the term "incidental" when referring to soil and surface water (via swimming) ingestion. Notwithstanding comments regarding the drinking water pathaway, neither "incidental" nor "accidental" should be referred to when characterizing the drinking water pathway (i.e., ingestion of groundwater).

2. **Executive Summary (p. 6 &7).** The sentence spanning these pages states that chemicals detected above detection limits and regulatory standards were carried through the human health risk assessment. Notwithstanding comments on Table 13, EPA's risk-based screening levels provided in that table are **not** regulatory standards or cleanup standards. EPA risk-based screening levels, such as the Regional Screening Levels (RSLs) (formerly the preliminary remediation goals (PRGs)), are intended to assist with the investigation of sites and to determine if further investigation is needed (USEPA, 2010). Because the RSLs are not regulatory standards, the HHRA must not refer to them as regulatory or cleanup standards. The HHRA should also clarify "detection limits." Many of the dioxin congeners were detected below the laboratory reporting limit, which is often referred to as the detection limit.

3. **Executive Summary (p. 7).** The second full paragraph on this page inaccurately states, "Total dioxin toxicity (for all toxic forms, measure as toxic equivalents) was elevated above new soil standards proposed by EPA, but not uniformly across the site." It is unclear what EPA standards the HHRA is referring to. Except for three samples collected within the NPL area, the dioxin TEQ concentrations in other areas of the site, including the areas evaluated in the HHRA, are not elevated above EPA's draft recommended interim PRG of 72 ppt. ESC&HE should provide a more accurate characterization of areas and soil depths of the site that have dioxin TEQ above the draft recommend interim residential soil PRG in the HHRA.

4. **Executive Summary (p. 7 - 9).** The text within the executive summary will need to be revised per the following Specific Comments on the exposure assessment, toxicity assessment, risk characterization, uncertainties, and findings and conclusions.

5. **Section 1.2 (p. 13).** EPA disagrees with ESC&HE that eight potential drum burial areas were identified. The Mundell geophysical investigation identified only three areas where subsurface readings were consistent with the possible presence of subsurface metallic objects.

6. **Section 1.3 (p. 19).** The third paragraph on this page inaccurately states that the draft recommended interim residential soil PRG of 72 ppt is based on a non-standard assumption that all of the dioxin comes from the contaminated site and that ordinarily only a fraction of the dose is assumed to derive from other sources. To the contrary, the non-carcinogenic PRG of 72 ppt is based on standard Superfund risk assessment assumptions and guidance. It is **not**

standard practice to include dietary intake when deriving soil PRGs. While relative source contribution (RSC) was considered in the interim PRGs, the draft recommended PRG document provides specific reasons why it was not adjusted from 1.0. ESC&HE should remove and or revise the final passage starting at "…although this number is based…"

7. **Section 1.3 (p. 19).** The discussion regarding EPA's proposed cancer slope factor (CSF) and reference dose (RfD) is problematic. First, EPA's reassessment of dioxin is not final and those toxicity values are subject to change. Second, the slope factors' units were mistakenly left out of the text. ESC&HE should revise the HHRA so that it states that EPA is in the process of finalizing the dioxin reassessment and that the toxicity values may be lower than previous values, including the toxicity values used to derive the interim PRGs. The CSF units should also be provided.

8. **Section 1.3, Table 1 (p. 20).** This table suggests that EPA has derived an alternate non-cancer PRG of 36 ppt, assuming 50% of the total dioxin is from the site. USEPA, including the draft recommended PRG document, has not derived a PRG of 36 ppt. The use of a RSC of 50% is not supported by the draft recommended PRG document. ESC&HE should revise the table so that it does not suggest that EPA has derived an interim non-cancer residential soil PRG of 36 ppt. In addition, because the recommended interim PRGs are draft, this table should be revised so that it indicates that the PRGs are draft. Note that the table heading inaccurately refers to the PRGs as EPA dioxin standard. If the table intends to list standards, then ESC&HE should list the current PRGs of 1,000 ppt and 5,000 ppt for residential and occupational soils, respectively.

   ESC&HE should make the following revisions to Table 1. First, the toxicity values provided in the draft dioxin reassessment should be removed. Second, the table should provide the units for CSFs. Third, the table should provide the reference dose (RfD) (i.e., ATSDR chronic MRL) used to estimate the draft recommended interim PRG.

9. **Section 2.0 (p. 20).** The introductory paragraph mistakenly refers to EPA's 1997 *Exposure Factors Handbook (EFH)* as guidance for calculating health risks. This document does not provide guidance on how to calculate health risks. The 1997, EFH provides recommendations for exposure factors to use in risk assessments. The introductory paragraph should reference EPA's 1989 *Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual (Part A)* (RAGS Part A) and supplemental parts (i.e., RAGS Parts B, C, D, E, and F), assuming these documents are used in the revised HHRA.

   The last sentence on this page states that the four steps used to create a risk assessment are: hazard identification, exposure assessment, toxicology assessment, and risk characterization. The toxicology assessment should be replaced with "dose-response assessment" if ESC&HE is referring to the risk assessment process in general. Note that the toxicity assessment of a human health risks assessment includes two steps, hazard identification and dose-response assessment. If, however, ESC&HE is referring to the organization of a site-specific human health risk assessment, then "hazard identification" should be replaced with "data collection and evaluation" per RAGS A (USEPA, 1989). Furthermore , "toxicology assessment" should be replaced with "toxicity assessment."

10. **Section 2.0 (p. 21).** The terminology on this page should be revised so that it is consistent with the four steps listed on the previous page. For example, this page refers to dose-response assessment, not toxicity assessment.

11. **Section 2.1.** This section mentions that RfDs and reference concentrations (RfCs) were obtained from EPA's RSL table and cancer slope factors were obtained from EPA's Integrated Risk Information System (IRIS). Additional toxicity information was obtained from ATSDR. The toxicity values used in the HHRA should be obtained in a manner consistent with EPA's toxicity value hierarchy provided in OSWER Directive 9285.7-53, which includes IRIS, EPA's Provisional Peer-reviewed Toxicity Value (PPRTV) database, and other original sources of toxicity values (e.g., CalEPA and ATSDR). While the RSL table follows OSWER Directive 9285.7-53, it may lag behind the changes to toxicity values in the IRIS, PPRTV, CalEPA, and ATSDR databases.

12. **Section 2.1 (p. 22).** The last sentence of this section mentions that chemicals lacking toxicity values were not included in the HHRA. Although health risks cannot be quantified for these chemicals, they should be carried through the HHRA and the lack of toxicity data for these compounds should be discussed in the uncertainties section.

13. **Section 2.3 (p. 23).** The passage stating "…residents' verbal accounts of widespread illnesses within the area, possibly related to past chemicals contamination." should be removed. A risk assessment is intended to be an objective document that provides factual information supported by data. The risk assessment should be devoid of unsubstantiated claims that could prejudice and/or mislead the reader. If ESC&HE has any documented accounts of health effects in the community, that information should be shared with the local, state, and federal health agencies and USEPA. General health concerns should also be directed to local, state, and federal health agencies.

14. **Section 2.4.** This section, which presents the conceptual site model (CSM), exposure pathways, and potential receptors, is relevant to the exposure assessment. Section 2.4 should be moved to the exposure assessment provided in Section 3.0 of the HHRA.

15. **Section 2.4 (p. 24).** Figure 3, which depicts the CSM, is inaccurate and incomplete. Elements of the figure that should be revised include the following:

    - Per the figure, barrels and spraying (presumably waste oil containing dioxin) are listed as on-site (i.e., proposed Strecker Forest Development Site) and off-site sources of contamination. With regards to the proposed Strecker Forest Development Site, the figure is not entirely consistent with the text in Section 2.4.1, nor is it consistent with potential sources identified in Section 2.2.4 of the ESA Report. Furthermore, previous EPA investigations have indicated that spraying had not occurred on the proposed Strecker Forest Development Site. This figure must be revised so that it provides an accurate account of potential sources of contamination that were released directly onto the proposed Strecker Forest Development Site.

- This figure depicts contaminant migration directly from historical activities to groundwater. With regards to groundwater contamination, the CSM should depict the transport of contaminants from the source to groundwater via soils (i.e., soil leaching). The current figure does not indicate that contaminants can migrate from soils to groundwater.
- The figure does not account for current and future complete exposure pathways. This is a critical element of the CSM and should be included in the figure.
- The figure does not list dermal contact as a route of exposure. Dermal contact is a potential route of exposure and it is addressed in the HHRA. Thus, it should be included in the figure.
- Vegetable gardening is mistakenly listed as a route of exposure. Vegetable gardening is an activity, not a route of exposure. Routes of exposure for vegetable gardening would potentially include soil ingestion, dermal contact, inhalation of vapors or particulates emitted from soil, and the ingestion of home grown produce. The figure must be revised to account for potential routes of exposure associated with vegetable gardening.
- The figure shows that off-site soils could have been impacted by historical activities. No potential routes of exposure or migration pathways have been identified for off-site soils.
- Recreational users should be substituted for visitors.
- Outdoor workers are listed in the CSM, but the exposure assessment does not discuss the outdoor worker exposure pathways nor are risk estimates derived for this scenario. Although risks to an outdoor worker would be less than to a resident, the HHRA should provide some information on why this pathway was not evaluated further.
- The CSM should be revised to account for transport and release mechanisms (e.g., soil leaching, volatilization) between sources and exposure media.
- This figure is unclear in identifying complete exposure pathways. A footnote should be provided that notes that an "x" represents a complete exposure pathway.
- The CSM should account for sediments within the ravine. A recreational user's direct contact with sediments should be evaluated in the HHRA.
- The CSM does not account for the construction worker scenario that is discussed in Sections 2.4.1 and 3.1. The CSM should be revised to account for the construction worker if the exposure pathway is complete.

16. **Section 2.4.1 (p. 25).** Citing ATSDR, the first paragraph states that a complete exposure pathway consists of five parts including a source of contamination, an environmental media and transport mechanism; a point of exposure; a route of exposure, and a target organism. The paragraph should be revised so that it is consistent with EPA risk assessment guidance. Target organism should be removed because a receptor is accounted for in the exposure point and route of exposure parts of the exposure pathway.

17. **Section 2.4.1 (p. 25).** The first sentence of the second paragraph states, "…contamination sources include waste buried in drums, waste on the ground, or waste poured into pits." The referenced statement lacks specificity regarding the sources of contamination and indicates

that there is some uncertainty regarding the presence of all three sources. Note that the sentence states that contamination sources include drums, waste on the ground, **or** waste poured into pits. ESC&HE should revise this section so that it defines "waste" and provide references to reports that document that source of contamination may include buried drums, waste on the ground, or waste poured into pits. Note that the data collected by Mundell, which was intended to address the most likely affected areas of the site, does not indicate any significant sources of contamination within the site as is insinuated in the referenced statement. Chemicals were generally not detected in on-site soils and detections fell within or below EPA's cancer risk range and below a non-cancer hazard index of 1.

18. **Section 2.4.2 (p.26).** The age groups provided in the first paragraph are not consistent with EPA's age group/bins provided in the 2008 *Child-Specific Exposure Factors Handbook* nor the 2005 *Supplemental Guidance for Assessing Susceptibility From Early-Life Exposure to Carcinogens*. ESC&HE should revise the paragraph so that it is consistent with EPA's most current age groups/bins and that the HHRA provide a distinction between those related to exposure and the groupings associated with toxicokinetics and toxicodynamics. The latter should be discussed in the toxicity assessment.

19. **Section 2.4.2 (p. 26).** The third paragraph mentions that construction workers are assumed to have different characteristics and exposure conditions compared to residents. The example provided for different characteristics is that adults have greater mass. A different example should be provided because adults are also evaluated under a residential scenario. For example, soil ingestion rates, particulate emission factors, and volatilization factors differ under construction worker scenarios. Furthermore, EPA generally assumes that men and women (including women of child-bearing age) will be engaged in construction work. This section does not indicate the construction worker's gender and it is unclear if the preceding paragraph is intended to be inclusive of the construction worker and recreational user receptors. Note that EPA's default body weight of 70 kilograms is an average body weight for men and women. The HHRA should evaluate men and women for all exposures involving adults.

    In addition, this section does not discuss the outdoor worker. The outdoor worker scenario, typically a scenario EPA evaluates under a commercial or industrial setting, should be discussed in this section.

20. **Section 3.1.1 (p. 27).** This section should be revised to incorporate the relevant text on the exposure populations from Section 2.4. Also, the discussion regarding routes of exposure should be moved to the following discussions on the exposure pathways. The route of exposure discussion currently provided in this section is incomplete.

21. **Section 3.2.1.** Although this section is intended to discuss complete exposure pathways associated with groundwater, a majority of this section is used to discuss the hydrogeology of the site and surrounding areas. EPA was unable to locate any discussion regarding pathways associated with the drinking water pathway, which is later characterized in the HHRA. The

exposure pathway discussion should discuss all four elements of the complete exposure pathway. Furthermore, a physical setting section should be provided in the exposure assessment that details the site's hydrogeology and other physical characteristics pertinent to exposures at the site.

22. **Section 3.2.1a (p. 29).** The text suggests it is possible for a conduit to develop underneath the groundwater divide that could transport groundwater from the south to the development area. No evidence of conduits exists at the site.

23. **Section 3.2.1b (p. 30).** The text cites Ewers (2010) to indicate that water levels from monitoring wells in a karst environment are typically low; on the order of a few feet of difference could exist if the well intersected a conduit. To date, no evidence of conduits or caves exists at the site. The Ewers article promotes the use of tracer tests to evaluate groundwater flow in a karst environment. As noted in the Additional Remedial Investigation report of March, 1998, dye tracer studies were conducted at the Bliss-Ellisville site. The studies indicate a hydraulic connection between this site's watershed and the Lewis Springs, approximately 2.6 miles north of the site.

24. **Section 3.2.1b (p. 30).** The text indicates hydraulic heads in karst aquifers could vary by 50 ft to 100 ft vertically under extreme precipitation/flooding events. Only one sampling event was conducted at the development area. Site or near site-specific evidence that indicates this magnitude of water table fluctuations in this area were not presented in this report.

25. **Section 3.2.1c (p. 31).** The text indicates that conduits do not provide a filtering mechanism to contaminants in the aquifer. There is no evidence of conduits noted in the 10 boring logs associated with wells at the proposed development or at the Bliss-Ellisville site.

26. **Section 3.2.1d (p. 32).** The text indicates that terrain elevations should not be used to determine local flow directions and the location of water divides. The Phase II ESA depicts a groundwater divide in the southwest corner of the property, near monitoring well MW-2. A review of the USGS map for this area depicts topography that could represent a groundwater divide. The HHRA indicates that monitoring well MW-2 has a lower head than monitoring well MW-4 and that this infers flow in a southwesterly direction in that area of the site and that groundwater could also flow from monitoring well MW-2 to monitoring well MW-5 (north-northeast) if a conduit connects the two areas. The report indicates the limitation of one sampling event that has been conducted at this site. This limitation and the subsequent inferences are misleading. There is no apparent evidence that conduits exist at this site.

27. **Section 3.2.1d (p. 33).** The last paragraph on this page mentions that in addition to dioxin TEQ, other contaminants were also very high in monitoring well MW6. Although several chemicals are detected above screening levels, EPA disagrees that the concentrations of these other contaminants, which range from a few µg/L to a few hundred µg/L, are "very high." Also, only three of these other contaminants exceed MCLs and/or EPA's acceptable risk

levels (i.e., >10^{-4} and HI of 1). Typically, concentrations in the thousands to hundreds of thousands of µg/L would be defined as "very high." The HHRA should specify the chemicals detected above screening levels and/or MCLs and accurately characterize the levels of contaminants in this well.

28. **Figure 6 (p.36).** The TEQ concentrations presented in the figures are incorrectly presented in units of µg/kg or ppb.

29. **Section 3.2.1d (p. 36-39).** The following discrepancies have been identified in the discussion regarding the hydrogeology and exposure pathways from the Bliss Property.

    - The report indicates that the stream adjacent to the Bliss property is not connected to the aquifer for part of the year. Past reports indicate this is a losing stream and dry during an on-site visit. The HHRA should cite evidence that groundwater has been detected in site-associated monitoring wells at shallower depths that may indicate flow into this stream during other parts of the year.
    - The text indicates that during the November sampling period, the water table was approximately 5 ft below the stream adjacent to the Bliss property. The measured water table in the seven monitoring wells on the proposed development area ranged from approximately 31 ft to 113 ft below ground surface (bgs). The HHRA should cite or provide data that indicates the depth to water in this area is 5 ft below the stream.
    - The text indicates that the water table at the Bliss Property (well MW-5) is 4 ft lower than in monitoring well MW-2. The November 2009 data indicates a difference of 2.71 ft rather than 4 ft.
    - The HHRA presents scenarios for groundwater flow and contaminate migration from the Bliss-Ellisville site to the southwest. The assumptions in these scenarios (e.g., water table fluctuations of ±10 ft at monitoring well MW-5 and a water table that may or may not be stable during precipitation events at monitoring well MW-2) are speculative and are not based on existing data.
    - The HHRA indicates a range of groundwater velocities that may occur in karst aquifers. However, there is no evidence of conduits on this site that may be able to transmit water at rates of up to 150,000 ft/day. Existing data does not suggest that a high degree of fracture connectivity is present for this rapid contaminant transport. The limited groundwater data set is not adequate to make this determination or support this supposition.
    - The HHRA presents another set of scenarios for flow to the existing residential area. As above, the scenarios assume conduits are at this site and that seasonal water table fluctuations can cause the migration of contaminants. No seasonal site groundwater data is available. The report suggests that high contaminant concentrations present at monitoring well MW-6 could spread throughout the ravine. The November 2009 sampling event indicated that the water table at monitoring well MW-6 was about 31 ft bgs. This head difference would have to be overcome and migrate from an elevation of approximately 638 ft to 680 ft (a 42 ft difference) to fill the ravine. Data that suggests this has occurred at the site was not available for review.

30. **Section 3.2.1d (p. 39).** This section inaccurately states that the sinkhole is a known source of dioxin and other contaminants. Previous EPA investigations have not indicated that the sinkhole is a known source of dioxin and other chemical contamination. Furthermore, data collected during the Mundell investigation do not indicate it as a known source of contamination.

31. **Section 3.2.1d (p. 39-40).** The text indicates the sinkhole is likely a local recharge hotspot that would raise the local water table and spread contaminants from the pond in all directions. The depth to water in this area is greater than 50 ft. In general, the water table will respond slower to infiltration in deeper wells than shallower wells. Surface water runoff or precipitation that infiltrates the area of the pond will be primarily controlled by the connectivity of the residuum and/or bedrock fractures. The residential area is approximately 200 ft north of the pond. Based on topography, surface water runoff will flow in an easterly direction toward the ravine. The ESA depicted groundwater flow in this area toward the ravine. To date, there is no evidence of conduits at this site or that contaminants at the pond can spread in all directions. No data or information is presented to support the statement that the pond (sinkhole) is a known source of dioxin and other contaminants.

32. **Section 3.2.1d (p. 39-40).** The headings provided on these pages indicate that this section will provide a discussion on the complete exposure pathways related to the sinkhole (i.e., pond area). However, this section fails to provide a complete discussion of the complete exposure pathways (i.e., a discussion of all the steps of the complete exposure pathway). No information is provided on the routes of exposure associated with pond water exposure nor the activities that receptors will be engaged in that will bring them into contact with pond water. Also, this section does not provide specifics on the receptor that will contact pond water under current conditions. Furthermore, under the future exposure pathway (i.e., proposed Strecker Forest subdivision) this section assumes that the pond will continue to exist. No discussion has been provided to support this assumption. This section should be revised to include a discussion on all elements of the complete current and future exposure pathways associated with the sinkhole. Assumptions regarding future conditions should also be clearly pointed out and supported in the text.

33. **Section 3.2.1d (p. 40).** Under the Callahan Property heading, the text again assumes there are conduits that could readily transmit groundwater from the south to the Strecker site. To date, there is no evidence that conduits exist at this site.

34. **Section 3.2.1f (p. 41).** The text indicates that there is a lack of data and because of this there are several uncertainties that should be considered in the exposure analysis. The lack of data should not give credence to suggestions/scenarios that karst features known to exist in other areas/regions may be present at this site.

35. **Section 3.2.1g (p. 42).** The text indicates that there is an exposure pathway for dioxins and other contaminants from the sinkhole to the residential area. The text also indicates that it is not clear how contaminants may spread in the subsurface. The text indicates that based on observations of the terrain the Callahan area appears to be a potential source of contaminants. Based on the area topography, it is unlikely that groundwater from the Callahan site will

migrate up-gradient to the proposed development area. A topographic high exists in the area of Strecker Road. The text indicates a network of unknown conduits can extend for many miles to spread contaminants unpredictably and very quick. Boring logs from numerous monitoring wells and soil borings at the proposed development area and the Bliss-Ellisville site did not indicate the presence of these features.

36. **Section 3.2.2.** This discussion is intended to discuss soil exposure pathways. However, this section is deficient in identifying all of the elements of the complete exposure pathways for soils. No discussion is provided on the soil exposure units (e.g., a future residential yard), which will depend on land-use. Also, this section does not cover all of the routes of exposure for the receptors identified. For example, incidental soil ingestion is not listed as a route of exposure in Section 3.2.2c, which discusses the routes of exposure for soil. This section should be revised to provide a more complete and accurate discussion of the complete exposure pathways for site soils.

37. **Section 3.2.2a (p. 43).** Although the second sentence of this section is a bit out of place, it incorrectly states that TEQ measurements were only recorded in dioxin TEQ and thus there is no distinction between water soluble and insoluble contaminants. Note that the laboratory analysis of groundwater and soil samples collected by Mundell included a congener analysis of dioxins, furans, and dioxin-like polychlorinated biphenyls (PCBs). Dioxin TEQs were derived from the analytical data for the dioxin, furan, and dioxin-like PCB congeners provided in the ESA Report for the purposes of screening groundwater and soil samples against dioxin's (i.e., dioxin TEQ and/or 2,3,7,8-TCDD) screening levels. Therefore, one can evaluate the transport of dioxins in soil with respect to the water solubility of individual congeners. However, dioxins tend to sorb to clayey/organic soil/sediment and are not very mobile in the environment. ESC&HE should revise the referenced sentence so that it is consistent with the analyses performed on the groundwater and soil samples collected at the site. Additional discussion should be provided regarding the solubility (or lack thereof) of dioxins and their fate and transport in soil (see below). The discussion should be moved to Section 3.2.2b, which discusses fate and transport of contaminants

    With regard to the mobilization of dioxins, the text apparently assumes the mobilization of these chemicals to conduits for contaminant transport. The text infers that once these chemicals migrate to the ravine/stream/groundwater they are then spread across the soil throughout the site during flooding events. To date no evidence of conduits exist at this site; only one groundwater sampling event has been conducted; no apparent stream flow or flood data exists; and, supplemental soil sampling was not conducted to verify the interpolations.

    The discussion in this section lacks clarity and coherency. For example, the reference to dioxin water solubility and its relation to soil migration and concentration levels are not explained. Thus, the sentence regarding solubility appears out of place. In addition, the discussion immediately following solubility refers to the linear kriging.

38. **Section 3.2.2a (p. 43-44)**. It is EPA's judgment that there is insufficient data to perform the dioxin TEQ kriging. This section lacks a thorough discussion on kriging, including the technical basis, underlying assumptions, calculations, limitations, and uncertainties. It is

unclear how the kriging applies to the exposure assessment (i.e., the exposure concentrations). Other than identifying some potential data gaps, the HHRA does not use kriging to extrapolate exposure concentrations, yet places the discussion within the exposure assessment. This is problematic because no technical basis or discussion is provided in support of the exposure point concentrations for dioxin TEQ. The section should be revised so that it discusses how the exposure point concentrations for dioxin TEQ were derived. A complete and detailed discussion should be provided in the proper context (i.e., section discussing data gaps and/or the nature and extent of contamination).

39. **Section 3.3.2a (p. 44).** The last sentence of this section states, "Of particular interest are the soil boring measurements taken at the pond area (B33), which contained ethylbenzene and naphthalene, and the ravine (B26), which contained benzene and di-n-octyl phthalate." References to data tables containing this information are not provided and no additional discussion is provided that discusses why these results are of particular interest. The statement appears to be an incomplete thought; regardless, the detections of these contaminants are insignificant. The trace levels of these contaminants are more than 1000 times lower than their respective residential risk-based screening levels, and their detections were below reporting limits (i.e., J-coded). In addition, the detection of di-n-octyl phthalate, a commonly used plasticizer, may have originated from plastics used in the sampling and analytical processes. Furthermore, this section did not take into account the soil sample results surrounding B33 and B26, where VOCs and semivolatile organic compounds (SVOCs) were generally not detected or detected at similar levels well below screening levels. ESC&HE should revise the text of this section to specifically discuss the levels of chemicals detected in soils and provide information on the samples used to derive exposure point concentrations. The current text is misleading and fails to address a critical element of the exposure assessment and the exposure point concentration. A discussion of the nature and extent of contamination is generally provided prior to the exposure assessment. The exposure assessment should focus on the elements of the complete exposure pathway, with particular attention given to the receptors, exposure point concentrations, routes of exposure, and contaminant migration routes.

40. **Figures 9-13 (p. 45-49).** Figures 9-13 are misleading, specifically the symbols and shading used to indicate dioxin concentrations at the site. For example, the second largest circles span a concentration of 20 – 400 ppt. With regard to the proposed Strecker Forest Subdivision, the highest detected dioxin TEQ concentration was 23.32 ppt. However, the figures would suggest otherwise. The colors indicating concentrations between 5-20 ppt and 20 and 400 ppt are not significantly different (i.e., same color slightly different shade) and could be easily misinterpreted. EPA strongly recommends that these figures be revised to be more legible and provide a more accurate characterization of dioxin TEQ levels. This would include using EPA's current dioxin PRGs and proposed draft PRGs as cut-off points demarking dioxin TEQ concentrations. Furthermore, more distinct colors should be used to differentiate dioxin TEQ concentrations.

41. **Section 3.2.2b (p. 49).** The text indicates that contaminants of concern (COCs) sorbed to soil may spread throughout the proposed development by erosional forces generated by heavy storm flow. The HHRA should present data that documents these types of

catastrophic events that have occurred at this site and/or in similar settings. Based on a review of Google earth aerial photography, there appears to be substantial woody/shrub/grass cover over the entire site. This cover would inhibit site-wide erosion from continually stripping soil for re-distribution over the entire proposed development.

42. **Section 3.2.3 (p. 50).** The two approaches used to evaluate surface water exposure pathways are technically flawed and conflict with each other. This section presents three dioxin TEQ concentrations for particulates in surface water. These concentrations are mistakenly listed as 0.06 µg/kg, 3.3 µg/kg, and 0.6 µg/kg, which equate to 60, 3,300, and 600 ppt, respectively, which are much higher than the concentrations detected in the stretch of the ravine being evaluated. Per Appendix II, these are based on soil concentrations where the units were not correctly converted and as a result are overestimated by a factor of 1,000. Of equal concern, is that the HHRA erroneously estimated dermal contact for dioxin entrained on particulates in water using dermal contact equations for soils. Thus, exposure parameters applicable to soil only, such as the soil adherence factor and absorption factor (ABS), are applied to water exposure. Note that dermal absorption of contaminants in water will differ significantly from soil. Additionally, despite the technical flaws in estimated TEQ concentrations, the dioxin TEQ concentrations in water can be calculated by dividing the mass of dioxin TEQ in soils eroded from the ravine by the daily stream flow (see the Specific Comments on Appendix II). Sediment exposures can be evaluated similar to soils. Given the significant technical flaws associated with the surface water exposure pathways, ESC&HE should revise the entire exposure pathway. There are also technical flaws in the use of shear stress modeling and other hydrologic models to derive dioxin TEQ (discussed in later comments).

    This section should be revised to provide a more complete characterization of the surface water exposure pathways as indicated in its heading. The discussion only defines how exposure point concentrations were derived. This discussion should include characteristics of the ravine that affect exposures, such as depth and how often water is present within the stream. Depth is especially critical because it drives the types of activities (e.g., swimming versus wading) that will occur in the stream. Additionally, the types of activities that are assumed to occur within the ravine should be discussed in this section. These types of activities can be extracted from the intake factors provided in Appendix III. However, the technical basis and assumptions behind these activities are not provided in the appendices. Finally, this section should include a discussion on the routes of exposure for surface water exposure pathways.

43. **Section 3.2.3 (p. 50).** The text indicates the clay layer ranges from 10 to 30 ft thick. A review of the boring logs indicates the clay layer to be as thin as 1.2 ft. The text indicates that cracks in the clay will allow for some precipitation to infiltrate. A review of the boring logs does not note any cracks in the clayey soil, but rather is described as being a combination of moist, wet, soft and/or plastic. The text should be revised to accurately characterize the thickness and characteristics of the clay layer.

44. **Section 3.2.3 (p. 50 and 51).** The second paragraph states the naphthalene and trimethylbenzene were measured in groundwater at 390 and 210 µg/L, respectively. EPA was not able to locate a concentration of 210 µg/L for 1,2,4 or 1,3,5- trimethylbenzene. This

section did not provide the rational for only using monitoring well MW-06 results, nor does it discuss any of the other contaminants detected in groundwater (see below). Note that the concentrations of the trimethylbenzene isomers should not be combined. Furthermore, naphthalene and trimethylbenzenes were generally not detected upgradient on the proposed Strecker Forest site. Therefore, this section gives the false impression that these contaminants may be present at the specified concentrations in surface water within the proposed development area.

As noted above, this section did not mention other contaminants that could also be found in surface water via groundwater. It is unknown if the HHRA addressed these chemicals in the exposure assessment and risk characterization, which were detected in monitoring well MW-06.

Given these inconsistencies and the uncertainties with the approach to estimate surface water concentrations, ESC&HE should revise this section so that it specifies and provides rationale for the monitoring wells used to estimate surface water concentrations. This section should specify the exact location(s) where the exposures will occur. If surface water contact occurs upgradient, then groundwater data collected on the Proposed Stecker Forest site should also be used. The HHRA should also provide intake rates and risk estimates for all chemicals carried through the evaluation. If chemicals are eliminated from particular exposure scenarios (e.g., via risk-based screening), then that information should be provided in the HHRA.

45. **Section 3.2.3 (p. 50).** The text indicates that groundwater tables will rise and connect to the outflow of the ravine. Based on the one sampling event, groundwater levels in monitoring well MW-6 are approximately 31 ft bgs. This head difference would have to be overcome during the event. The HHRA should present evidence that this has occurred in the past.

46. **Section 3.2.3 (p. 51).** Per the text, this section states, "During stormflow, the groundwater tables in the area will rise and connect to the outflow of the ravine…" Although EPA has significant concerns regarding the attenuation factor of 0.1, this section should specify the areas of the site where the water tables will rise and connect with the outflow of the ravine. If groundwater will enter the ravine within the proposed Strecker Forest Development Site, then groundwater from that area should also be used to derive the surface water exposure point concentrations.

47. **Section 3.3.1.** Although this section lacks clarity regarding the types of exposure scenarios being evaluated (e.g., residential versus recreational), the exposure factors and assumptions provided in this section are not consistent with those recommended by EPA guidance and used in EPA risk assessments. These inconsistencies include the following:

    - This section specifies that the calculations are based on a 10 year old male child body weight of 30 kilograms unless otherwise noted. It is not clear why the HHRA did not use an average body weight for boys and girls in the age groups accounted for in the 10 year exposure duration (e.g., average body weight of boys and girls between the ages of 1-10). Under residential scenarios, EPA uses a body

weight of 15 kilograms, which represents an average body weight of young children between the ages of 1 and 6. Note that young children have a greater intake to body weight ratio (i.e., higher exposures) compared to the unspecified age group (having a body weight of 30 kg) used in the HHRA. Also, under recreational scenarios, Region 7 generally calculates the average body weight from all age groups that would potentially visit a site. Region 7 typically evaluates older children between the ages of 7-16 under recreational scenarios. EPA recommends that ESC&HE use an average body weight that is representative of the age groups accounted for in the exposure duration.

- The second sentence of the first paragraph mentions that a child spends 200 days/year playing in soil. Although the source of this value is not provided, the HHRA should mention that this exposure frequency is applicable to dermal contact routes of exposure, because it differs from exposure frequencies used for the inhalation and ingestion routes of exposure shown in Appendix IV.
- The last sentence states, "We will assume that the child has never ingested ground water and has only drunk city water, which is assumed to be free of contaminants in question." It is unclear why ESC&HE had to make an assumption regarding past groundwater use at the site. Information is available regarding the use of groundwater in the area and the source of drinking water for surrounding areas. The HHRA should be revised so that it accurately characterizes all current and future complete exposure pathways.
- The second paragraph provides a body weight of 74 kg and 87 kg, for women and men, respectively. The source(s) of these values is not provided and they exceed the mean body weight recommended by EPA guidance and the 1997 Exposure Factors Handbook (EFH). The HHRA should use the mean adult body weight of 70 kg recommended in EPA guidance (USEPA, 1989, 1991a).
- The last sentence states, "Finally, we will assume that the adults have lived at the residence since 1970 and ingested groundwater for a 30 year span before the area switched to city water." This assumption is without basis, considering the age of adjacent subdivisions, the timeframe of exposure (i.e., 1970), and that there is no data to support that the water-bearing unit containing site-related contaminants has been used as a source of drinking water. In other words, the past exposure pathway is incomplete. A risk assessment is an objective document that should evaluate current and future complete exposure pathways. Assuming that a pathway was complete in the past with an abundance of information to the contrary is unsound and misleading.

48. **Section 3.3.2 (p. 52-54).** Numerous errors and inconsistencies with regards to the dermal contact example calculation have been found and are discussed below. Note that many of these comments also apply to other routes of exposure and their corresponding intake equations provided in Appendix IV.

    - The example equations mistakenly provide a dioxin TEQ concentration of 0.02332 mg/kg (or 23,320 ppt) from soil boring B33. The dioxin TEQ concentrations were not correctly converted from pg/g (ppt) to mg/kg and as a result the concentration and corresponding cancer and non-cancer risk estimates

are overestimated by a 1,000-fold. The dioxin TEQ concentration should be 0.00002332 mg/kg or 23.32 ppt, which is provided in Tables 5 and 9 and Figure 14 of the ESA Report.

- The dioxin TEQ concentration of 23.32 ppt was detected in soil boring B19, not soil boring B33. The dioxin TEQ in soil boring B-33 was 1.15 ppt. This section should be revised so that it identifies the correct boring or uses a concentration of 1.15 ppt.
- The example does not indicate the timeframe of the exposure scenario and type of receptor (i.e., residential or recreational) being addressed in the equations. Unless ESC&HE uses surface soil samples in the derivation of exposure point concentrations, the scenario must be described as a future exposure scenario. It is not plausible that current receptors (e.g., recreational visitors) are coming into direct contact with subsurface soils, especially soils at 4-8 ft bgs, which was the depth of the sample used to derive the exposure point concentration.
- The HHRA mentions that uncertainties associated with the chemical concentrations include that the data was collected at 4-8 ft bgs and that the soil concentrations located above 4-8 ft bgs are unknown and the effects of residential construction are unknown. These assertions are problematic. First, ESC&HE has disregarded surface soil samples collected near Boring 19 that shed light on the nature and extent of contamination. Furthermore, ESC&HE has failed to address the biased sampling scheme used by Mundell. Finally, a HHRA should not be performed on a data set where the nature and extent of contamination is "unknown."
- This example mistakenly provides a surface area of 1.16 cm^2/event for a child. The example provided in RAGS Part A is 1.16 m^2/event and represents a 50^{th} percentile value of total body surface area. In addition to lacking plausibility (i.e., whole body exposure to soil), EPA dermal risk assessment guidance was updated with the issuance of EPA's RAGS Part E. RAGS Part E provides a default surface area of 2,800 cm^2 for a child between the ages of 1 and 6 and assumes that the areas available for dermal contact with soil are the face, hands, forearms, lower legs, and feet (USEPA, 2004).
- The HHRA should use the default soil to skin adherence factor of 0.2 mg/cm^2-event (USEPA, 2004). The value provided in the HHRA is applicable to the hands only. The default value provided in RAGS Part E is weighted according to the face, forearms, hands, lower legs, and feet and assumes children playing in wet soil. Also, the soil to skin adherence factor is a contact rate. EPA recommends that the equations account for the number of events the receptors will contact on a daily basis. The exposure frequency should be adjusted to days/year.
- The HHRA assumes an exposure frequency of 200 events/year for dermal contact with soils. Although it is unclear if the example is for a residential scenario, EPA generally assumes that the exposure frequency for dermal contact is identical to the exposure frequencies for the other routes of exposure. ESC&HE should use a dermal contact exposure frequency of 350 days/year for a residential exposure scenario.

- The HHRA specifies an exposure duration of 10 years. Generally, EPA assumes the default exposure duration of 30 years for a residential exposure. However, non-cancer average daily doses are typically based on a child's 6 year exposure duration because they will have a higher intake per body weight and that chronic non-cancer toxicity values are averaged over the duration of exposure (e.g., 6 years). Cancer lifetime average daily doses are based on 30 year time-weighted exposure of 6 years as a child and 24 years as an adult.
- This section erroneously cites page 6-35 of RAGS Part A, which **does not** provide a child's body weight. The sources of all exposure factors used in the document should be correctly cited.
- EPA could not replicate the non-cancer intake estimate using the numbers provided in the equation. Notwithstanding comments regarding the exposure point concentration, body weight, exposure frequency, exposure duration, surface area, and the soil to skin adherence factor, the intake and subsequent hazard quotient are overestimated by a factor of 10. It appears that the mg to kg conversion factor of 10^{-6} may not have been correctly converted to scientific notation (i.e., 1E-06).
- Similar to the non-cancer intake, EPA could not replicate the cancer intake. ESC&HE should check and recalculate all exposure and risk estimates.

49. **Section 3.4 (p. 54-55).** There are several inconsistencies and inaccuracies with the uncertainties provided in this section. A list of these inconsistencies and inaccuracies are listed below.

- The composition of dioxin TEQ is erroneously listed as an uncertainty. The results of the dioxin, furan, and dioxin-like PCB congener analyses **are** provided in the ESA Report. ESC&HE should remove these statements regarding dioxin TEQ composition.
- EPA disagrees that physical properties, such as body weight and surface area are significant uncertainties. These exposure factors are well-studied and are based on large data sets.
- ESC&HE should replace "sociological properties of the target organisms, such as habits and durations" with "behavior characteristics of the receptor, such as activity patterns and intake."
- This section erroneously lists historical groundwater ingestion concentrations as an uncertainty. There is sufficient information available that indicates that this pathway was not complete in the past or under current conditions. This statement is also problematic because previous sections indicated that it was uncertain that this pathway was complete in the past, but the referenced statement would suggest that the pathway was complete and the only uncertainty is in regards to the groundwater concentrations. ESC&HE should remove the referenced statement.
- The HHRA inaccurately states that the outflow of the ravine at different periods of the year is "unknown." Per Section 3.2.3 of the HHRA, the intermittent stream in the ravine goes dry during periods of low precipitation and floods during periods of heavy precipitation. Using historical rainfall data, ESC&HE should be able to predict the periods of the year where outflow of the ravine is significant. ESC&HE should

revise the referenced statement to indicate that the precise outflow of the ravine is difficult to predict. Assertions that the outflow is "unknown" should be removed.

50. **Section 3.5.** This section lacks text and only provides tables and figures. Text should be provided in this section describing the tables and figures.

51. **Section 3.5, Table 3 and 4 (p. 55).** The average daily doses (non-cancer intake) and lifetime average daily doses (cancer intake) provided in this table are overestimated by a factor of 10. This results in risk estimates that are overestimated by a factor of 10. ESC&HE should check and recalculate all exposure and risk estimates.

    Tables 3 and 4 do not provide an inhalation intake for dioxin TEQ because it is not volatile. Note that the inhalation of dioxin can be evaluated via the inhalation of particulates emitted from surface soil pathway. A particulate emission factor (PEF) will need to be derived to evaluate this pathway.

52. **Figures 14 and 15 (p. 56).** Figures 14 and 15 are generally unnecessary. The supporting text is lacking and the underlying modeling and calculations for these tables were not provided in the HHRA. If retained, the HHRA should provide the models and calculations used to derive these figures. The headings of these figures should be shortened and a discussion on the effects of temperature on volatilization in the text should be provided.

    In addition, per EPA's *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment)*, inhalation exposures are no longer evaluated as a dose (USEPA, 2009). RAGS Part F updates Superfund's methods for evaluating inhalation risks and hazards so that they are consistent with EPA's *Inhalation Dosimetry Methodology* (USEPA 1994). Based on this update, inhalation rate and body weight are no longer accounted for in the intake equation. Rather an exposure concentration (e.g., $\mu g/m^3$) is estimated, which takes into account exposure time. RAGS Part F and its implementation memo are available on-line at http://epa.gov/oswer/riskassessment/ragsf/index.htm. The HHRA (i.e., intake equations) should be revised to account for RAGS Part F.

53. **Section 3.5, Table 5 and 6 (p. 57).** Similar to the comments on Tables 3 and 4, the intakes are overestimated by a factor of 10 on Tables 5 and 6. EPA could not replicate the dioxin TEQ cancer intake of 6.64E-7 mg/kg-day provided in Table 6 using the intake factors provided in the HHRA and a concentration of 23.32 ppt. For reference, EPA derived an intake of 2.22E-08 mg/kg using the intake factors provided in Appendix IV and a dioxin TEQ of 23.32 ppt.

54. **Figures 16 – 20 (p. 58-60).** See the Specific Comment on Figures 14 and 15.

55. **Tables 7-10 (p. 60-61).** The headings for Tables 7 - 10 are misleading because it suggests that adults ingested groundwater from 1970 to 2000 from monitoring wells MW-1 - MW-7. It is not clear why children would not have been included. However, the HHRA provides no information or technical basis to support that impacted groundwater was used as a source of

drinking water at the site from 1970 to 2000. Depending on the results of the groundwater usability evaluation, the HHRA must evaluate future drinking water scenarios. References to past exposures that did not occur should be removed.

These tables should also define "NA," and differentiate between those that are not available because the contaminant was not detected in a specific monitoring well or that a toxicity value is lacking for that particular route of exposure.

56. **Table 11 (p. 61).** This table lists "NA" for dermal contact with naphthalene and trimethylbenzene in surface water. Both of these chemicals should be evaluated under the dermal contact route of exposure. Chemical-specific information regarding the dermal absorption of these chemicals is provided in RAGS Part E.

57. **Table 12 (p. 62).** This table lists "NA" for ingestion of dioxin in surface water. Per EPA comments on Appendix II, dioxin surface water concentration can be estimated and used to estimate the ingested and dermal contact dose from surface water.

58. **Section 4.1 (p. 64).** The text regarding EPA's cancer slope factor (CSF) and RfD for dioxin should be revised to indicate that they are proposed values. The current text suggests that they are final values.

    The last paragraph states:

    > "The EPA response to the NRC gives an RfD for dioxin of 0.7 pg/kg-day (US EPA 2010a). This dose is for all sources, including the amount in food and in environmental media from a specific site such as the Proposed Strecker Forest Development Site. For many situations, cancer potency is the most sensitive value for protecting health, especially over long periods of time. There are situations in which the non-cancer effects are the more sensitive measure, but protecting for both types of effects for future exposures will mean lower level exposures are needed to prevent cancer at a rate of 1 cancer per million people."

    Portions of this passage are inaccurate, lack clarity, or are not applicable to the proposed toxicity values for dioxin. The paragraph should state that the proposed dioxin RfD and CSF can be used to evaluate health risks resulting from exposure to dioxin in the diet and environment. The last two sentences should also be removed. In addition to lacking applicability to dioxin at the cancer risk level provided, the passage is unclear and lacks consistency with EPA's point of departure, which is one in a million individual **excess** cancer risk. If non-cancer effects were the more sensitive measure, the corresponding cancer risk would be less than one in a million. It is not clear how (nor is it plausible that) protecting for both types of effects, will mean that the lower exposure levels will need to be reached to achieve the same cancer risk level. Such a statement would apply to cumulative cancer risks.

59. **Section 4.2.** Rather than focus on the toxicity values of the chemicals of potential concern, this section performs risk-based screening and provides general information on chemical, physical, and toxic characteristics of the contaminants of potential concern. Note that risk-

based screening to identify chemicals of potential concern should be performed prior to the exposure assessment. Although information regarding a contaminant's chemical, physical, and toxic characteristics is important, specific information regarding the contaminants' toxicity values and sources should be provided in this section. A table providing the toxicity values for these contaminants is not provided until the risk characterization section.

60. **Table 13 (p. 65 – 66).** Although this table should be moved out of this section, EPA has identified several inconsistencies. These inconsistencies and recommended revisions are listed below:

    - Table 13's heading mistakenly refers to EPA's "maximum concentration level" and a footnote to this table refers to MCLs. Note that MCL is an acronym for maximum contaminant level. Regardless, MCLs are not applicable to soil. "Maximum concentration level" and MCLs should be replaced with EPA's RSLs (see below).
    - As noted in EPA's comments on the ESA Report, EPA no longer uses the Region 9 PRGs, which were last updated in October of 2004. A majority of the Region 9 PRGs are outdated due to updates in toxicity values and risk assessment guidance (e.g., RAGS Part F). EPA uses the RSLs available on-line at: http://www.epa.gov/region9/superfund/prg/. The most current version is dated November 2010.
    - Table 13 does not indicate the exposure scenarios (e.g., residential soil) that the screening levels are applicable to. This information should be provided on the table.
    - In a few instances the Table 13 notes that a chemical is "unregulated" when a screening level is not available. Note that these chemicals lack toxicity values, and therefore, RSLs were not derived. MRBCA screening levels were derived using other methods that may not be consistent with EPA guidance or policy. This table should be revised to indicate that RSLs are not available for those chemicals due to a lack of toxicity values.

61. **Table 14 (p. 66-67).** Although Table 14 should be moved out of this section, the following revisions should be made: First, as noted above, MCL is an acronym for maximum contaminant level, not "maximum concentration level." Also, for the purposes of screening, the HHRA should use EPA's tapwater RSLs. Finally, this table provides an MCL for naphthalene. Naphthalene does not have an MCL.

62. **Section 4.2 (p. 67-70).** The information provided on these pages should be retained, but the HHRA should include a discussion on the chronic effects associated with the chemicals of potential concern, including tables and text on the toxicity values used to estimate non-cancer and cancer risks. With the exception of the cancer classifications, EPA recommends moving the discussion on these pages to the appendix and revising the text to incorporate a discussion on the toxicity values used to estimate health risks. Furthermore, the references to OSHA's permissible exposure limits (PELs), which are often hundreds to thousands of times higher than EPA screening levels for air, are not applicable to the HHRA.

63. **Table 15 (p. 70).** EPA recommends using EPA's tapwater RSLs for screening metals. As indicated above, the term "maximum concentration level" should be replaced with "maximum contaminant level." It is also recommend that clarification be provided on lead's action level in the footnote. The HHRA should provide specific information regarding the location of these detections and include the analytical data for all groundwater samples collected by Mundell and others. This information is needed, given that ESC&HE alleges that widespread metals contamination is identified in groundwater across the site in Section 6.1.

64. **Section 4.3 (p. 71-73).** See comment above on Section 4.2.

65. **Section 4.4 (p. 73-74).** The information provided in this section is relevant to the risk characterization, not the toxicity assessment. This section should be moved to Section 5.0. ESC&HE should provide clarification on EPA's cancer risk range, especially cancer risks between the point of departure (i.e., 10^{-6}) and 10^{-4}. Additional language regarding cancer risk within EPA's acceptable (or target) cancer risk range can be found in OSWER Directive 9355.0-30 (USEPA, 1991b). Also, the summary information regarding the risk estimates must be revised to account for the revisions in unit conversions and daily dose calculations.

66. **Section 5.0 (p. 75).** The last sentence of the first paragraph on this page states, "These final calculations will be compared to background levels of risk range ($1x10^{-6}$ to $1x10^{-4}$) when evaluating cancer risk and an HI of 1 when evaluating total noncarcinogenic hazards for each target organ." ESC&HE should replace "background levels of risk range" with EPA's "acceptable cancer risk range." Note that the current passage mistakenly suggests that background cancer risks are between 1 in a million and in 1 in 10,000, which is not consistent with the overall (i.e., lifetime) risks of developing cancer that are 1 in 2 and 1 in 3 for men and women, respectively (NCI, 2010).

67. **Section 5.0 (p.75-76).** The paragraph spanning these pages is inaccurate and generally not relevant to the risk characterization section of the HHRA. Due to its placement and inaccuracies, this paragraph will likely mislead the reader regarding site contaminants and potential health risks. Specific discrepancies are discussed below.

    The first sentence states that per the ESA Report, the chemicals of concern include VOCs, SVOCs, PCBs, RCRA metals, herbicides/pesticides, and dioxins/furans. This is not consistent with the specific chemicals carried through the HHRA and suggests that all of these types of chemicals are present at the site and pose health risks, which is false. In addition, "chemicals of concern" is a common Superfund risk assessment term used for chemicals that pose unacceptable health risks. It is not appropriate to apply that term to the entire analyte list nor should the risk characterization section reiterate the entire analyte list. The risk characterization section should focus on the chemicals carried through the HHRA.

    The remaining portions of the paragraph discuss general acute and chronic health effects of VOCs, SVOCs, PCBs, and dioxins/furans. Although this information is relevant to the toxicity assessment and should be moved to that section, EPA has significant concerns

regarding the placement of this information. Based on the available information and because only chronic exposures are evaluated in the HHRA, acute health effects are **not** of concern at the site. Thus, the inclusion of acute health effects in the risk characterization section, which is intended to discuss the qualitative and quantitative risk estimates for complete exposure pathways, is misleading. The discussion also lacks specificity regarding the toxicity of individual chemicals. Instead, the paragraph provides a generalized discussion regarding the carcinogenic potential and acute and chronic health effects of VOCs, SVOCs, PCBs, and dioxin/furans. Again, the HHRA should focus on the health effects and risks associated with the chemicals carried through the risk assessment.

As mentioned above, this paragraph should be removed from the risk characterization section. Relevant portions of the paragraph should be added to the toxicity assessment. Furthermore, pesticides/herbicides and RCRA metals analyses **were not performed** during the Mundell sampling event nor were they identified as COCs in the ESA Report. ESC&HE should ensure that the HHRA accurately portrays the information provided in the ESA Report.

68. **Table 16 (p. 76).** Table 16, which provides toxicity values for chemicals of potential concern, should be moved to the toxicity assessment. The table heading inaccurately states that the chemicals in the table were detected above cleanup standards. The levels used to identify chemicals of potential concern in the HHRA are screening levels, not cleanup standards as discussed in previous comments. In addition, the following corrections should be made to this table:

    - Table 16 does not provide inhalation cancer toxicity values for the chemicals of potential concern. Due to the lack of information provided in the HHRA, EPA was unable to determine whether cancer risks were characterized for the inhalation route of exposure. Inhalation unit risk (IURs) are available for benzene, ethylbenzene, naphthalene, 1,1,1,2-tetrachloroethane, and 1,1,2,2-tetrachloroethane, and should be used to quantify cancer risks resulting from inhalation exposures to chemicals of potential concern. The table below provides the IURs for these chemicals and the sources of the values.

	IUR $(\mu g/m^3)^{-1}$	**Source**
Benzene	8.8E-06	IRIS
Ethylbenzene	2.5E-06	CalEPA
Napththalene	3.4E-05	CalEPA
1,1,1,2-Tetrachloroethane	7.4E-06	IRIS
1,1,2,2,-Tetrachloroethane	5.8E-05	CalEPA
Dioxin TEQ	3.8E+01	CalEPA

IRIS: Integrated Risk Information System (USEPA, 2011a).
CalEPA: California Environmental Protection Agency (CalEPA, 2011).

- The sources for the toxicity values in Table 16 were not provided. For the purposes of transparency, the source of each toxicity value must be provided in the HHRA. The HHRA should directly cite all original sources of toxicity values in accordance with OSWER Directive 9285.7-53, the sources of the toxicity values are also provided in EPA's RSL table.
- Table 16 does not provide the target organ/critical effects in which the RfD and RfC are based. This information should generally be included in the HHRA and can be obtained from the IRIS, Provisional Peer-Reviewed Toxicity Value (PPRTV), CalEPA, and ATSDR databases.
- Table 16 provides toxicity values for di-n-octyl phthalate; however, the RfD is based on a withdrawn EPA provisional toxicity value. EPA's Provisional Peer Reviewed Toxicity Value (PPRTV) database no longer provides an RfD for this compound. The RfC and its source could not be located. Thus, these toxicity values are not supported by EPA and should not be used to assess health risks. They may provide inaccurate risk estimates and contribute to the overall uncertainty of the HHRA. Per OSWER Directive 9285.7-53, the HHRA should use established toxicity values that have undergone external peer review and are publically available.
- On Table 16 it notes that CSFs are not available for ethylbenzene and 1,1,1,2-tetrachloroethane. This is incorrect, CSFs are available for these compounds. The HHRA should use a CSF of 1.1E-02 $(mg/kg\text{-}day)^{-1}$ and 2.6E-02 $(mg/kg\text{-}day)^{-1}$ for ethylbenzene and 1,1,1,2-tetrachloroethane, respectively. The source of these values are CalEPA (2011) and IRIS (USEPA, 2011a), respectively.
- Table 16 only lists trimethylbenzene, not the individual isomers (i.e., 1,2,4-trimethylbenzene and 1,3,5-trimethylbenzene) that were analyzed for in the soil and groundwater samples. The toxicological basis for evaluating these isomers together is not provided nor is this supported by EPA. The HHRA should evaluate the trimethylbenzene isomers separately. The RfC is applicable to 1,2,4-trimethylbenzene and is a PPRTV. The RfD is applicable to 1,3,5-trimethylbenzene and is a PPRTV appendix value. Unlike PPRTVs, PPRTV appendix values are generally not recommend for qualitative risk assessment.
- The RfD for 1,1,2,2-tetrachloroethane is outdated. The ESC&HE should use the value provided in IRIS of 2E-02 mg/kg-day.
- Table 16 should be revised so that it provides a RfD of 8E-02 mg/kg-day for toluene.
- Table 16 provides draft EPA toxicity values for dioxin. The EPA does not currently support the use of the draft toxicity values in the HHRA. ESC&HE should obtain the toxicity values according to EPA's toxicity value hierarchy (USEPA, 2003).
- Table 16 does not provide the chemicals' gastrointestinal absorption efficiencies (ABS_{GI}) that are used to derive dermal toxicity values from oral toxicity factors. It is unclear if these adjustments were made in the HHRA. See RAGS Part E on how to apply ABS_{GI}.

69. **Table 17 (p. 77).** The soil dioxin TEQ cancer risks for soil borings B26 and B33 (i.e., B19) and hazard quotient for soil boring B26 are overestimated by a factor of 10,000 given that the concentrations in ppt were not correctly converted to mg/kg (ppm) and the 10-fold overestimate of the cancer and non-cancer intakes. The non-cancer ingestion HQ for soil boring B33 is overestimated by a factor of 1,000. The average daily dose provided in

Tables 5 does not appear to have been carried forward in the HQ estimate. The risk estimates and Table 17 must be revised (i.e., mathematical errors corrected) so that the HHRA provides an accurate assessment of potential health risks.

The HHRA lacks a summary table that shows the risk estimates for all chemicals and complete exposure pathways. This information is critical for transparency and a critical piece of a human health risk assessment. Furthermore, this information is necessary for conveying risks posed by all compounds and to confirm the accuracy of risk estimates. As noted in many previous comments, numerous errors and inconsistencies have been identified in the HHRA and similar mistakes may have also been made in the calculation tables that were not included in the HHRA.

70. **Section 5.0 (p. 77).** Per previous comments, the text requires revisions with regards to the cancer risk and non-cancer hazard index estimates. The revised hazard indices (HI) will be below 1, so the discussion regarding high non-cancer risk is not relevant and must be removed. The discussion regarding cancer risks will also have to be revised given that the risks should fall within the range from less than 10^{-6} to no greater than 10^{-5}. All risk estimates should also be rounded to one significant digit.

    EPA has serious concerns over the sentence that discusses the risks for adults who have consumed "on-site groundwater." Suggesting that people have used on-site groundwater as a source for drinking water is false and misleading. People (children and adults) have not used on-site groundwater as a source of drinking water. Although existing site data indicates that the drinking water pathway is incomplete for the water-bearing unit evaluated in the HHRA, the HHRA should more clearly define the exposure timeframe of the exposures.

71. **Section 5.1.** The uncertainties section is intended to be a balanced discussion regarding the uncertainties associated with the HHRA that may over or underestimate health risks. However, while very brief, the HHRA tends to focus only on those that may underestimate health risks and is rather dismissive of the uncertainties that would overestimate health risks. This section does not address any uncertainties with the exposure modeling (e.g., erosion modeling) and underlying assumptions, nor does it discuss uncertainties with the exposure pathways (i.e., drinking water pathway). The uncertainties section should be revised so that it provides a balanced and detailed discussion on site-specific uncertainties that may contribute to an over or underestimation of health risks.

72. **Section 5.1.1 (p. 78).** ESC&HE should remove "one hundred percent" from the last sentence of the first paragraph. Numerous inaccuracies have been identified in the HHRA and several assumptions are based on only anecdotal information.

73. **Section 5.1.1 (p. 78-79).** EPA has concerns regarding the discussion on chemical interactions, which include the following:

    - The risk characterization fails to evaluate cumulative cancer risks and cumulative target organ/critical effect HIs. This is a necessary step in risk assessments and is

critical for determining whether site-related risks exceed acceptable risk levels. It will also reduce uncertainties pertaining to chemical interactions.

- The discussion regarding interactions is incomplete. The text does not provide any information regarding the types of chemical interactions (e.g., addition, potentiation, synergism, antagonism). Given that this document is intended for the public, the types of interactions and their definition should be provided.
- This section mentions that some chemical interactions are well-documented and understood. Although true, interactions are generally observed at concentrations that are much higher (i.e., many orders of magnitude) than the levels detected at the site. Little or no data is available on interactions at environmental doses.
- ESD&HE should revise the sentence that states, "…but to determine interactions of all chemicals is impossible." The passage could be replaced with: "… but to determine interactions of all chemicals is not currently possible."

74. **Section 5.1 (p. 79).** The last paragraph erroneously states, "Uncertainty in an exposure assessment can lead to a miscalculation and underestimation of a risk." Miscalculation generally refers to mathematical errors, which are not related to the exposure assessment. A majority of exposure factors are based on upper-bound estimates in order to evaluate the reasonable maximum exposure and to ensure that health risks are not underestimated. In fact, the exposure factors are more likely to lead to an overestimation of health risks (assuming default values are used). Finally, the brief discussion provides no examples from the exposure assessment that may cause health risks to be over or underestimated. The referenced paragraph should be revised to provide a balanced discussion on exposure factors that may lead to an over or underestimation of health risks. The discussion regarding "miscalculations" should be removed.

75. **Section 5.2 (p. 79-80).** The HHRA treats data gaps separate from uncertainties. Data gaps contribute to uncertainty and should be discussed under the context of uncertainty. The following inconsistencies have been identified:

    - Although this section refers to detection limits, ESC&HE should remove any reference that chemical readings come back as "zero." Rather, the HHRA should accurately state that chemical readings may be non-detect.
    - The definition of detection limit is not accurate. Per RAGS Part A, detection limit is defined as the lowest amount that can be distinguished from the normal "noise" of an analytical instrument or method.
    - This section states, "Often these undetectable amounts of chemicals are not harmful." This statement is unnecessary and irrelevant to this HHRA given the detection limits and the exposures being evaluated. It may mislead readers and thus should be removed.
    - Although detection limits for non-detect results are critical for estimating exposure point concentrations for data sets containing detects and non-detects, this section mentions that they are important in acknowledging data gaps. While data gaps may exist when detection limits are above screening levels, detection limits are generally not of concern when they are below screening levels and would not be considered a "data gap" or "uncertainty." The slight underestimate of risk would be negligible.

Unless the HHRA can provide site-specific information where detection limits were insufficient (i.e., above screening levels) and contribute to uncertainty regarding health risks, then the discussion should be removed.

- The last sentence of the first paragraph states, "Assuming that a non-detected contaminant does not exist, even in small amounts, often leads to underestimated risk (Smith, 1991)." This statement mischaracterizes the information provided on the EPA Region 3 web-site, which addresses the treatment of non-detects in deriving exposure point concentration for chemicals with non-detect and detect results. It does not specifically address chemicals that were non-detect for all samples. Furthermore, non-detected chemicals (having adequate detection limits below screening levels) would have a negligible effect on risk estimates. The referenced statement should be removed.
- The discussion regarding a lack of RfDs and RfC is redundant.
- The statement regarding a lack of regulatory standards is inaccurate. The chemicals in question lack toxicity values to derive screening levels. Regulatory standards are not synonymous with screening levels/RSLs/PRGs.
- The text seems to indicate the absence of soil data from the entire location. Soil samples were collected and submitted for analysis from over 50 locations in the proposed development area.
- The text indicates that monitoring wells are located on the north, east and south edge of the property. The text should be modified to indicate that monitoring well MW-4 is located near the ravine in the central portion of the site.
- The text indicates the western pond area may develop into a sinkhole into which groundwater flows. Based on depth to water measurements from site monitoring wells MW-2 (112.96 ft) and MW-4 (49.73 ft) and the site topography, groundwater in the pond area is probably greater than 50 ft bgs and may be closer to 100 ft bgs. The development of a sinkhole that extends to groundwater seems unlikely in this area.

76. **Section 6.1 (p. 81).** This section, which is intended to discuss the findings of the HHRA, is inaccurate and addresses issues that were not previously discussed in the HHRA. These discrepancies are listed below.

- This section inaccurately states that the residential soil cleanup standard of 1,000 ppt for dioxin was sufficient to define the extent of site contamination from the adjacent Bliss-Ellisville Site. The nature and extent of contamination is not defined solely by a cleanup standard. Rather EPA defined the extent of previous investigations according to detailed information regarding the types of releases that occurred at the Bliss-Ellisville Site and potential migration routes.
- The second paragraph states, "Our review found that samples according to depth were lacking across the site and were concentrated entirely in the northwest area." It is not clear if the HHRA is referring to a lack of sampling in the northwest area or that sampling was concentrated in the northeast area of the site (i.e., near the NPL site). Regardless, environmental investigations focus on (i.e., are biased toward) areas of the site that are most likely to be impacted by contamination, based on field observations and historical information/data gathered about the site regarding past activities and land uses that may have resulted in contamination. The investigations

conducted at the proposed Strecker Forest Development Site have focused on areas of the site most likely to be contaminated and extend from the southwest portion of the site (i.e., pond area) to the NPL area bordering the northwest area of the site. For example, the selection of soil samples for laboratory analysis during the ESA was primarily based on the highest PID field readings.

- This section mentions that sampling indicates soil contamination by dioxin and dioxin-like compounds, metals, and VOCs. This is not consistent with the HHRA, which discusses dioxin and dioxin-like compounds, VOCs, and SVOCs. Also, metals were not part of the ESA soil sample analysis.
- This section erroneously states, "Groundwater contamination with metals or volatile organic chemicals, or both is present (in most places sampled) at concentrations above background or regulatory (drinking water) standards." First, the HHRA has **not** evaluated background so it is not possible to conclude that chemicals detected in groundwater were detected above background. This is especially critical for metals. While the HHRA is lacking a figure and table containing metals, SVOCs and VOCs contamination above regulatory standards it is generally confined to the northeast corner, which is located in an area that is not part of the proposed development. Detections in the area of the proposed development, most of which are J-coded, are generally below screening levels. Furthermore these detections were generally found in water samples collected from soil borings, not competent monitoring wells.
- The last portion of this section briefly discusses the vapor intrusion pathway. The vapor intrusion pathway was **not** addressed in any previous sections of the HHRA including the exposure assessment, the conceptual site model, and risk characterization sections, which address complete exposure pathways.

Per the discrepancies above, this section requires a complete revision so that it accurately characterizes the scope and intent of previous investigations. This includes specifically describing the uncertainties with the investigations that provided the data for the HHRA. A more complete and accurate characterization of the groundwater contamination is also necessary and should be supported with data. Assertions that contaminants are above background should be supported with data, or otherwise removed. With regard to groundwater, consideration should also be given to the quality of the analytical data and how and where the sample was collected (e.g., monitoring well vs. soil boring and usable aquifer vs. non-usable groundwater). Lastly, the findings section of a HHRA is not an appropriate section to discuss a pathway not previously addressed. This pathway should be carried through the entire HHRA, if there is the potential that it is a complete pathway. Models and calculations should be provided.

77. **Section 6.2.** Per previous EPA comments, the conclusions section requires a complete revision. The following inconsistencies have been identified:

    - This section states, "The completed exposure pathways, including potential exposure to metals and volatile organic compounds in groundwater result in appreciable risks to human health, especially resident children." The HHRA did not evaluate a child's exposure to groundwater.

- The text indicates that contamination from almost any uphill location can move in multiple directions and carry contaminants to almost any residential location. This generic statement should be put into the context of the proposed development area. Without the proper context, these statements are potentially alarming and of limited value to the site evaluation.
- The text indicates VOCs from groundwater can result in vapor intrusion into current and future residences, based on monitoring well tests and initial models of groundwater flow in the area. However, modeling inputs and well tests were not provided for review. In addition, the vapor intrusion pathway was not evaluated in the text nor was data provided for review.
- The last sentence of the first paragraph states that there is not enough data to conclude that risks are not elevated. If ESC&HE contends that there is insufficient data (i.e., data gaps) to conclude that risks are not elevated, then there is also not enough data to conclude that risks are elevated.
- The second paragraph mentions that the comprehensiveness of the HHRA and prevalence of assumptions are directly affected by the amount and spatial distribution of available data (i.e., ESA and MDNR groundwater data). The HHRA should acknowledge and account for other data sets that are available for the site, but were excluded from the HHRA.
- The statements regarding dioxin posing cancer and non-cancer threats will need to be revised following the corrections to the intake calculations.

78. **Section 6.3.** Similar to comments on Sections 6.1 and 6.2, the recommendation section must be rewritten to account for revisions addressed in previous comments. Listed below are EPA concerns regarding Section 6.3.

- ESC&HE recommends that access to the site needs to be restricted and appropriate warnings placed. The risk estimates for direct contact with soils (when revised to account for the mathematical errors) do not warrant these actions and no other information has been provided (nor is available) to support these actions.
- ESC&HE recommends the use of personal protective equipment. It is unclear who this recommendation is intended for and it would not be an appropriate recommendation for nearby residents.
- This section mentions that buildings on the property may be contaminated with various chemicals and they should be evaluated, removed and properly disposed. This information and relevant exposure pathways were not previously addressed in the HHRA. The recommendations should be reflective of the findings of the HHRA.
- The last paragraph mentions that the community should be notified and cautioned against entering the property. It is unclear what property is being referred to. The HHRA (i.e., soil risk estimates) has not supported such actions on the proposed Strecker Forest Development Site.

79. **Appendix II.** The modeling to predict dioxin concentrations is technically flawed. Below is a list of flaws identified on Appendix II.

    - ESC&HE has used an oversimplified approach of using average rainfall totals over three months to estimate the volume of water that would flow in the ravine during flooding events. No data has been provided to support the flow used in the modeling.
    - The erosion modeling is intended to be applied to erosion within the stream. However, the modeling presented in the appendix has been applied to the whole drainage area. Note that the critical shear stress model used in this appendix is applicable to streambank erosion.
    - The model assumes a silt/clay content of 100%, but does not specifically state that this assumption had to be made to be consistent with the critical shear stress model used to estimated soil erodibility.
    - The calculated mass of soil leaving the site during high flow events over a three month period is equivalent to approximately 233 m^3 of soil (assuming a bulk density of 1,500 kg/m^3). This is not possible based on the conditions and characteristics of the site.
    - The dioxin TEQ concentrations are overestimated due to miscalculations in unit conversions.
    - The equations used to estimate dioxin TEQ concentrations sorbed to particulates are flawed stemming from the use of a conversion factor of 1 kg/m^3. No information is provided regarding this factor and based on the equation provided this conversion factor cannot mean that 1 kg of soil is contained in 1 cubic meter of water. The only other conversion would be for converting the volume of water to a mass, but a cubic meter of water has a mass of 1,000 kg. Therefore, the mass of the volume of water in the denominator has been significantly underestimated. However, because the equation divides a mass of dioxin in soil (which was derived by multiplying the mass of soil by the dioxin TEQ concentration) by the volume of water over the same period of time (i.e., a day), there is no need to convert the concentrations to µg/kg. Removing the flawed conversion factor and converting the water volume to liters will result in a dioxin TEQ concentration in surface water.

80. **Appendix IV.** ESC&HE should revise this appendix to more clearly indicate the exposure pathways being evaluated (e.g., residential receptors direct contact with surface soil).

81. **Appendix IV (Equation 1a).** Equation 1a provides a dioxin TEQ concentration of 0.00371 mg/kg (or 3,710 ppt) for soil boring B26. Per the ESA Report, the dioxin TEQ from soil boring B26 is 3.71 ppt or 0.00000371 mg/kg. In addition, the soil sample collected at soil boring B26 was collected from a depth of 8-10 feet below ground surface (bgs) per Tables 5 and 9 and Figure 14 of the Mundell Report, not 4-8 feet bgs as indicated in the HHRA. These inconsistencies must be revised and intakes and risks recalculated. See also the specific comments regarding the other dermal contact exposure factors at B-33.

82. **Appendix IV (Equation 1b).** The soil sample depth must be revised. Revisions are also necessary for other exposure factors. However, per RAGS Part E, dermal contact with VOCs in soil is a negligible pathway and need not be evaluated because they would tend to be volatilized from the soil on skin and should be accounted for via inhalation (USEPA, 2004).

83. **Appendix IV (Equation 1c).** The soil depth must be revised. Revisions to the other exposure factors are also necessary per other specific comments on the dermal contact route of exposure.

84. **Appendix IV (Equation 1d, 1e, and 1f).** The following revisions should be made to this section.

    - Benzene should be replaced with dioxin TEQ in Equation 1d.
    - The dioxin TEQ concentration in Equation 1d should be revised to 3.71 ppt or 0.00000371 mg/kg.
    - The soil sample depth for boring B26 should be revised to 8-10 ft bgs.
    - The HHRA assumes an incidental soil ingestion rate of 200 mg/day (USEPA, 1991). This upper-bound soil ingestion rate is applicable to young children between the ages of 1 and 6. Unless the HHRA is revised to account for a 30-year exposure that includes young children, the HHRA should use the default soil ingestion rate of 100 mg/day recommended by EPA guidance (USEPA, 1991a). This soil ingestion rate is applicable to older children and adults. Also, this section should be revised to state that the soil ingestion rate is an upper-bound soil ingestion rate, not an average ingestion rate as mistakenly indicated in the HHRA. For additional discussion on these values, see USEPA, (1991a).
    - The HHRA assumes an exposure frequency of 365 events/year. Exposure frequency should be expressed in days/year. Note that soil ingestion is based on mg/day and accounts for a receptor's daily soil and dust (e.g., soil-derived indoor dust) ingestion, and is intended to address chronic exposures. The exposure frequency should also be adjusted to the upper-bound residential exposure frequency of 350 days/year (USEPA, 1991) to account for vacations and other days away from the home.
    - Revisions to the exposure duration, age of receptor, and body weight are also recommended per previous comments.

85. **Appendix IV (Equations 1g and 1h).** The inhalation pathway should be assessed consistent with RAGS Part F. The equations provided are technically flawed. Per the exposure factors, they do not result in a dose (i.e., mg/kg-day) as intended. The chemical concentration is in mg/kg and it is not converted into an air concentration via the use of a volatilization factor. Note that the inhalation rate is in m^3/day. In addition, these equations do not provide the models and soil concentrations that were used to derive the VOC concentrations. It appears that Henry's Law constant was multiplied by the soil concentration. This is a misapplication of Henry's Law and oversimplification of the volatilization of chemicals in soils and the subsequent migration, dispersion, and diffusion into atmospheric air. When evaluating the inhalation of volatile chemicals emitted from soils, a volatilization factor should be derived and applied to the soil concentration. Equations for deriving chemical-specific volatilization factors are provided in USEPA (2002b). For metals, dioxin, and other chemicals lacking

volatility, a particulate emission factor should be derived to evaluate the inhalation pathway (See also USEPA, 2002b).

Under the exposure time parameter, which is not used in the inhalation equation provided (but would be used following RAGS Part F methodology); it is assumed that there is exposure to "high levels through the basement." There is no support for this assumption that high levels of contaminants are migrating through the basement. The existing site data **does not** support this assertion. It is also unclear what pathway is being referenced, but the equations and simplified modeling are not relevant to nor should they be applied to the vapor intrusion pathway. The pathway being presented (via the equations and CSM) is applicable to inhalation of volatiles emitted from soils in outdoor air. If the vapor intrusion pathway is a concern for soils, then a separate evaluation must be performed using the Johnson & Ettinger Model. However, based on EPA's review of the existing soil data, the concentrations are negligible with respect to the vapor intrusion pathway.

86. **Appendix IV (B-33).** The comments provided on the ingestion, dermal contact, and inhalation routes of exposure for B-26 also apply to B-33.

87. **Appendix IV (Equation 4c).** Again, the evaluation of dermal contact with dioxin TEQ in surface water is technically flawed. The erosion modeling and intake equations must be revised so that intake is evaluated via dermal contact with surface water.

Phase II Environmental Site Assessment Report, March 3, 2010

General Comments

1. The scope of the ESA Report is generally consistent with ASTM standards relating to the Phase II environmental assessment process (ASTM Practice E 1903 – 97). The primary objectives of conducting a Phase II ESA, as stated in the ASTM standard practice, are to investigate recognized environmental conditions (RECs) identified in the Phase I ESA for the purpose of providing sufficient information regarding the nature and extent of contamination to assist in making informed business decisions about a property and, where applicable, to satisfy the innocent purchaser defense under the Comprehensive Environmental Response, Compensation, and Liability Act, as amended (CERCLA) as defined in 42 U.S.C. § 9601(35)(B). A Phase II ESA is not intended to provide a full characterization of a site's environmental conditions or the level of investigation necessary to support remedial decision-making. The ESA Report provides a screening level assessment that is best suited for identifying areas requiring further investigation. The usefulness of the Mundell Report as a basis for risk assessment or remedial planning is limited.

2. Based on EPA's review of the data provided in the ESA Report, it will yield inaccurate and unreliable risk estimates for decision-making. Risk assessments are generally performed on robust data sets where the nature and extent of contamination has been fully delineated. The samples collected in the Phase II ESA are more in line with a screening level assessment. EPA's main concerns regarding the existing set include, but are not limited to the following:

First, the sampling scheme was biased because it focused on areas of suspected contamination and the samples were collected from depth intervals with the highest photoionization detector (PID) readings or visible signs of impacts. As a result, exposure concentrations would be expected to be biased high. Second, only one sample was collected and analyzed from each soil boring (i.e., the depth interval with the visible impacts or highest PID reading). Typically, data used in risk assessments include samples collected at multiple depths from a single boring. Given that soil samples were not collected from the other depth intervals and that the same depth intervals were not consistently collected across the site, there are significant uncertainties that the data will provide a representative characterization of exposure concentrations (horizontally and/or vertically) across the site. Furthermore, the surface soil sampling depth intervals lack consistency. Some intervals span the 0-1 foot below ground surface (bgs) interval while others span the 0-2 and 0-3 foot bgs intervals. Although this may not be of concern for screening the site, these intervals lack comparability for estimating exposure point concentrations under current conditions. Surface soil exposures generally involve exposures to contaminants (especially contaminants lacking volatility, such as dioxins) in the top 2 centimeters of soil (USEPA, 2002b). The inclusion of large sampling intervals could over or underestimate the concentration at the surface. EPA has similar concerns over the subsurface sampling intervals.

3. The Report often refers to the screening levels used to evaluate the sample results as "cleanup" levels. It is generally not appropriate to refer to screening levels as "cleanup" levels. It suggests that any concentration above a screening level requires cleanup. The ESA Report should not refer to screening levels as cleanup levels.

4. The Report briefly discusses qualified data and refers to Appendix C for QA/QC testing; however, the Report lacks a discussion of how qualified data may affect the data evaluation (i.e., comparison to screening levels), especially the dioxin and furan results, which have exceptionally low screening levels. EPA was also unable to locate data validation reports. Note that a large percentage of the dioxin and furan results were qualified as estimated values ("J" or "QJ") and some constituents were detected in the associated method blank. Many of the VOC detections, which had exceptionally low detection limits well below their screening levels, were also qualified. In addition, there are some discrepancies between duplicate samples, which are likely attributable to typical field and analytical variability. For example, the TEQ concentration for soil boring B-06 and its field duplicate are 0.27 and 6.66 parts per trillion (ppt), respectively. 2,3,7,8-TCDD was only detected in the field duplicate. Given the uncertainties associated with the accuracy of qualified data, it is critical that the risk assessment provide a detailed and balanced discussion on the data quality and how it affects site health risks. Data validation reports should be provided with the ESA Report and referenced in the risk assessment. Note that data quality and usability assessments are critical elements of the risk assessment process (USEPA, 1989).

5. The Report has set a background TEQ concentration of 4.95 ppt that is based on three samples collected at depth. Then this concentration is used in combination with the dioxin/furan congener fingerprint to determine whether the soil samples were related to a background source or non-background dioxin source material. EPA has significant concerns with this approach, especially if it is continued in the human health risk assessment. First,

the background concentration is based on too few samples to be considered statistically reliable for use in a human health risk assessment. Typically, 10 to 20 background samples are recommended for evaluating background, which is often based on a statistical estimate of the average or upper-bound confidence limit. Furthermore, surface soils may be more affected by anthropogenic background, and background determination should have included surface soil samples. Finally, the congener content analysis is problematic, which is best illustrated by the soil sample results for B-14, B-23, and B-28, which failed the background analysis. Although 2,3,7,8-TCDD was not detected in these samples, they failed due to a single qualified detection of pentadioxin at a concentration of less than 1 ppt. Almost all of the other dioxin and furan congeners were lower in these samples compared to their respective background values. Given the uncertainties regarding qualified data, especially at the analytical levels being evaluated and with consideration given to the other congener results, it is EPA's judgment that a single qualified detection is not indicative of a non-background dioxin source material.

6. The ESA Report includes only a limited amount of data that is useful for characterizing current levels of potential dioxin exposure, and does not apply the appropriate EPA dioxin criterion for comparison purposes. The dioxin cleanup criterion of one part per billion for residential soils which was applied during the 1998 EPA cleanup of the Bliss and Contiguous Properties remains current and valid. As pointed out in previous EPA correspondence to the City of Wildwood, EPA has proposed to lower the Preliminary Remediation Goals (PRGs) for dioxin in soil, but it is unclear at this time if the dioxin PRGs will be revised and what, if any, impact this action would have on assessment of conditions at the proposed Strecker Forest subdivision.

7. The ESA Report's text and tables focus on the results of the ESA sampling. In addition to providing the results of the ESA sampling, Figures 13 and 14 provide historical sample results. The complete analytical results for the historical samples are not provided. Given that the Report uses the historical samples in the figures to identify areas that exceed screening levels, EPA recommends that the ESA Report provide the complete analytical results for these samples in the data summary tables or in an appendix.

8. The soil data presented in the ESA Report were compared to the most current version of the EPA RSLs, which are dated November 2010. The maximum soil concentrations in the samples collected by Mundell exceed the respective RSL for six compounds detected in a single sample. This single sample was collected from the NPL area at a depth of 7-10 feet below ground surface. Assessment of the data must consider the potential for exposures to occur in this area. The NPL area is not included in the proposed development, and the potential for exposure to subsurface soils in this area is not considered likely under reasonably anticipated future use. The ESA Report also presents historic data from the previous Phase II Environmental Site Assessment. One test pit sample collected near the western pond area marginally exceeded the EPA RSL for a single compound. All soil levels reported in the Mundell report, including the EPA RSL exceedences, fall within EPA's acceptable cancer risk range of 1E-04 (1 in 10,000 chance of developing cancer) to 1E-06

(one in a million) and below a non-cancer hazard quotient of 1. The soil data presented in the ESA Report do not indicate that conditions warrant source removal or cause concern for protection of human health for the proposed residential development.

9. The ESA Report presents analytical results from shallow ground water samples collected from the seven monitoring wells and three boreholes. Assessment of ground water data must consider the potential for migration and the potential for ground water use (e.g., drinking water). The use of shallow ground water for any purpose has not been identified in the vicinity of the proposed subdivision. A number of private wells drawing from the deep aquifer have been identified, but no impacts to the deep ground water quality have been identified in well testing performed by the State. The shallow ground water contaminants identified in the ESA Report only marginally exceed any standards for domestic use or potential vapor intrusion, and only in the NPL area in the northeast portion of the parcel. Investigations performed by the State indicate that the shallow ground water in this area is moving away from the proposed development and is not a cause of concern for the proposed Strecker Forest Development Site. The ESA Report does not consider site-specific factors in the assessment of vapor intrusion risk, and no potential source area was identified. Mere exceedence of a conservative health-protective screening criterion without further assessment of site-specific conditions does not mean that an unacceptable human health risk exists.

10. Dioxin congener analysis was performed for soil and ground water samples collected during the Mundell ESA. Dioxin toxic equivalence (TEQ) concentrations were calculated by Mundell for the reported data. Dioxin TEQ concentrations exceeding the EPA MCL of 0.03 ppt were not detected in any of the ground water samples collected by Mundell. Dioxin TEQ concentrations for surface and subsurface soil samples collected in the area of the proposed residential development also did not exceed the current interim EPA PRG of 1,000 ppt for dioxin in residential soil. In January, 2010, EPA proposed to revise the interim PRG levels for dioxin in residential soil to 72 ppt. EPA has not completed decision-making for the potential revised PRG levels, and it is unclear at this time what, if any, effect a revision to dioxin PRG levels would have on assessment of conditions at the Bliss and Contiguous Properties and the surrounding area. Regardless, all dioxin TEQ concentrations reported in the Mundell Report in the area proposed for residential development were less than the revised interim PRG level for dioxin in residential soils proposed by EPA. The maximum surface soil dioxin TEQ concentration reported in this area was 6.96 ppt and the maximum subsurface TEQ concentration was 23.32 ppt.

    Dioxin TEQ levels exceeding the current 1,000 ppt level for residential soils were exceeded at two sample locations in the northeast portion of the subject parcel. Reported dioxin TEQ levels up to 6,527 ppt were reported for a subsurface soil sample collected from a depth of 7-10 feet below ground surface (bgs) at monitoring well MW-6 location. A dioxin TEQ concentration of 152 ppt was reported in a subsurface sample collected from a depth of 0.5 – 2.0 ft. bgs at the location of soil boring B-10, also in the northeast portion of the site. All other reported dioxin concentrations were less than the current or proposed EPA PRG levels for dioxin in residential soil. The reported exceedences of dioxin PRGs in the northeast portion of the parcel were subsurface discrete samples which cannot be used to characterize exposure potential and associated health risks. Not only were the samples collected from

subsurface soil which is not assessable for direct contact, but health risks associated with dioxin TEQ are based on overall levels across an exposure unit, not a single point. The presence of dioxin TEQ levels exceeding 1,000 ppt does not necessarily indicate an unacceptable health risk in the northeast portion of the parcel and would not affect conditions in the area proposed for development. Further assessment of dioxin TEQ levels in the northeast portion of the parcel would be required if further characterization of potential health risks in this isolated area is of interest.

11. The dioxin congener data presented in the Mundell Report is suspect due to the attachment of data qualifiers. For example, all of the detected dioxin congeners that contribute to the maximum reported dioxin TEQ of 23.32 ppt in the area proposed for development represent estimated values. Dioxin was also detected in method blanks associated with the corresponding dioxin congener analysis. EPA Region 7 standard practice is to exclude qualified (estimated) dioxin congener data in a definitive calculation of dioxin TEQ levels. The use of the qualified data for TEQ calculation in the Mundell report is questionable.

12. The Mundell Report and draft HHRA made no attempt to show correlation between the dioxin congener profile detected in Mundell samples with the dioxin congener of concern at the Bliss and Contiguous Properties where dioxin impacts have been characterized. During investigation and cleanup actions conducted by EPA at the Bliss and Contiguous Properties, the specific congener 2,3,7,8-TCDD was used as an indicator chemical due to its prevalent contribution to TEQ levels at the site. In the samples collected by Mundell from the area proposed for development, 2,3,7,8-TCDD levels were below detection limits or were not present in significant concentrations. The congener distribution in Mundell samples collected from the area proposed for development is more consistent with ubiquitous dioxin levels typically found near developed areas, and appears unrelated to hazardous waste activities that resulted in contamination of the adjacent Bliss and Contiguous Properties. The Bliss-related dioxin congener, 2,3,7,8-TCDD, did contribute significantly to dioxin TEQ levels reported in the northeast portion of the parcel, indicating some level of potential impact from the adjacent NPL site.

Specific Comments

1. **Executive Summary (p. 8).** Under the "Solid Waste Disposal Area" heading the Report states, "Based on observations made during the field study, the solid waste area poses an immediate human health and safety risk to trespassers entering the property. This is the result of the poor condition of the exposed waste materials, metallic debris and miscellaneous materials found in those areas." Given that the Report's primary focus is on human health risks resulting from exposure to chemicals in soil and groundwater, EPA recommends that the ESA Report provided a clearer distinction between physical safety hazards and health risks resulting from exposure to soil and groundwater. For example, EPA offers the following change to the first sentence above: "Based on the observations made during the field study, the solid waste area poses a physical safety risk to trespassers entering the property."

The second paragraph under the "Solid Waste Disposal Area" mentions that soil sampling results may vary from the conditions beneath particular solid waste areas. Then it mentions that without the complete removal of the accumulated waste and "associated" impacted soils, it is not possible to assess that the site conditions are acceptable for development. The data does not indicate significant impact to soils in the solid waste disposal area. It is not clear how a risk assessment could be performed for this area when the Phase II ESA has not characterized conditions. A risk assessment is performed after the nature and extent of contamination have been defined. EPA recommends that the Phase II ESA specify the data gaps, if any.

2. **Executive Summary (p. 9).** In a couple instances on this page, the Report mentions environmental risks. Unless the discussion is intended to be inclusive of ecological risks, EPA recommends replacing environmental risks with human health risks.

3. **Executive Summary (p. 10).** The Report recommends that the NPL area, the central solid waste, eastern disturbed area, and the western pond area be restricted with fencing and signage to prevent direct contact with exposed surface materials present in those areas. The technical basis for this recommendation has not been provided nor does the data support the recommendations regarding site access restrictions. The analytical results show that VOCs, SVOCs, and PCBs in surface soil were either not detected or were detected below risk-based residential soil screening levels. 2,3,7,8-TCDD and TEQ levels in surface soil fall below the current residential soil PRG of 1,000 ppt. Notwithstanding a couple of the historical samples where the sample depth is not provided, the VOCs, SVOCs, and PCBs screening level exceedences found during the Phase II ESA sampling are confined to a single subsurface soil sample collected at the 7-10 foot depth interval. The maximum detected concentration of 2,3,7,8-TCDD, which exceeds the current residential soil standard, was also detected in this subsurface soil sample. Given that the levels of VOCs, SVOCs, and PCBs in surface soil are below screening levels and that dioxin levels in surface soils are below the current residential PRG, it is unclear why the Report recommends that access to the aforementioned areas be restricted to avoid direct contact with surface material.

4. **Executive Summary (p. 11).** The second recommendation on this page discusses the removal of impacted soil in the solid waste disposal area and vicinity of the western pond. Based on the data, it is unclear why the Report recommends soil removal in these areas when VOCs, SVOCs, PCBs, and dioxins were either not detected or detected below and/or within EPA's target risk range.

5. **Section 3.7 (p. 41).** In addition to comparing soil and groundwater analytical data to MRBCA screening levels, the Report compares the data to the 2004 Region 9 Preliminary PRGs. The 2004 Region 9 PRGs, which are outdated, are no longer used by EPA and have been replaced by EPA's RSLs (USEPA, 2010). The RSLs, which account for the most current EPA risk assessment guidance and policy and toxicological data, should be used in the report.

This section also notes that the soil analytical data were compared against Region 9 PRGs to determine if the detected concentrations exceed acceptable human health risk levels. EPA screening levels do not define acceptable human health risk levels. They are intended to screen sites for additional characterization. While contaminant concentrations may exceed screening levels, they may not pose unacceptable health risks.

6. **Section 3.8.** This section makes several comparisons of the groundwater analytical data to the screening levels in EPA's 2002 vapor intrusion (VI) guidance. All of the screening levels in that guidance are outdated with the issuance of RAGS Part F (USEPA, 2009). Also, many chemicals' toxicity values have changed since 2002. The Phase II ESA should derive the groundwater-to-indoor-air screening levels by applying a conservative attenuation factor (0.001) to the residential ambient air RSLs. The full equation that is used to derive the groundwater VI screening levels is provided in Appendix F of the 2002 VI guidance and the attenuation factor is recommended in EPA's VI database (USEPA, 2008b). A more thorough evaluation of the VI pathway is needed that is consistent with EPA's VI guidance and the Interstate Technology & Regulatory Council's VI guidance (ITRC, 2007). This would include developing a conceptual site model for the VI pathway, screening the existing data, identifying data gaps, if any, and documenting the evaluation.

7. **Section 3.9 (p. 51).** This section briefly discusses the results of the dust samples collected at the Dozier Garage and provides a TEQ concentration of 8.5 parts per trillion (ppt) for the wipe sample. No information is provided in the Report as to how a wipe sample concentration, which is typically expressed in mass per area (e.g., ng/cm^2), was converted to a mass per mass concentration. Although it is not certain how this conversion was made and how reliable the estimate might be, EPA recommends that the equations, assumptions, and other information used to complete the conversion be provided in the ESA Report. EPA also recommends that a brief discussion of the wipe sampling techniques be provided in Section 3 and that wipe sample results and TEQ calculations be included in the data tables. Note that wipe samples are generally not used to assess health risk given the complications with estimating exposure.

8. **Section 4.3.2.2 (p. 55).** The second paragraph on this page states, "...while the non-cancer risk PRG (1E-05 risk) for residential soil is..." Note that the non-cancer PRG for dioxin is based on a HI of 1. Non-cancer health effects **are not** expressed as a probability (e.g., 1E-05 risk). The text should be revised by noting that the non-cancer PRG is based on an HI of 1.

9. **Section 4.3.2.3 (p. 56).** Revisions should be made to the congener content screening for evaluating background. It should include a comparison of individual congener concentrations and account for the uncertainties in the analytical data.

10. **Section 4.4.2 (p. 57).** The fourth paragraph states that chemical risk in the western pond area appears to be manageable with proper source removal. Based on review of the data from this area, it is unclear how the Phase II ESA has concluded that source removal is needed in this area. VOCs, SVOC and PCBs were either not detected or detected below screening levels and the maximum TEQ was 23.32 ppt, which is well within EPA's target cancer risk range and below a non-cancer HI of 1.

11. **Section 4.4.2 (p. 58).** The last paragraph states,

> "Assuming for a moment that the dioxin-furan TEQ exceedences are of an acceptable level, and the geotechnical stability of the pond are is determined to be adequate for residential development, then the relatively limited chemical impact observed around B-23 and near B-33 could be addressed by excavation and proper disposal of the buried object and affected soil, followed by a geophysical survey and confirmatory sampling. However, if TEQ exceedences represent an unacceptable level of risk, then more widespread excavation of near-surface soil would need to be completed, until acceptable TEQ levels were attained."

It is unclear why the Report recommends removal of soils in the western pond area if TEQ concentrations are within acceptable levels. As noted in the previous comment, other chemicals were not detected or detected below screening levels. Generally removal/remediation is only recommended when health risks exceed acceptable levels.

12. **Section 4.4.3 (p. 58).** This section appears to recommend a limited removal in the haul road area, depending on the final cleanup goal. Note that one sample was collected from this area and the TEQ concentration is 3.98 ppt. The fact that TEQ concentrations fall within target risk levels, EPA is uncertain how the limited amount of data from this area would support a removal action.

13. **Section 4.4.5 (p. 59).** This section indicates that soil removal may be warranted in the Eastern Disturbed Area. Given that the chemicals do not exceed screening levels or fall within EPA's target risk range, soil removal does not appear necessary for this area. The ESA Report should provide specific data/information that supports why soil removal is needed for this area.

14. **Section 4.4.6 (p. 60).** It is not clear why the Report recommends access restrictions to the NPL area, which has undergone clean-up in the past, including surface soil removal and the addition of clean fill. The levels of dioxin (i.e., TEQ) in the surface soil samples do not exceed the current residential PRG of 1,000 ppt and the exceedence at 6,527 ppt was found at-depth (7-10 feet bgs). The ESA Report should provide clarification on the basis for this recommendation and what type of access should be restricted in this area.

15. **Section 5.2.1 (p. 65).** See previous comment on recommendations regarding access restrictions to the site.

16. **Figure 13.** This figure depicts soil sample locations where VOCs, SVOCs, and PCBs exceed "cleanup levels" (i.e., MRBCA or EPA Region 9 PRGs). All of the VOC, SVOC, and PCB soil screening level exceedences listed in the Report were confined to one Phase II ESA sample and three historical sample locations. The Report screened soils against the protection of groundwater and vapor intrusion screening levels along with direct contact screening levels. Provided below is a summary table (Table 1) comparing the maximum detections that exceeded the screening levels in the Report to the most current screening

levels for residential soils (i.e., EPA RSLs). As shown, five out of the 12 chemicals do not exceed residential soil RSLs. The remaining seven exceed their respective carcinogenic screening levels, but would fall below levels corresponding to a cancer risk of 10^{-4} and/ or 10^{-5}. These exceedences were confined to one Phase II ESA sample (MW-06) and one historical sample location (TP–06). Furthermore, the maximum detections were generally found in subsurface samples, which are generally not evaluated under residential scenarios, except for volatiles (inhalation pathway only) or when subsurface soil is expected to be brought to the surface (e.g., via re-grading) under site development. Site development is not expected to occur in the NPL area.

Table 1. Risk-Based Screening of Soil Results

Chemical	Maximum Detection (mg/kg)	Location (Depth in feet)	Screening Levels Residential Soil RSL (mg/kg)	Above Screening Level
1,2,4-trimethylbenzene	58	MW-06 (7-10)	62 n	No
1,3,5-trimethylbenzene	53	A-4 *	780 n	No
ethyl benzene	44	MW-06 (7-10)	5.4 c	Yes
methylene chloride	1 J	MW-06 (7-10)	11 c	No
tetrachloroethylene	0.67	MW-06 (7-10)	0.55 c	Yes
m&p xylene	170	MW-06 (7-10)	3,400 n	No
naphthalene	71	MW-06 (7-10)	3.6 c	Yes
benzo(a)pyrene	0.15	A-4 *	0.015 c	Yes
dibenz(a,h)anthracene	0.11 J	MW-06 (7-10)	0.015 c	Yes
2-methylnaphthalene	8.1	MW-06 (7-10)	310 nc	No
arochlor 1248	0.24	MW-06 (7-10)	0.22 c	Yes
arochlor 1254	1.1	TP-06 (Test Pit) *	0.22 c	Yes

J: Estimated result. Result is less than the reporting limit.
nc: Based on a non-cancer HI of 1.
c: Based on a cancer risk of 10^{-6}
*: Historical sample.

Figure 15. Figure 15 depicts the groundwater sample locations and analytical results. The figure also shows that exceedences of screening levels are confined to boring location B-33(W) and monitoring well MW-06. Below EPA has provided a summary table (Table 2) comparing the maximum detections that exceeded the screening levels in the Report to the most current drinking water screening levels. Also provided is a similar table (Table 3) that compares all VOCs to screening levels that are applicable to the vapor intrusion pathway. Note that several of the maximum detections were "J" and/or "B" coded by the analytical laboratory, which contributes to uncertainty regarding the actual concentration of these chemicals in groundwater. Furthermore, our screening did not consider whether the groundwater is of sufficient quality or yield for domestic purposes, which is a critical determination when performing a human health risk assessment.

Figure 15 in the Mundell Report identifies eight chemicals that exceed either an MRBCA action level or EPA PRG. As shown in Table 2, six out of the eight chemicals exceed their respective groundwater RSLs and the four chemicals having MCLs exceeded their respective drinking water standards. All but one of the screening levels and/or MCL exceedences are confined to the NPL area where site redevelopment is not expected to occur. Except for the bis(2-ethylhexyl)phthalate (DEHP) detection in soil boring B-33(W), chemicals were either not detected or detected below screening levels in all the groundwater samples collected from the area of the proposed Strecker Forest Development. DEHP is widely used as a plasticizer and its primary use is in the production of polyvinyl chloride (PVC). Because it has the potential to leach from plastics, DEHP contamination detected in ground water samples often originates from plastic materials used in the sampling and analytical processes.

All but six of the detected VOCs are below the most conservative vapor intrusion screening levels (attenuation factor = 0.001) for groundwater (see Table 3). The exceedences of the most conservative vapor intrusion screening levels for these six compounds were confined to monitoring well MW-06 located in the northeast portion of the parcel. Two of these six VOCs (trichloroethylene and 1,3,5-trimethylbenzene) only marginally exceed the most conservative screening level. The remaining four VOCs (ethylbenzene, naphthalene, 1,2,4-trimethylbenzene, and vinyl chloride), are still below the screening level based on an attenuation factor of 0.00001. The concentrations of all VOCs in groundwater samples collected in the area of the proposed Strecker Forest development are listed below and screened against the most conservative vapor intrusion screening levels.

Based on these findings and the downgradient location of monitoring well MW-06, The EPA screening level evaluation of the vapor intrusion pathway generally indicates that the pathway is either incomplete or would not pose unacceptable health risks. This evaluation did not consider the uncertainty in the data set (i.e., qualified data), the potential karst geology, or dilution. This evaluation considered maximum detections (from a single round of sampling), not an area-wide average that may be more representative of VOC concentrations that could affect the vapor intrusion pathway over many years.

Table 2. Risk-Based Screening of Groundwater Results

Chemical	Maximum Detection (µg/L)	Location	Groundwater Screening Levels (µg/L)		Above Screening Level?
			RSL	MCL	RSL/MCL
1,2,4-Trimethylbenzene	240	MW-06	15 n	NA	yes/-
1,3,5-Trimethylbenzene	31	MW-06	370 n	NA	no/-
Methylene Chloride	7.2 J B	MW-06	4.8 c	5	yes/yes
Trichloroethylene	5.1 J	MW-06	2 c	5	yes/yes
Vinyl Chloride	3.9 J	MW-06	0.016 c	2	yes/yes
Naphthalene	390 B	MW-06	0.14 c	NA	yes/-
2-Methylnaphthalene	15	MW-06	150 n	NA	no/-
Bis (2-Ethylhexyl)phthalate	12	B-33(W)	4.8 c	6	yes/yes

J: Estimated result. Result is less than the reporting limit.
B: The associated method blank contains the analyte at a level above the method detection limit.
n: Based on non-cancer hazard index of 1.
c: Based on cancer risk of 1E-06.
NA: MCL is not available.

Table 3. Risk-Based Screening of Groundwater - Vapor Intrusion Pathway
(Volatile chemicals only per USEPA, 2002a)

Chemical	Maximum Detection (µg/L)	Location	Vapor Intrusion Screening Levels[1] (µg/L)	
			α = 0.001	α = 0.00001
Benzene	0.51 J	MW-06	1.35 c	135 c
Chloroethane	4.3 J	MW-06	22,222 nc	2,222,222 nc
Chloroform	0.29 J	MW-05	0.73 c	73 c
Chloromethane	0.077 J	B-33(W)	260 nc	26,068 nc
1,2-Dichlorobenzene	1.6 J	MW-06	2,692 nc	269,231 nc
1,1,1 Trichloroethane	0.18 J	MW-05	70429 nc	742,857 nc
1,1-Dichloroethane	2.4 J	MW-05	6.5 c	653 c
1,1-Dichloroethene	0.096 J	MW-05	197 nc	19,680 nc
cis-1,2-Dichloroethylene[2]	12	MW-06	378 nc	37,769 nc
trans-1,2-Dichloroethylene	0.84 J	MW-06	166 nc	16,579 nc
Ethylbenzene	190	MW-06	3.0 c	301 c
Isopropylbenzene	34	MW-06	894	89,362
Methylene Chloride	7.2 J B	MW-06	39.1 c	3,914 c
2-Methylnaphthalene	15	MW-06	na	na
n-Butylbenzene[3]	29	MW-06	1,859 nc	185,874 nc
n-Propylbenzene	34	MW-06	2,330 nc	232,952 nc
Naphthalene	390 B	MW-06	4.0 c	400 c
p-Isopropyltoluene	2.4 J	MW-06	na	na
sec-Butylbenzene[3]	6.2 J	MW-06	1,761 nc	176,056 nc
Tetrachloroethylene	0.37 J	MW-05	0.6 c	57 c
tert-Butylbenzene[3]	1.8 J	MW-06	2,053 nc	205,339 nc
Toluene	4.9 J	MW-06	19,155 nc	1,915,542 nc
Trichloroethylene	5.1 J	MW-06	3.0 c	298 c
1,2,4-Trimethylbenzene	240	MW-06	29 nc	2,899 nc
1,3,5-Trimethylbenzene[4]	31	MW-06	29 nc	2,899 nc
m,p-Xylene	790	B-26 (W)	472 nc	47,220 nc
o-Xylene	160	MW-06	476 nc	47,619 nc
Vinyl Chloride	3.9 J	MW-06	0.14	14

J: Estimated result. Result is less than the reporting limit.
W: Water sample collected in a soil boring.
B: The associated method blank contains the analyte at a level above the method detection limit.
na: Screening levels are not available. A suitable surrogate compound could not be identified.
n: Based on non-cancer hazard index of 1.
c: Based on cancer risk of 1E-06.

[1] Groundwater vapor intrusion screening levels derived according to equations provided in USEPA, 2002a. Attenuation factors span the range of groundwater-to-indoor-air attenuation factors (α) presented in EPA's vapor intrusion database (USEPA, 2008b). The attenuation factor of 0.001 represents an upper-bound value (i.e, 95% percentile).
[2] *trans*-1,2-dichloroethylene is used a surrogate chemical (toxicity value only) for *cis*-1,2,-dichloroethylene's screening level.
3 n-Propylbenzene is used a surrogate chemical (toxicity value only) for n-butylbenzene, sec-butylbenzene, and ter-butylbenzene's screening levels.
[4] 1,2,4-trimethylbenzene is used a surrogate chemical (toxicity value only) for 1,3,5-trimethylbenzene's screening level.

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