RESPONSE TO EPA/EPD'S DRAFT COMMENTS (January 8, 2021)
"Identification of Constituents of Potential Concern and Exposure Assessment – Human Health Baseline Risk Assessment Technical Memorandum for the LCP Chemicals Site, Brunswick, Georgia"

GENERAL COMMENTS

EPA General Comment #1. *Further discussion is needed in the OU2 BRA Memo to determine if contaminated "surface soil" as normally considered exists in the Cell Building Area (CBA) and whether it should be evaluated as such. The CBA is covered by a 12 to 36-inch soil cover which was installed to prevent direct exposure during the Removal phase of the response at LCP. Wherever this soil cover is present, it may be possible to assume there would be no contamination in the surface soil depth interval. In addition, the soil cover is underlain by the pre-existing concrete floor slabs which extend for a large percentage of the area under the soil cover. As a result, contaminated "surface soil" as normally considered in an environmental investigation may not be present in a way as normally evaluated in OU2. Presentation of the cut/fill map data is requested to clarify the discussion.*

Response: We have undertaken a detailed review of all soil depth intervals in the CBA by evaluating both the variable soil cover thickness and concrete thickness across the area. In doing so we noticed that the soil cover was mistakenly double counted. At some point in the past the database was altered to adjust the sample depths in the CBA by an assumed uniform 2-foot cap thickness. The soil depths were then adjusted again last year as part of the evaluation for the OU2 BRA Memo. The evaluation has been revised (and is attached) after correcting for the mistaken double counting and to also include an adjustment for the concrete slabs. Attachment A provides details on this evaluation.

The soil Exposure Unit for the OU2 BRA is the area around the CBA that was excluded from the OU3 HHBRA. This area is slightly larger than the area where the soil cover was placed (see Figure A-1 of Attachment A). As can be seen in Figure A-2, the vast majority of the CBA is covered by some soil cover; however, we estimate that approximately 14% of the CBA Exposure Unit (on the borders) have less than one foot of cover soil. To address the concern over the limited number of historical samples that classify as surface soil, we plan to use the historical data that is currently located from the ground surface to 5 ft bgs (the "mixed soil" horizon) to represent both surface soil and the mixed soil zones. This is reasonable as we would not anticipate that the condition in the surface soil zone (0-2 ft bgs) would be significantly different from the mixed soil zone (0-5 ft bgs). This adjustment is also inherently conservative as it does not account for the presence of the clean soil cover that is placed over the majority of the exposure unit. Accordingly, the same COPCs will apply for all receptors being evaluated in the BRA.

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Response: See the OU3 RI Report (Appendix D) and the OU3 FS Report (Section 5) for how the evaluation was made with respect to the vadose zone. The only portion of the Site soil (and

thus the soil-to-groundwater leaching) not evaluated in OU3 is limited to the CBA footprint – thus this footprint remains to be evaluated with OU2. As for the condition below the high water-table horizon (site-wide including beneath the CBA footprint), the condition of the saturated soil will be evaluated in the RI/FS (not in the BRA) in terms of serving as a source for a dissolved-phase groundwater plume.

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Response: The updated COPC tables corrected for depth (included as Attachment B) show that there are 9 or more results for most VOC and SVOC constituents in the mixed soil horizon.

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Response: The text of the OU2 BRA Memo will be revised to clarify that the memo contains the inputs for the exposure assessment, but that the full exposure assessment will be completed in the BRA.

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Response: The text of the OU2 BRA Memo will be revised to include the following text in Section 1:

The HHBRA will be based upon the process presented in EPA Region 4 Guidance (EPA, 2018) with site-specific elements as presented in the HHBRA for OU3 (EPS, 2012). The HHBRA process includes the following elements:

- Data Collection and Evaluation including identifying Chemicals of Potential Concern ("COPCs");
- Exposure Assessment including identification of receptors and exposure factors;
- Toxicity Assessment including presentation of toxicity values;
- Risk Characterization including quantifying potential Excess Lifetime Cancer Risk ("ELCRs") and non-cancer hazards to receptors;
- Identifying Chemicals of Concern ("COCs") based on specific risk levels; and
- Developing site-specific remedial goals.

This TM delivers the results of the Data Collection and Evaluation and part of the Exposure Assessment. The Data Collection and Evaluation includes defining the data (site-wide groundwater and CBA soil) to be included in the HHBRA report and identification of COPC derived from screening of the data. An Exposure Assessment includes three elements: characterization of the exposure setting, identification of exposure pathways, and quantification of exposure. This TM provides the results of the first two elements (including presentation of Conceptual Site Models ("CSM") for groundwater and soil, and exposure factors to be used for each receptor and pathway), which provides the frame work for quantification of exposure that will be included in the HHBRA report.

EPA General Comment #8. *The Uncertainty Evaluation for COPCs presented in Section 3.4 is incomplete. Besides detection limits, consideration should also be given to uncertainties related to soil cover assumptions, data processing, and sample numbers/methods, as these items potentially impact the remainder of the risk assessment. Revise Section 3.4 of the OU2 BRA Memo to expand the uncertainty analysis to include uncertainties associated with other aspects of the data screening process, including those mentioned in this comment.*

Response: The text of the OU2 BRA Memo will be revised to include the following:

COPC Screening Process. Constituents were selected as COPCs based on comparisons between the maximum detected concentration and conservative risk-based screening criteria (i.e., USEPA residential RSLs). Both the use of the maximum concentrations and conservative screening values are an upper-bound representation of potential risk. A number of detected

constituents did not have an RSL. RSLs for toxicological "surrogates" for some of these constituents were used in the screening process. There were also a number of constituents with no or limited detected results, but for which more than 5% of the data records have analytical detection limits that exceed the relevant RSL values. These constituents could not be completely eliminated as COPC based on the detection limits and were identified as "Qualitative COPCs." There is also inherent uncertainty related to sample counts.

Environmental Sampling and Analysis. This risk assessment is based on the sampling results obtained from the various investigations at the property, often biased to locations of suspected contamination. Variability in sampling results can arise from various components including field sampling, laboratory analyses, and test methods. These elements are inherent in any long-term and complex site assessment such as involved with this Site, and are judged to have minimal impact on the overall assessment of risk.

Exposure Assumptions. The exposure assessment framework is based on a number of assumptions with varying degrees of uncertainty. Uncertainties can arise from the types of exposures examined, the points of potential human exposure, the concentrations of COPCs at the points of human exposure, and the intake assumptions. The selection of exposure pathways is a process, often based on best professional judgment that attempts to identify the most probable potentially harmful exposure scenarios. In the absence of a value for a particular exposure parameter, professional judgment based on site conditions will be used. Individuals can come into contact with chemicals via a number of different exposure routes. Standard default rates will be used for most exposures. These represent upper-bound values and provide reasonable maximum activity assumptions. The use of these standard default and upper-end values makes it likely that the risk is not underestimated, and may in fact be overestimated.

EPA General Comment #9. *Surrogate RSLs are not identified in the COPC selection tables, Tables 1, 2, 3 and 4. Revise these tables to include the constituents for which surrogate RSLs were assigned.*

Response: COPC selection tables have been revised and are included in Attachment B.

EPA General Comment #10. *It is customary in the Introduction to preview whether an ecological risk assessment will be performed for the Site. Revise the OU2 BRA Memo to include mention of whether an ecological risk assessment will be conducted. Additionally, state whether any previous risk assessments have been conducted at OU2, and if so, summarize the results.*

Response: The OU2 BRA Memo will be revised to clarify that an ecological risk assessment is not warranted for site-wide groundwater or the CBA portion of OU2. There is no reasonable ecological exposure to the groundwater condition and as for the CBA, the area is covered with clean fill soil to a thickness precluding ecological exposure.

EPA General Comment #11. *Section 2.0 Background is missing a description of the past and present Site operations. Without knowing the chemical processes and the type of manufacturing that was conducted at the LCP Chemicals facility, the selection of COPCs cannot be placed in the proper context, particularly if the eventual HHBRA will be a stand-alone document. Although currently shown in an abbreviated manner in Section 4.0, revise Section 1.0 of the OU2 BRA Memo to include descriptions of the Site operations, as well as a brief summary of the Site characterization mentioned in the Introduction. Alternatively, include a statement that the*

additional required background information will be included in the full Remedial Investigation Report.

Response: The text of the OU2 BRA Memo will be revised to state that additional information regarding past manufacturing operations will be included in the RI Report (the HHBRA will be a chapter of this report).

EPA General Comment #12. *Following on from Comment #5, the discussion of the receptor populations to be evaluated in the HHBRA lacks sufficient detail. For example, rationale to support selection of the receptor populations to be evaluated is not provided. Revise Section 4.3 of the OU2 BRA Memo to include more detailed discussion of how the receptor populations to be evaluated in the HHBRA were selected, citing applicable activity and land use assumptions.*

Response: The text of the OU2 BRA Memo will be revised to include additional details regarding receptors:

The risk assessment will consider five exposure scenarios: (1) Commercial/Industrial Worker (current/future scenario), (2) Excavation Worker (future scenario), (3) Trespasser (current scenario), (4) Trespasser (future scenario); and (5) Hypothetical Resident (future scenario). The Conceptual Site Models are included in Attachment C and the Exposure Factors and Equations are included in Attachment D. Some of the exposure assumptions (such as exposure frequencies and applicable soil depths) were selected to be consistent with the OU3 HHBRA. However, the majority of the intake factors (such as body weight and ingestion rates) were updated to reflect factors currently used in the EPA RSL calculations.

Industrial Worker Industrial Workers may potentially be exposed to surficial soil at the CBA, and vapor intrusion from groundwater into buildings that may be constructed in the future at the site. Exposures of Industrial Workers to impacted media are limited to surficial soil routes. For the purposes of the risk assessment, workers will be assumed to be exposed to surficial soil (defined here as 0 to 2 feet below ground surface (ft-bgs)) in the CBA, in the absence of any specific work gear (such as coveralls, gloves, etc.) other than commonly worn clothing. The current/future Industrial Worker scenario includes constituent exposure via incidental ingestion of and dermal contact with surface soil, and inhalation of particulates and vapors in air. In the future, buildings may be constructed at the site. As volatile constituents are present in groundwater at the site, vapor intrusion will be evaluated for future Industrial Workers using EPA's Vapor Intrusion Screening Level (VISL) Calculator.

Excavation Worker Excavation Workers may be potentially exposed to soil at the CBA and vapors emanating from groundwater. In the event that any surface or subsurface excavations were to occur at the site, future Excavation Workers potentially could come in contact with constituents in a "mixed soil" interval consisting of both surficial and subsurface soil (defined here as 0 to 5 ft-bgs). For the purposes of the risk assessment, Excavation Workers will be assumed to be exposed to soil in the absence of any specialized protective equipment or clothing other than commonly worn protective clothing. The Excavation Worker scenario includes potential exposure to constituents via ingestion, dermal contact, and inhalation of particulates and vapors potentially released from the soil during excavation activities. The Excavation Worker scenario will also include evaluation of inhalation of vapors that might accumulate in a trench excavation.

Trespasser Trespassers may potentially be exposed to surficial soil at the CBA. The entrance to the LCP Site and property line along Ross Road are gated and fenced. The north and south property lines are also fenced. Security measures at the site currently include personnel to prevent unauthorized entrance to the site. Access to the site is further restricted by the adjacent marsh. The soil cap on the surface of the CBA would limit the potential for exposure via ingestion, dermal contact, and inhalation. Nevertheless, the Trespasser scenario will conservatively evaluate potential exposure to COPCs via ingestion of and dermal contact with surficial soil, and inhalation of particulates and vapors in air. To mirror the OU3 HHBRA, separate risks for current and potential future trespassers will be calculated. These scenarios differ only with respect to the assumptions about the frequency with which trespassers might access the property. Under the current scenario, access is assumed to be limited by the security measures described above. Under the future scenario, the exposure frequency is increased, (conservatively) reflecting the possibility that site access might not be controlled as tightly in the future.

Hypothetical On-Site Resident Future use of the site is anticipated to remain largely commercial/industrial, although some portions of the site may be amenable to less restrictive future land use. Honeywell has no intention of converting any portion of the property to residential use, and this restriction will be recorded (i.e., deed restriction) in the event the property or portions thereof are sold in the future. It is common practice with any HHBRA to evaluate a scenario involving residential reuse of the site. However, the hypothetical future Resident risk characterization is useful as a conservative surrogate for virtually any type of unrestricted land use and as such, the analysis may be useful to future land planning for various sub-portions of the property. The Hypothetical Resident could be exposed to surficial soil in the CBA, groundwater at the site, and vapor intrusion from groundwater into future buildings constructed at the site. It is noted that Honeywell is developing a deed restriction (per the OU3 ROD) to preclude the potential for future residential use of the property, and to preclude use of groundwater on the property.

The Hypothetical Resident scenario conservatively evaluates potential exposure to COPCs via ingestion of and dermal contact with surficial soil, and inhalation of particulates and vapors in air. Exposure of Hypothetical Residents to groundwater via ingestion, dermal and inhalation exposure routes. Potential inhalation exposure to vapors in indoor air will also be evaluated using the EPA's VISL Calculator.

EPA General Comment #13. *There is no consideration of the potential for a vapor intrusion exposure scenario in a theoretical future onsite building structure. The fifth line of Section 4.5 Potential Exposure Pathways (Conceptual Site Model [CSM]) mentions inhalation of COPCs from groundwater as a complete exposure route, however, this suggests inhalation of VOCs from potable water use. Revise the HHBRA TM to include inhalation of VOCs via vapor intrusion as a separate, potentially complete exposure route for all receptors that are assumed to be present in an onsite building structure in the future (e.g., worker, resident).*

Response: Vapor intrusion exposure pathway will be added to the OU2 BRA memo. A revised CSM is included as Attachment C and as referenced above, the EPA's VISL Calculator and exposure factors presented in Attachment D will be used to calculate the risks of vapor intrusion to the Hypothetical Resident and Industrial Worker receptors.

EPA General Comment #14. *The Exposure Factors table on Page 10 is missing exposure parameters for the quantification of risks/hazards to Industrial workers and Trespassers. Although it is expected that the baseline residential case is conservative, and ultimately protective of less-exposed receptors, risk calculations should be performed for all receptors identified to be of concern. Revise the OU2 BRA Memo to add columns of variables pertinent to industrial workers and trespassers.*

Response: The Industrial Worker and Trespasser receptors will be added to the receptors. The CSMs and exposure factor table have been updated accordingly and are included in Attachment C and Attachment D.

EPA General Comment #15. *The Exposure Factors table refers to the receptor that will be evaluated quantitatively as a "Const Wkr" – construction worker. However, both throughout the text and on the CSMs, this receptor is referred to as an Excavation Worker. Revise the OU2 BRA Memo to standardize the name of this receptor and correct this discrepancy.*

Response: The OU2 BRA Memo will be updated to remove construction worker and only reference Excavation Worker receptors.

EPA General Comment #16. *Exposure equations detailing the calculation of daily intake are not provided for review. Revise Section 4.8 of the OU2 BRA Memo to provide the equations that will be used and/or the source of the equations, and include the symbols cited in the exposure factors table.*

Response: The OU2 BRA Memo states that the equations used by EPA for calculating RSL values will be used for calculation of daily doses. However, for clarity the equations themselves will be included in the revised memo, and are included as Attachment D.

EPA General Comment #17. *The designations on the CSM in Figure 6, Human Health Conceptual Site Model – OU2 Groundwater, are confusing and inappropriate. Although theoretically incomplete, the groundwater pathways are complete for the purposes of this HHBRA. Revise Figure 6 to remove, "Indicates incomplete pathways that are still being evaluated quantitatively" and designate all groundwater pathways as either potentially complete or incomplete.*

Response: This statement has been removed from the CSM - Figure 6 (see Attachment C).

EPA General Comment #18. *Following on from a comment above, Figure 6, Human Health Conceptual Site Model – OU2 Groundwater is missing construction (excavation) workers, who could be exposed to VOCs via inhalation in a trench. Revise Figure 6 to include construction (excavation) workers as future receptors for site groundwater.*

Response: A revised CSM is included as Attachment C.

SPECIFIC COMMENTS

EPA Specific Comment #1. *Section 4.3.1, pg 8, second paragraph, sentence 3 through the end of this paragraph: "The Site is currently zoned Basic Industrial...HHBRA will be based on*

unrestricted groundwater use (i.e., residential potable use) per EPA Guidance (EPA, 2018)...serves as a conservative baseline evaluation of theoretical residential risk." This text paints a picture that the assessment of residential use of the groundwater is being assessed only due to very conservative guidance from EPA Region 4. In fact, this requirement for assessment of the groundwater is primarily based on the National Contingency Plan (EPA-FR 1990: "EPA expects to return usable ground waters to their beneficial uses wherever practicable...") as well as on the EPA National Risk Assessment Guidance (EPA 1989, 2010). Hence this text should be revised to reflect this wider scope of the need for protection/restoration of groundwater. The following text would be more appropriate: "Based on the current zoning for the site (Basic Industrial), as well as on Decision Documents EPA has issued for OU1 and OU3, it is not anticipated that the Site property will be developed as residential. EPA, however, always considers the potential use of the groundwater as a separate decision from the land use of the property itself. Since the state considers the groundwater underlying this site to be a source of potable water, EPA must then assess the groundwater as a potential source of residential drinking water. Accordingly, the OU2 groundwater is being assessed in a hypothetical future scenario assuming residential use of the water. The estimated scenario-specific health risks, together with health-based drinking water standards, will serve to determine if groundwater remediation needs to be considered, and if institutional control measures need to be implemented until the health protective concentrations are achieved."

Response: The OU2 BRA Memo will be revised to include the following: Based on the current zoning for the site (Basic Industrial), as well as on Record of Decision documents EPA has issued for OU1 and OU3, the Site property will be not be developed as residential. However, the HHBRA will assess groundwater as a potential source of residential drinking water.

EPA Specific Comment #2. *Section 4.3.2, assessment of exposure to soil in the CBA: "...the HHBRA will be assess restricted and unrestricted use (i.e., residential exposure) per EPA Guidance..." For correctness and clarity, this text should be revised to read: "...the HHBRA will also assess restricted use (i.e., industrial onsite worker exposure) and unrestricted use (i.e., residential exposure) per EPA Guidance..."*

Response: The OU2 BRA Memo will be revised per the EPA's comment.

EPA Specific Comment #3. *Section 4.6, Table of Exposure Factors on pg 10. The receptors and the exposure factors listed in this table are incomplete and ambiguous. For the residential exposure scenario, the receptors should be "Residential Child" and "Residential Adult". This table should also include exposure factors separately for the other receptors shown in the Conceptual Site Models (Figures 6 & 7)- i.e., the "Adult Industrial Worker" and the "Trespasser". The specific age-span and the exposure frequency of the assumed Trespasser should be clearly defined/explained.*

Response: The exposure factor table has been updated accordingly and is included as Attachment D. The OU2 BRA memo will be updated to provide more information on all the receptors. The trespasser will be evaluated as it was in the OU3 HHBRA, which assumes an adolescent trespasser (per EPA Region 4 guidance, aged 7-16) under current (restricted access) and future (less restricted access) scenarios. Exposure frequencies of 24 days/year and 52 days/year will be used for the current and future scenarios (respectively), which is consistent with the HHBRA for OU3.

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- Risk Characterization including quantifying potential Excess Lifetime Cancer Risk ("ELCRs") and non-cancer hazards to receptors;
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- Developing site-specific remedial goals.

This TM delivers the results of the Data Collection and Evaluation and part of the Exposure Assessment. The Data Collection and Evaluation includes defining the data (site-wide groundwater and CBA soil) to be included in the HHBRA report and identification of COPC derived from screening of the data. An Exposure Assessment includes three elements: characterization of the exposure setting, identification of exposure pathways, and quantification of exposure. This TM provides the results of the first two elements (including presentation of Conceptual Site Models ("CSM") for groundwater and soil, and exposure factors to be used for each receptor and pathway), which provides the frame work for quantification of exposure that will be included in the HHBRA report.

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COPC Screening Process. Constituents were selected as COPCs based on comparisons between the maximum detected concentration and conservative risk-based screening criteria (i.e., USEPA residential RSLs). Both the use of the maximum concentrations and conservative screening values are an upper-bound representation of potential risk. A number of detected

constituents did not have an RSL. RSLs for toxicological "surrogates" for some of these constituents were used in the screening process. There were also a number of constituents with no or limited detected results, but for which more than 5% of the data records have analytical detection limits that exceed the relevant RSL values. These constituents could not be completely eliminated as COPC based on the detection limits and were identified as "Qualitative COPCs." There is also inherent uncertainty related to sample counts.

Environmental Sampling and Analysis. This risk assessment is based on the sampling results obtained from the various investigations at the property, often biased to locations of suspected contamination. Variability in sampling results can arise from various components including field sampling, laboratory analyses, and test methods. These elements are inherent in any long-term and complex site assessment such as involved with this Site, and are judged to have minimal impact on the overall assessment of risk.

Exposure Assumptions. The exposure assessment framework is based on a number of assumptions with varying degrees of uncertainty. Uncertainties can arise from the types of exposures examined, the points of potential human exposure, the concentrations of COPCs at the points of human exposure, and the intake assumptions. The selection of exposure pathways is a process, often based on best professional judgment that attempts to identify the most probable potentially harmful exposure scenarios. In the absence of a value for a particular exposure parameter, professional judgment based on site conditions will be used. Individuals can come into contact with chemicals via a number of different exposure routes. Standard default rates will be used for most exposures. These represent upper-bound values and provide reasonable maximum activity assumptions. The use of these standard default and upper-end values makes it likely that the risk is not underestimated, and may in fact be overestimated.

EPA General Comment #9. *Surrogate RSLs are not identified in the COPC selection tables, Tables 1, 2, 3 and 4. Revise these tables to include the constituents for which surrogate RSLs were assigned.*

Response: COPC selection tables have been revised and are included in Attachment B.

EPA General Comment #10. *It is customary in the Introduction to preview whether an ecological risk assessment will be performed for the Site. Revise the OU2 BRA Memo to include mention of whether an ecological risk assessment will be conducted. Additionally, state whether any previous risk assessments have been conducted at OU2, and if so, summarize the results.*

Response: The OU2 BRA Memo will be revised to clarify that an ecological risk assessment is not warranted for site-wide groundwater or the CBA portion of OU2. There is no reasonable ecological exposure to the groundwater condition and as for the CBA, the area is covered with clean fill soil to a thickness precluding ecological exposure.

EPA General Comment #11. *Section 2.0 Background is missing a description of the past and present Site operations. Without knowing the chemical processes and the type of manufacturing that was conducted at the LCP Chemicals facility, the selection of COPCs cannot be placed in the proper context, particularly if the eventual HHBRA will be a stand-alone document. Although currently shown in an abbreviated manner in Section 4.0, revise Section 1.0 of the OU2 BRA Memo to include descriptions of the Site operations, as well as a brief summary of the Site characterization mentioned in the Introduction. Alternatively, include a statement that the*

additional required background information will be included in the full Remedial Investigation Report.

Response: The text of the OU2 BRA Memo will be revised to state that additional information regarding past manufacturing operations will be included in the RI Report (the HHBRA will be a chapter of this report).

EPA General Comment #12. *Following on from Comment #5, the discussion of the receptor populations to be evaluated in the HHBRA lacks sufficient detail. For example, rationale to support selection of the receptor populations to be evaluated is not provided. Revise Section 4.3 of the OU2 BRA Memo to include more detailed discussion of how the receptor populations to be evaluated in the HHBRA were selected, citing applicable activity and land use assumptions.*

Response: The text of the OU2 BRA Memo will be revised to include additional details regarding receptors:

The risk assessment will consider five exposure scenarios: (1) Commercial/Industrial Worker (current/future scenario), (2) Excavation Worker (future scenario), (3) Trespasser (current scenario), (4) Trespasser (future scenario); and (5) Hypothetical Resident (future scenario). The Conceptual Site Models are included in Attachment C and the Exposure Factors and Equations are included in Attachment D. Some of the exposure assumptions (such as exposure frequencies and applicable soil depths) were selected to be consistent with the OU3 HHBRA. However, the majority of the intake factors (such as body weight and ingestion rates) were updated to reflect factors currently used in the EPA RSL calculations.

Industrial Worker Industrial Workers may potentially be exposed to surficial soil at the CBA, and vapor intrusion from groundwater into buildings that may be constructed in the future at the site. Exposures of Industrial Workers to impacted media are limited to surficial soil routes. For the purposes of the risk assessment, workers will be assumed to be exposed to surficial soil (defined here as 0 to 2 feet below ground surface (ft-bgs)) in the CBA, in the absence of any specific work gear (such as coveralls, gloves, etc.) other than commonly worn clothing. The current/future Industrial Worker scenario includes constituent exposure via incidental ingestion of and dermal contact with surface soil, and inhalation of particulates and vapors in air. In the future, buildings may be constructed at the site. As volatile constituents are present in groundwater at the site, vapor intrusion will be evaluated for future Industrial Workers using EPA's Vapor Intrusion Screening Level (VISL) Calculator.

Excavation Worker Excavation Workers may be potentially exposed to soil at the CBA and vapors emanating from groundwater. In the event that any surface or subsurface excavations were to occur at the site, future Excavation Workers potentially could come in contact with constituents in a "mixed soil" interval consisting of both surficial and subsurface soil (defined here as 0 to 5 ft-bgs). For the purposes of the risk assessment, Excavation Workers will be assumed to be exposed to soil in the absence of any specialized protective equipment or clothing other than commonly worn protective clothing. The Excavation Worker scenario includes potential exposure to constituents via ingestion, dermal contact, and inhalation of particulates and vapors potentially released from the soil during excavation activities. The Excavation Worker scenario will also include evaluation of inhalation of vapors that might accumulate in a trench excavation.

Trespasser Trespassers may potentially be exposed to surficial soil at the CBA. The entrance to the LCP Site and property line along Ross Road are gated and fenced. The north and south property lines are also fenced. Security measures at the site currently include personnel to prevent unauthorized entrance to the site. Access to the site is further restricted by the adjacent marsh. The soil cap on the surface of the CBA would limit the potential for exposure via ingestion, dermal contact, and inhalation. Nevertheless, the Trespasser scenario will conservatively evaluate potential exposure to COPCs via ingestion of and dermal contact with surficial soil, and inhalation of particulates and vapors in air. To mirror the OU3 HHBRA, separate risks for current and potential future trespassers will be calculated. These scenarios differ only with respect to the assumptions about the frequency with which trespassers might access the property. Under the current scenario, access is assumed to be limited by the security measures described above. Under the future scenario, the exposure frequency is increased, (conservatively) reflecting the possibility that site access might not be controlled as tightly in the future.

Hypothetical On-Site Resident Future use of the site is anticipated to remain largely commercial/industrial, although some portions of the site may be amenable to less restrictive future land use. Honeywell has no intention of converting any portion of the property to residential use, and this restriction will be recorded (i.e., deed restriction) in the event the property or portions thereof are sold in the future. It is common practice with any HHBRA to evaluate a scenario involving residential reuse of the site. However, the hypothetical future Resident risk characterization is useful as a conservative surrogate for virtually any type of unrestricted land use and as such, the analysis may be useful to future land planning for various sub-portions of the property. The Hypothetical Resident could be exposed to surficial soil in the CBA, groundwater at the site, and vapor intrusion from groundwater into future buildings constructed at the site. It is noted that Honeywell is developing a deed restriction (per the OU3 ROD) to preclude the potential for future residential use of the property, and to preclude use of groundwater on the property.

The Hypothetical Resident scenario conservatively evaluates potential exposure to COPCs via ingestion of and dermal contact with surficial soil, and inhalation of particulates and vapors in air. Exposure of Hypothetical Residents to groundwater via ingestion, dermal and inhalation exposure routes. Potential inhalation exposure to vapors in indoor air will also be evaluated using the EPA's VISL Calculator.

EPA General Comment #13. *There is no consideration of the potential for a vapor intrusion exposure scenario in a theoretical future onsite building structure. The fifth line of Section 4.5 Potential Exposure Pathways (Conceptual Site Model [CSM]) mentions inhalation of COPCs from groundwater as a complete exposure route, however, this suggests inhalation of VOCs from potable water use. Revise the HHBRA TM to include inhalation of VOCs via vapor intrusion as a separate, potentially complete exposure route for all receptors that are assumed to be present in an onsite building structure in the future (e.g., worker, resident).*

Response: Vapor intrusion exposure pathway will be added to the OU2 BRA memo. A revised CSM is included as Attachment C and as referenced above, the EPA's VISL Calculator and exposure factors presented in Attachment D will be used to calculate the risks of vapor intrusion to the Hypothetical Resident and Industrial Worker receptors.

EPA General Comment #14. *The Exposure Factors table on Page 10 is missing exposure parameters for the quantification of risks/hazards to Industrial workers and Trespassers. Although it is expected that the baseline residential case is conservative, and ultimately protective of less-exposed receptors, risk calculations should be performed for all receptors identified to be of concern. Revise the OU2 BRA Memo to add columns of variables pertinent to industrial workers and trespassers.*

Response: The Industrial Worker and Trespasser receptors will be added to the receptors. The CSMs and exposure factor table have been updated accordingly and are included in Attachment C and Attachment D.

EPA General Comment #15. *The Exposure Factors table refers to the receptor that will be evaluated quantitatively as a "Const Wkr" – construction worker. However, both throughout the text and on the CSMs, this receptor is referred to as an Excavation Worker. Revise the OU2 BRA Memo to standardize the name of this receptor and correct this discrepancy.*

Response: The OU2 BRA Memo will be updated to remove construction worker and only reference Excavation Worker receptors.

EPA General Comment #16. *Exposure equations detailing the calculation of daily intake are not provided for review. Revise Section 4.8 of the OU2 BRA Memo to provide the equations that will be used and/or the source of the equations, and include the symbols cited in the exposure factors table.*

Response: The OU2 BRA Memo states that the equations used by EPA for calculating RSL values will be used for calculation of daily doses. However, for clarity the equations themselves will be included in the revised memo, and are included as Attachment D.

EPA General Comment #17. *The designations on the CSM in Figure 6, Human Health Conceptual Site Model – OU2 Groundwater, are confusing and inappropriate. Although theoretically incomplete, the groundwater pathways are complete for the purposes of this HHBRA. Revise Figure 6 to remove, "Indicates incomplete pathways that are still being evaluated quantitatively" and designate all groundwater pathways as either potentially complete or incomplete.*

Response: This statement has been removed from the CSM - Figure 6 (see Attachment C).

EPA General Comment #18. *Following on from a comment above, Figure 6, Human Health Conceptual Site Model – OU2 Groundwater is missing construction (excavation) workers, who could be exposed to VOCs via inhalation in a trench. Revise Figure 6 to include construction (excavation) workers as future receptors for site groundwater.*

Response: A revised CSM is included as Attachment C.

SPECIFIC COMMENTS

EPA Specific Comment #1. *Section 4.3.1, pg 8, second paragraph, sentence 3 through the end of this paragraph: "The Site is currently zoned Basic Industrial...HHBRA will be based on*

unrestricted groundwater use (i.e., residential potable use) per EPA Guidance (EPA, 2018)...serves as a conservative baseline evaluation of theoretical residential risk." This text paints a picture that the assessment of residential use of the groundwater is being assessed only due to very conservative guidance from EPA Region 4. In fact, this requirement for assessment of the groundwater is primarily based on the National Contingency Plan (EPA-FR 1990: "EPA expects to return usable ground waters to their beneficial uses wherever practicable...") as well as on the EPA National Risk Assessment Guidance (EPA 1989, 2010). Hence this text should be revised to reflect this wider scope of the need for protection/restoration of groundwater. The following text would be more appropriate: "Based on the current zoning for the site (Basic Industrial), as well as on Decision Documents EPA has issued for OU1 and OU3, it is not anticipated that the Site property will be developed as residential. EPA, however, always considers the potential use of the groundwater as a separate decision from the land use of the property itself. Since the state considers the groundwater underlying this site to be a source of potable water, EPA must then assess the groundwater as a potential source of residential drinking water. Accordingly, the OU2 groundwater is being assessed in a hypothetical future scenario assuming residential use of the water. The estimated scenario-specific health risks, together with health-based drinking water standards, will serve to determine if groundwater remediation needs to be considered, and if institutional control measures need to be implemented until the health protective concentrations are achieved."

Response: The OU2 BRA Memo will be revised to include the following: Based on the current zoning for the site (Basic Industrial), as well as on Record of Decision documents EPA has issued for OU1 and OU3, the Site property will be not be developed as residential. However, the HHBRA will assess groundwater as a potential source of residential drinking water.

EPA Specific Comment #2. *Section 4.3.2, assessment of exposure to soil in the CBA: "...the HHBRA will be assess restricted and unrestricted use (i.e., residential exposure) per EPA Guidance..." For correctness and clarity, this text should be revised to read: "...the HHBRA will also assess restricted use (i.e., industrial onsite worker exposure) and unrestricted use (i.e., residential exposure) per EPA Guidance..."*

Response: The OU2 BRA Memo will be revised per the EPA's comment.

EPA Specific Comment #3. *Section 4.6, Table of Exposure Factors on pg 10. The receptors and the exposure factors listed in this table are incomplete and ambiguous. For the residential exposure scenario, the receptors should be "Residential Child" and "Residential Adult". This table should also include exposure factors separately for the other receptors shown in the Conceptual Site Models (Figures 6 & 7)- i.e., the "Adult Industrial Worker" and the "Trespasser". The specific age-span and the exposure frequency of the assumed Trespasser should be clearly defined/explained.*

Response: The exposure factor table has been updated accordingly and is included as Attachment D. The OU2 BRA memo will be updated to provide more information on all the receptors. The trespasser will be evaluated as it was in the OU3 HHBRA, which assumes an adolescent trespasser (per EPA Region 4 guidance, aged 7-16) under current (restricted access) and future (less restricted access) scenarios. Exposure frequencies of 24 days/year and 52 days/year will be used for the current and future scenarios (respectively), which is consistent with the HHBRA for OU3.

EPA Specific Comment #4. *Tables 1 & 2, groundwater COPC selection. Units of "mg/kg (milligrams per kilogram)" are shown on these tables. Units for groundwater concentration should be mass of contaminant per volume of water (i.e., mg/L or µg/L). The RSL and MCL values listed in these tables indicate that the RSL and MCL values are in µg/L units. Please correct the units stated on the table and verify that the contaminant concentration data are in the same units as the RSL and MCL values.*

Response: Revised COPC tables are included in Attachment B.

EPA Specific Comment #5. *Tables 1 & 2, groundwater COPC selection, screening of chromium. No RSL is listed here for chromium in groundwater. There are recommended EPA RSLs for trivalent chromium (Cr+3) and hexavalent chromium (Cr+6) in tap water. If no speciation of groundwater samples has been performed to determine the concentration of Cr+6, then the total chromium concentration should all be assumed to be Cr+6 for screening and assessment of groundwater (with appropriate discussion in the uncertainty section of the HHBRA regarding the uncertainty of the quantity of each form of chromium as well as the uncertainty about whether ingested chromium is carcinogenic). If this assumption results in chromium posing unacceptable health risks, speciation analysis is recommended to determine the concentration of Cr+6 in site groundwater so that the risks can be more accurately assessed.*

Response: The RSL for chromium was inadvertently left off the original COPC tables. The revised tables use the CrIII and the CrVI RSLs. Hexavalent chromium was tested in the 2012 site-wide groundwater sampling event in 18 monitoring wells (selected by the EPA), with 3 wells reporting detections: MW-504B reporting 81 ppb CrVI with 1090 ppb total Cr; MW-504B reporting 112 ppb CrVI with 1340 ppb total Cr; and MW-510B reporting 41 ppb CrVI with 1690 ppb total Cr (i.e., results ranging from 2-8% CrVI to Cr (total) where detections occurred). The COPC tables utilize the 2012 results for comparison to the hexavalent chromium RSL.

EPA Specific Comment #6. *Tables 3 & 4, CBA soil COPC selection, screening of chromium. The RSL listed for chromium in these tables is for Cr+6 in residential soil. This RSL is appropriate to use for screening of total chromium if no speciation of soil samples has been performed to determine the concentration of Cr+6. As discussed in the previous comment, if the assumption of total soil chromium all being in the Cr+6 form results in Chromium posing unacceptable health risks, speciation analysis is recommended to determine the concentration of Cr+6 in site soil.*

Response: The COPC table now includes a comparison of total chromium results to both CrIII and CrVI RSLs. No speciation has been performed on site soil.

EPA Specific Comment #7. *Section 4.3.1 Groundwater. Please define/explain the word "clean" in the first paragraph, sixth line.*

Response: Prior sampling of local residential water supply wells by the EPA (during the removal action) shows all results meet health-based criteria (e.g., MCLs) and exhibited no indication of Site-related influence (a conclusion reached by the EPA OSCs who oversaw the sampling activity).

Comments Provided by Georgia Environmental Protection Division (EPD)

EPD Comment #1) **Section 3.2.2: CBA Subsurface** *This Section mentions that a mixed soil depth of 0-5 feet below ground surface (ft bgs) will be evaluated. Since there are more detections from 2-5 ft bgs than in the 0-2 ft bgs interval, there is a concern that combining surface soil and subsurface soil to evaluate mixed soil will dilute the mixed soil exposure point concentration (EPC). Section 2.21 of EPA's Region 4 Human Health Risk Assessment Supplemental Guidance [R4HHRA] indicates that surface and subsurface soil (which the guidance states is typically "from the bottom of the defined depth of surface soil up to 10 feet below land surface") should be evaluated as separate media. Please justify evaluating mixed soil and/or provide correspondence where this was previously approved by EPA and EPD. If not, please evaluate surface and subsurface soil as separate media in the HHBRA.*

Response: The soil data will be treated the same as it was in the approved OU3 HHBRA. Specifically, surface soil is the 0-2 ft-bgs interval and mixed soil for the Excavation Worker is the 0-5 ft-bgs interval. A 0-5 ft-bgs interval is appropriate for an Excavation Worker as they would be exposed to soil within this entire interval, not just the 2-5 ft-bgs interval.

EPD Comment #2) **Section 3.4: Uncertainty Evaluation for COPCs** *The Memo mentions that a "designation of Potential COPC ("PCOPC") is given to constituents that were not detected, but had more than 5% of detection limits greater than the screening level". The designation of "PCOPCs" does not conform to the recommended constituent of potential concern (COPC) selection procedures outlined in Section 2.6 of EPA's Region 4 Human Health Risk Assessment Supplemental Guidance [R4HHRA]. Also, since the HHBRA indicates that PCOPCs will be evaluated in the risk assessment, referring to constituents as PCOPCs adds unnecessary confusion given that the term "COPCs" already refers to all constituents that are further evaluated in a risk assessment. To address this comment, please label all PCOPCs as COPCs and evaluate all COPCs in the risk assessment.*

Response: The COPC tables have been revised and are included in Attachment B where the designation has been changed from PCOPC to qualitative COPCs to be consistent with the OU3 HHBRA.

EPD Comment #3) **Section 4.3.2: CBA Subsurface Receptors and Exposure** *The Memo discusses control of exposures; "...subsurface disturbance of the CBA will be prohibited and limited to minor reworking of the soil cover or addition of hardscape surface (e.g., parking or surface storage)". However, the presence of free-product mercury in the CBA will not only result in physical exposures; leaching to groundwater must also be considered.*

Response: Free product mercury occurs in the saturated zone (i.e., within the aquifer matrix) beneath portions of the remaining cell building slabs. It will be evaluated in the OU2 RI/FS in terms of its product solubility as related to serving as a potential source for dissolved-phase mercury in groundwater. This is not the same as soil-to-groundwater leaching, and its inclusion in the HHBRA is not appropriate (as the resultant groundwater condition is already being evaluated in the HHBRA).

EPD Comment #4) **Section 4.6: Exposure Parameters** *The Memo indicates that central tendency exposure (CTE) will be evaluated in the HHBRA along with reasonable maximum exposure (RME). Since remedial decisions will only be made on RME, it is recommended that the CTE evaluation not be included in the HHBRA to reduce any confusion*

that may result. If the HHBRA will include a CTE evaluation, please place the evaluation into a separate section and explicitly mention in the text that remedial decisions will only be made based on RME.

Response: A CTE evaluation is standard practice in superfund site risk assessments and furthermore, it was conducted in the OU3 HHBRA. Thus, we respectfully request its inclusion in the OU2/CBA risk assessment for sake of completeness and consistency with OU3.

EPD Comment #5) Section 4.7.3: Groundwater EPC

a) *There are concerns with the proposed approach for determining groundwater exposure point concentrations (EPCs). The RPs correctly cite EPA's Determining Groundwater Exposure Point Concentrations [GWEPC][1] when stating that EPCs should be calculated using data from groundwater wells located within the core of the plume. However, page 6 of [GWEPC] also states that "assessors need adequate characterization of the entire plume to be able to identify the core of the plume". Section 4.7.3 does not discuss if and how the plume will be characterized. Also, Section 4.2.1 of the Memo states that there is contaminant leakage from the Satilla Formation into the Ebenezer Formation and that the latter Formation has a high degree of concentration attenuation. If so, it may not be appropriate to aggregate four years of sampling results since older results may not represent current site conditions. Please address these concerns by providing additional information in the Section. Please note that if site and data considerations preclude deriving a groundwater EPC based on the upper confidence limit of the arithmetic mean (i.e. 95% UCL), [GWEPC] provides for using the maximum detected concentration as the EPC.*

Response: It is unclear what the comment desires in terms of providing "additional information" in the Tech Memo. We speculate the reviewer desires an evaluation of the existing site characterization data set in order to derive to region of the 'plume core', a concept which lacks a precise definition. A site such as LCP with a complex and geographically-diverse groundwater COC condition does not lend itself to the concept of a 'plume core'. Thus, we propose to use a cumulative point (well) risk analysis to identify the area (separate assessments will be done for the Satilla Fm and Ebenezer Fm zones) posing the highest risk, from which a group of wells will be identified to quantify the EPCs.

b) *The Memo mentions that the [GWEPC] expresses a preference for using data from two sampling events from the previous year to calculate the EPC. Furthermore, the Memo discusses that systematic monitoring was not conducted and the most recent available data is from 2017. Consistent with the [GWEPC] guidance's inclination to use data from the previous year, will provision be made for the collection of more recent samples? Bullets in this section also state that samples will be used from the 2017 to 2020 time period, please clarify or revise, as sampling from 2017 was used and mentioning samples post-2017 can lead to further confusion.*

Response: Further clarification on what data will be used in the HHBRA will be provided in the OU2 BRA Memo. The dataset used in the Site Characterization Summary Report was the most recent time an individual constituent was sampled in each well. This same dataset was used for the groundwater COPC screening. The data to be used for groundwater EPC calculations will be

[1] [GWEPC] = United States, United States Environmental Protection Agency, Office of Solid Waste and Emergency Response. (2014, February). *Memorandum for Determining Groundwater Exposure Point Concentrations, Supplemental Guidance* (OSWER Directive 9283.1-42). Retrieved from https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=236917

based upon this same dataset and the plume evaluation discussed in the response to the previous comment. We have no intentions of conducting further sampling in support of the RI (and HHBRA) – a position that we believed was reached with the agencies' approval of the Site Characterization Summary Report.

EPD Comment #6) **Figure 5: Area Water Wells** *Please incorporate on-site production wells on Figure 5 showing the Area Water Wells.*

Response: Figure 5 will be revised to include the two remaining on-site water wells.

EPD Comment #7) **Figure 6: Conceptual Site Model – OU2 Groundwater** *The conceptual site model (CSM) only evaluates the inhalation/ingestion/dermal contact of groundwater for the hypothetical resident. Since industrial and excavation workers are expected to be present at the facility, please modify the CSM so that industrial worker and excavation worker inhalation/ingestion/dermal contact exposure to groundwater is evaluated.*

Response: Exposure of Excavation Workers to vapors emanating from groundwater to a trench will be evaluated in the HHBRA as shown in the CSM in Attachment C. Respectfully, we do not intend to include groundwater exposure to Industrial Workers. Honeywell is actively developing a deed restriction (per the OU3 ROD) to preclude use of groundwater on the property.

EPD Comment #8) **Tables 3 and 4: Cell Building Area (CBA) Soil COPCs Selection** *The Tables show that for both semi-volatile organic compounds (SVOCs) and volatile organic compounds (VOCs), there is only one surface soil sample and generally less than five mixed soil samples. This is not sufficient characterization of SVOCs and VOCs and is of concern given that several SVOCs and VOCs are being eliminated as COPCs based on the results of one sample; see #2a re FOD above. Section 4.2.2 indicates that polycyclic aromatic hydrocarbons (PAHs) are "ubiquitous throughout the CBA study area" and that there is a "probable petroleum smear zone caused by historical water table fluctuation" which indicates that both SVOCs and VOCs are of concern at the CBA. To ensure that there is enough information to adequately characterize the risks from SVOCs and VOCs exposure in soil, please provide a plan for further characterization (e.g. collecting more samples) of soil SVOCs and VOCs.*

Response: As described above, the appropriate depths of historical samples have been re-adjusted to reflect the current condition. This is discussed more fully in Attachment A. Revised COPC tables are included in Attachment B. Using this dataset, additional sampling is not necessary as there is sufficient data for conducting the HHBRA. PAHs were analyzed in 13 samples and most other SVOCs and VOCs were analyzed in 9 or more samples.

EPD Comment #9) **Executive Summary** *Editorial consideration – please close the parenthesis after the RAGS citation in the last sentence of the Executive Summary opening paragraph.*

Response: The OU2 BRA Memo will be revised per the EPD's comment.

Attachments:

A CBA Dataset
B COPC Tables
C Conceptual Site Models
D Exposure Factors and Equations

Comments Provided by Georgia Environmental Protection Division (EPD)

EPD Comment #1) **Section 3.2.2: CBA Subsurface** *This Section mentions that a mixed soil depth of 0-5 feet below ground surface (ft bgs) will be evaluated. Since there are more detections from 2-5 ft bgs than in the 0-2 ft bgs interval, there is a concern that combining surface soil and subsurface soil to evaluate mixed soil will dilute the mixed soil exposure point concentration (EPC). Section 2.21 of EPA's Region 4 Human Health Risk Assessment Supplemental Guidance [R4HHRA] indicates that surface and subsurface soil (which the guidance states is typically "from the bottom of the defined depth of surface soil up to 10 feet below land surface") should be evaluated as separate media. Please justify evaluating mixed soil and/or provide correspondence where this was previously approved by EPA and EPD. If not, please evaluate surface and subsurface soil as separate media in the HHBRA.*

Response: The soil data will be treated the same as it was in the approved OU3 HHBRA. Specifically, surface soil is the 0-2 ft-bgs interval and mixed soil for the Excavation Worker is the 0-5 ft-bgs interval. A 0-5 ft-bgs interval is appropriate for an Excavation Worker as they would be exposed to soil within this entire interval, not just the 2-5 ft-bgs interval.

EPD Comment #2) **Section 3.4: Uncertainty Evaluation for COPCs** *The Memo mentions that a "designation of Potential COPC ("PCOPC") is given to constituents that were not detected, but had more than 5% of detection limits greater than the screening level". The designation of "PCOPCs" does not conform to the recommended constituent of potential concern (COPC) selection procedures outlined in Section 2.6 of EPA's Region 4 Human Health Risk Assessment Supplemental Guidance [R4HHRA]. Also, since the HHBRA indicates that PCOPCs will be evaluated in the risk assessment, referring to constituents as PCOPCs adds unnecessary confusion given that the term "COPCs" already refers to all constituents that are further evaluated in a risk assessment. To address this comment, please label all PCOPCs as COPCs and evaluate all COPCs in the risk assessment.*

Response: The COPC tables have been revised and are included in Attachment B where the designation has been changed from PCOPC to qualitative COPCs to be consistent with the OU3 HHBRA.

EPD Comment #3) **Section 4.3.2: CBA Subsurface Receptors and Exposure** *The Memo discusses control of exposures; "...subsurface disturbance of the CBA will be prohibited and limited to minor reworking of the soil cover or addition of hardscape surface (e.g., parking or surface storage)". However, the presence of free-product mercury in the CBA will not only result in physical exposures; leaching to groundwater must also be considered.*

Response: Free product mercury occurs in the saturated zone (i.e., within the aquifer matrix) beneath portions of the remaining cell building slabs. It will be evaluated in the OU2 RI/FS in terms of its product solubility as related to serving as a potential source for dissolved-phase mercury in groundwater. This is not the same as soil-to-groundwater leaching, and its inclusion in the HHBRA is not appropriate (as the resultant groundwater condition is already being evaluated in the HHBRA).

EPD Comment #4) **Section 4.6: Exposure Parameters** *The Memo indicates that central tendency exposure (CTE) will be evaluated in the HHBRA along with reasonable maximum exposure (RME). Since remedial decisions will only be made on RME, it is recommended that the CTE evaluation not be included in the HHBRA to reduce any confusion*

that may result. If the HHBRA will include a CTE evaluation, please place the evaluation into a separate section and explicitly mention in the text that remedial decisions will only be made based on RME.

Response: A CTE evaluation is standard practice in superfund site risk assessments and furthermore, it was conducted in the OU3 HHBRA. Thus, we respectfully request its inclusion in the OU2/CBA risk assessment for sake of completeness and consistency with OU3.

EPD Comment #5) Section 4.7.3: Groundwater EPC

a) *There are concerns with the proposed approach for determining groundwater exposure point concentrations (EPCs). The RPs correctly cite EPA's Determining Groundwater Exposure Point Concentrations [GWEPC][1] when stating that EPCs should be calculated using data from groundwater wells located within the core of the plume. However, page 6 of [GWEPC] also states that "assessors need adequate characterization of the entire plume to be able to identify the core of the plume". Section 4.7.3 does not discuss if and how the plume will be characterized. Also, Section 4.2.1 of the Memo states that there is contaminant leakage from the Satilla Formation into the Ebenezer Formation and that the latter Formation has a high degree of concentration attenuation. If so, it may not be appropriate to aggregate four years of sampling results since older results may not represent current site conditions. Please address these concerns by providing additional information in the Section. Please note that if site and data considerations preclude deriving a groundwater EPC based on the upper confidence limit of the arithmetic mean (i.e. 95% UCL), [GWEPC] provides for using the maximum detected concentration as the EPC.*

Response: It is unclear what the comment desires in terms of providing "additional information" in the Tech Memo. We speculate the reviewer desires an evaluation of the existing site characterization data set in order to derive to region of the 'plume core', a concept which lacks a precise definition. A site such as LCP with a complex and geographically-diverse groundwater COC condition does not lend itself to the concept of a 'plume core'. Thus, we propose to use a cumulative point (well) risk analysis to identify the area (separate assessments will be done for the Satilla Fm and Ebenezer Fm zones) posing the highest risk, from which a group of wells will be identified to quantify the EPCs.

b) *The Memo mentions that the [GWEPC] expresses a preference for using data from two sampling events from the previous year to calculate the EPC. Furthermore, the Memo discusses that systematic monitoring was not conducted and the most recent available data is from 2017. Consistent with the [GWEPC] guidance's inclination to use data from the previous year, will provision be made for the collection of more recent samples? Bullets in this section also state that samples will be used from the 2017 to 2020 time period, please clarify or revise, as sampling from 2017 was used and mentioning samples post-2017 can lead to further confusion.*

Response: Further clarification on what data will be used in the HHBRA will be provided in the OU2 BRA Memo. The dataset used in the Site Characterization Summary Report was the most recent time an individual constituent was sampled in each well. This same dataset was used for the groundwater COPC screening. The data to be used for groundwater EPC calculations will be

[1] [GWEPC] = United States, United States Environmental Protection Agency, Office of Solid Waste and Emergency Response. (2014, February). *Memorandum for Determining Groundwater Exposure Point Concentrations, Supplemental Guidance* (OSWER Directive 9283.1-42). Retrieved from https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=236917

based upon this same dataset and the plume evaluation discussed in the response to the previous comment. We have no intentions of conducting further sampling in support of the RI (and HHBRA) – a position that we believed was reached with the agencies' approval of the Site Characterization Summary Report.

EPD Comment #6) **Figure 5: Area Water Wells** *Please incorporate on-site production wells on Figure 5 showing the Area Water Wells.*

Response: Figure 5 will be revised to include the two remaining on-site water wells.

EPD Comment #7) **Figure 6: Conceptual Site Model – OU2 Groundwater** *The conceptual site model (CSM) only evaluates the inhalation/ingestion/dermal contact of groundwater for the hypothetical resident. Since industrial and excavation workers are expected to be present at the facility, please modify the CSM so that industrial worker and excavation worker inhalation/ingestion/dermal contact exposure to groundwater is evaluated.*

Response: Exposure of Excavation Workers to vapors emanating from groundwater to a trench will be evaluated in the HHBRA as shown in the CSM in Attachment C. Respectfully, we do not intend to include groundwater exposure to Industrial Workers. Honeywell is actively developing a deed restriction (per the OU3 ROD) to preclude use of groundwater on the property.

EPD Comment #8) **Tables 3 and 4: Cell Building Area (CBA) Soil COPCs Selection** *The Tables show that for both semi-volatile organic compounds (SVOCs) and volatile organic compounds (VOCs), there is only one surface soil sample and generally less than five mixed soil samples. This is not sufficient characterization of SVOCs and VOCs and is of concern given that several SVOCs and VOCs are being eliminated as COPCs based on the results of one sample; see #2a re FOD above. Section 4.2.2 indicates that polycyclic aromatic hydrocarbons (PAHs) are "ubiquitous throughout the CBA study area" and that there is a "probable petroleum smear zone caused by historical water table fluctuation" which indicates that both SVOCs and VOCs are of concern at the CBA. To ensure that there is enough information to adequately characterize the risks from SVOCs and VOCs exposure in soil, please provide a plan for further characterization (e.g. collecting more samples) of soil SVOCs and VOCs.*

Response: As described above, the appropriate depths of historical samples have been re-adjusted to reflect the current condition. This is discussed more fully in Attachment A. Revised COPC tables are included in Attachment B. Using this dataset, additional sampling is not necessary as there is sufficient data for conducting the HHBRA. PAHs were analyzed in 13 samples and most other SVOCs and VOCs were analyzed in 9 or more samples.

EPD Comment #9) **Executive Summary** *Editorial consideration – please close the parenthesis after the RAGS citation in the last sentence of the Executive Summary opening paragraph.*

Response: The OU2 BRA Memo will be revised per the EPD's comment.

Attachments:

A CBA Dataset
B COPC Tables
C Conceptual Site Models
D Exposure Factors and Equations

ATTACHMENT A
CBA DATASET

ATTACHMENT A

CBA DATASET

Introduction

The area of interest for the soil risk evaluation is the area including the CBA that was excluded from the OU3 HHBRA. This area (shown on Figure A-1) is slightly larger than the area where the soil cover was placed.

Based on comments from the EPA, the dataset to be used in the OU2 HHBRA was reevaluated. The sample depths of historical data were adjusted to account for the soil cover and/or concrete slabs that are present over the soil, thus increasing the distance from the ground surface to where the original samples were collected. In risk assessments, it is assumed that different receptors have potential exposure to soil based on the depth of the soil below ground surface (e.g., site workers are assumed to have exposure to surface soil, which is from the ground surface to two feet below the ground surface). Accordingly, the datasets used in a risk assessment are based on depth intervals. Soil data has been collected in the cell building area (CBA) from 1994 to 2019. However, a soil cover was placed over the CBA in 1996/1997. Additionally, in some areas (building footprints) the soil cover was placed over concrete slabs. Thus, the depths below the ground surface where soil samples were collected prior to the cover are located at different depths now that a cover is present. Accordingly, the sample depths for samples collected prior to installation of the soil cover were adjusted to reflect the post-cover condition today. A summary of the process that was used to make this adjustment is presented below.

Soil Depth Adjustments

A topographic contour of the site from 1994 was available as an AutoCad file. This file was brought into ArcGIS and georectified in order to utilize the Georgia state plane coordinate system, which is the coordinate system used for designating the locations of soil samples collected at the site. Once positioned correctly, the topographic contours were manually adjusted to close the polylines so that there were not open breaks where labels obscured the original contours. The next step was to use the ArcGIS software to create a raster file interpolation based on the contours. Raster files make it possible to estimate a ground surface elevation at any location within the raster area.

A GIS shapefile was available showing the topographic contours of the site in 1997 after construction of the soil cover. This shapefile was used to create another raster file interpolation of the ground surface in 1997.

Figure A-2 shows the raster interpolations for 1994 and 1997. The ArcGIS software was used to find the difference in elevation between the 1994 and 1997 rasters. This elevation difference represents the estimated soil cover thickness in the CBA. The result is shown on Figure A-3.

A file of all the soil sample locations in the CBA area was imported into ArcGIS. The software was used to assign the estimated soil cover thickness to each sample location. Figure A-3 shows

the locations of soil samples collected prior to the cover and the estimated soil cover thickness applied at each location.

Boring logs from sampling that was conducted in 2018 were reviewed to determine where concrete slabs were encountered and the depths of those slabs. This information was used to estimate the locations of the slabs in the CBA (Figure A-4). The pre-cover soil sample locations were added to this figure to determine where soil depths should be adjusted to incorporate the concrete slabs.

The resulting estimated soil cover and concrete slab thicknesses were then imported into the site database. The original depths assigned to each soil sample were archived within the database as separate fields. For the pre-cover soil samples, the cover thickness and concrete slab thickness were added to the database table and the depth designations were changed by adding the cover thickness to both the start depth (D1) and the end depth (D2). For example, if at a location the original pre-cover sample depth interval was 4-5 ft (D1 = 4 and D2 = 5) and the cover thickness at this location was estimated to be 2 ft and concrete slab of 8 inches, then the revised depths were changed to 6.67 ft (D1) and 7.67 ft (D2). Table A-1 shows the depth adjustments for the soil samples collected prior to installation of the cover.

CBA HHBRA Dataset

The site database was queried to determine the sample results that should be included in the OU2-CBA HHBRA. ArcGIS was used to determine which historical soil locations are located within the CBA Exposure Unit. This information was imported into the database. A query was created to extract the results for just these samples in the CBA Exposure Unit. The query also included conditions to limit the soil depths in keeping with the procedure used in the OU3 HHBRA. Specifically, a D1 < 5 and a D2 ≤ 6. (Note that as discussed in the main text of this letter, the COPC selection process was conducted for the mixed soil horizon (0-5 ft bgs) to be representative of both the surface soil and mixed soil horizons.) Duplicate results (e.g., field duplicates) and data addressed during site removal activities (stockpile samples and other data marked as "removed") were also excluded. The resulting samples to be used in the HHBRA are shown in Table A-2 and on Figure A-5. These are the samples included in the COPC screening presented in Attachment B.

CBA Exposure Unit

Topography

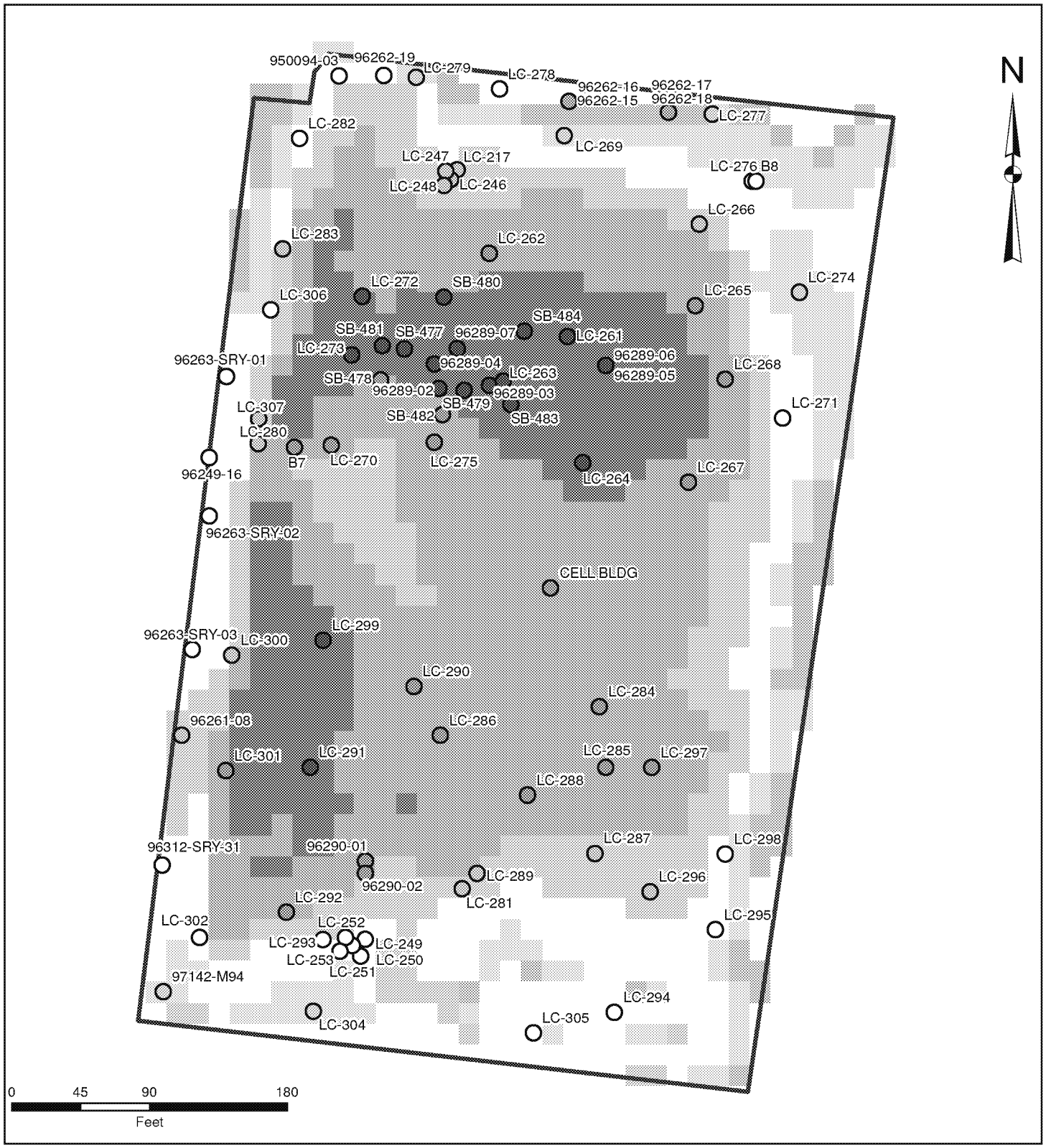
CBA Exposure Unit
LCP Chemicals Site
Brunswick, GA

CBA Exsposure Unit

Ground Surface Elevation (ft)

- <0.5 ft
- 0.5 - 5
- 5 - 10
- 10 - 11
- 11 - 12
- 12 - 13
- 13 - 14
- 14 - 15
- 15 - 20
- > 20

Ground Surface Interpolations
LCP Chemicals Site
Brunswick, GA



CBA Exposure Unit

Elevation Difference (ft)

- 0
- 0 - 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2.- 2.5
- > 2.5

Soil Samples (pre-soil cover)

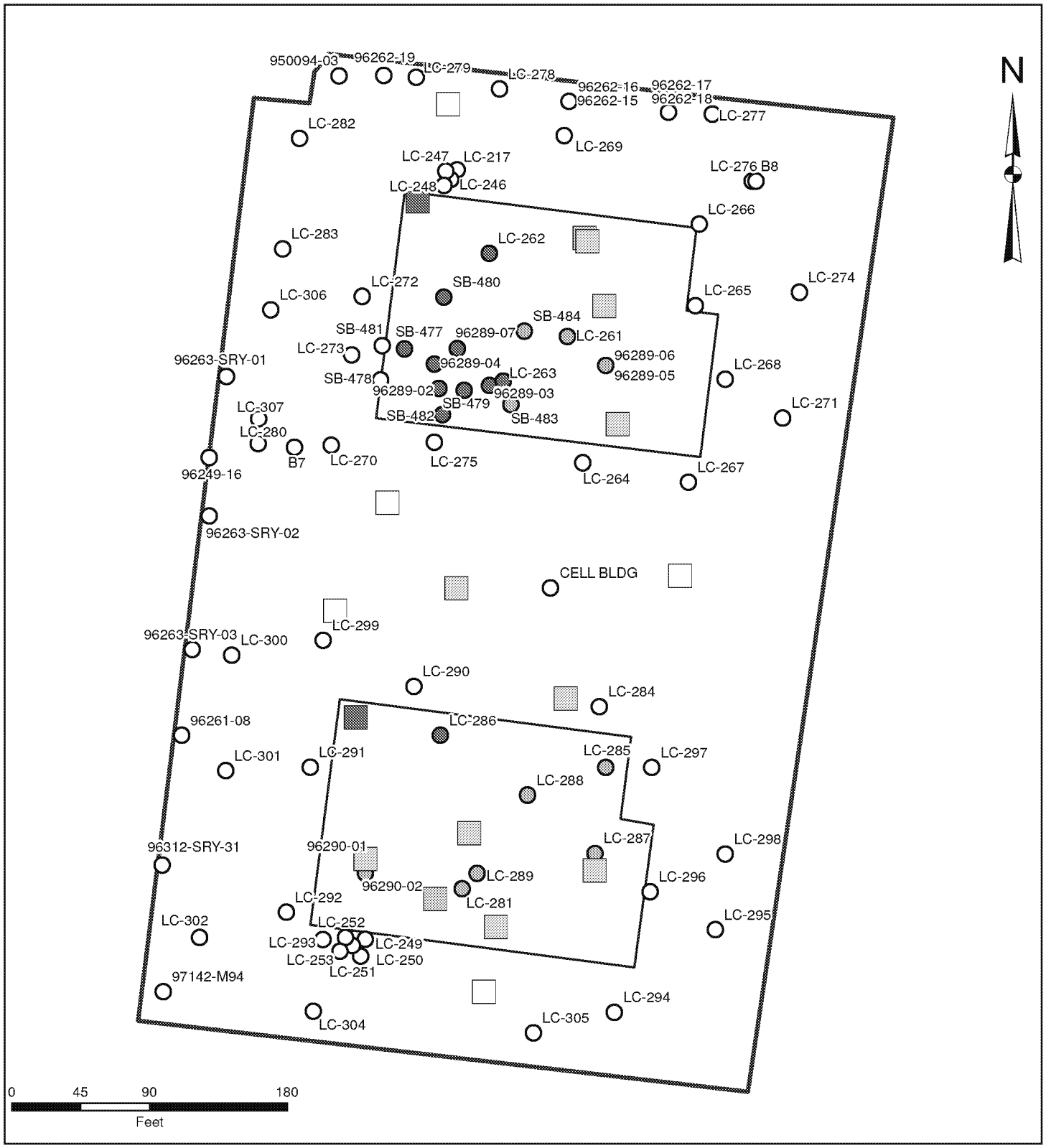
Depth Adjustment

- None
- < 0.5 ft
- 0.5 - 1 ft
- 1 -- 1.5 ft
- 1.5 - 2 ft
- 2 - 2.5 ft
- > 2.5 ft

Soil Cover Thickness
LCP Chemicals Site
Brunswick, GA

Environmental Planning Specialists, Inc.

Figure No. A-3



CBA Exposure Unit

Cell Building Outlines

Locations where two 8" slabs observed

Locations where one 8" slab observed

Locations where no slab observed

Soil Samples (pre-soil cover)

Assumed Concrete Thickness

None

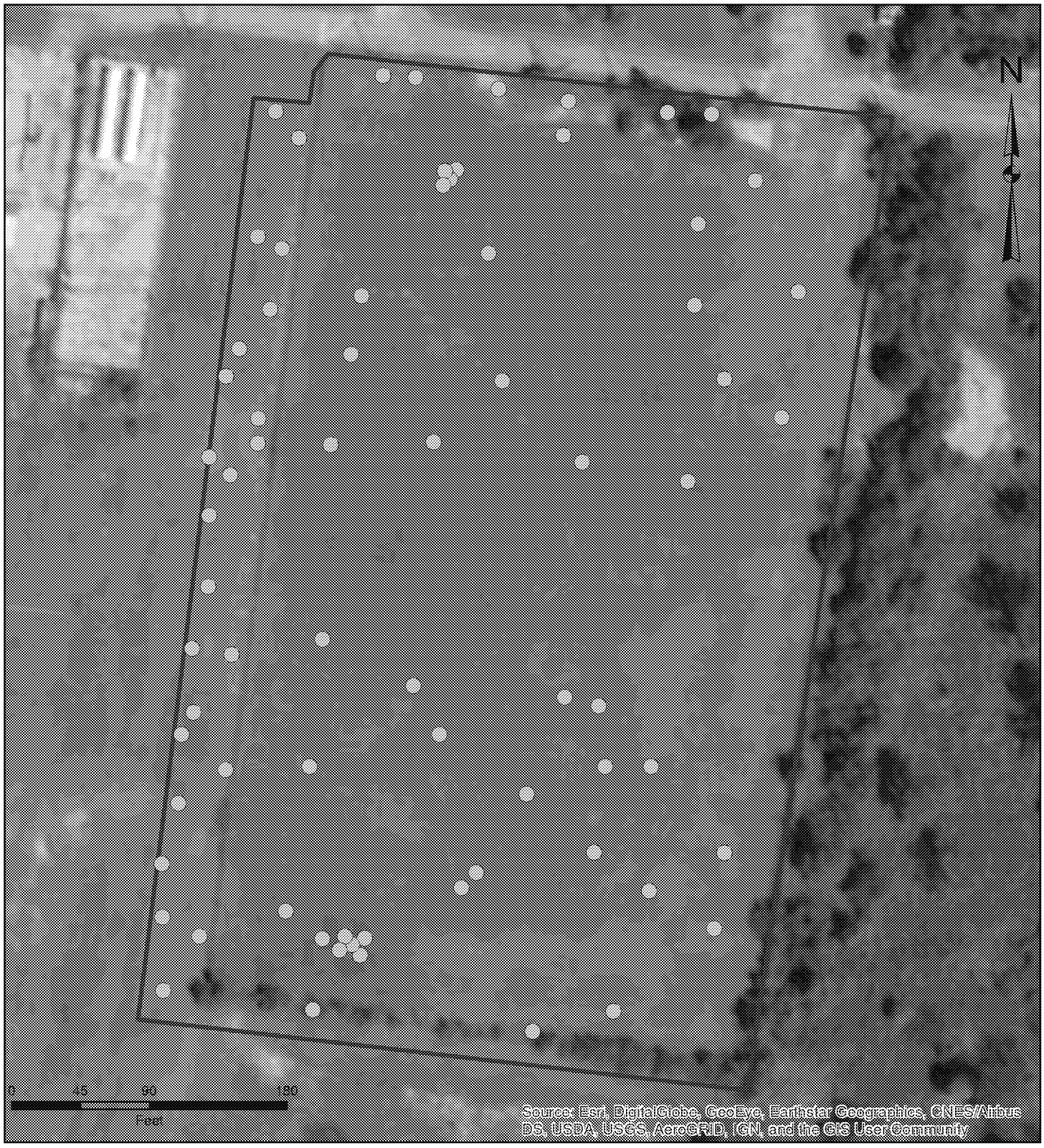
8"

16"

Concrete Slab Thickness
LCP Chemicals Site
Brunswick, GA

Environmental Planning Specialists, Inc.

Figure No. A-4



Mixed Soil Samples (0-5 ft)

CBA Exposure Unit

Historical Soil Samples to be Included in the HHBRA
LCP Chemicals Site
Brunswick, GA

Table A-1. Soil Depth Changes for Samples Collected Prior to the CBA Soil Cover

Location	Sample Date	Original D1 (ft)	Original D2 (ft)	Soil Cap Thickness (ft)	Concrete Thickness (ft)	Total Depth Change (ft)	New D1 (ft)	New D2 (ft)
96249-16	9/5/1996	2.5	3.5				3.8	4.8
96261-08	9/17/1996	0	1	1.6		1.58	1.6	2.6
96262-15	9/18/1996	2	3	0.04		0.04	2.0	3.0
96262-16	9/18/1996	3	4	0.04		0.04	3.0	4.0
96262-17	9/18/1996	2	3	0.1		0.08	2.1	3.1
96262-18	9/18/1996	3	4	0.1		0.08	3.1	4.1
96262-19	9/18/1996	2	2.1				3.1	3.2
96263-SRY-01	9/19/1996	0	1.5	1.2		1.18	1.2	2.7
96263-SRY-02	9/19/1996	0	3	1.4		1.38	1.4	4.4
96263-SRY-03	9/19/1996	0	2.5	1.4		1.38	1.4	3.9
96289-02	10/15/1996	2	3	2.6	0.66	3.23	5.2	6.2
96289-03	10/15/1996	2	3	2.7	0.66	3.41	5.4	6.4
96289-04	10/15/1996	2	3	2.6	0.66	3.29	5.3	6.3
96289-05	10/15/1996	2	3	2.8	1.33	4.14	6.1	7.1
96289-06	10/15/1996	3	4	2.8	1.33	4.14	7.1	8.1
96289-07	10/15/1996	3	3.5	2.7	0.66	3.34	6.3	6.8
96290-01	10/16/1996	2	3	2.1	1.33	3.44	5.4	6.4
96290-02	10/16/1996	2	3	2.0	1.33	3.34	5.3	6.3
96312-SRY-31	11/7/1996	0	3.25	1.5		1.50	1.5	4.7
97142-M94	5/22/1997	0	4.5	0.9		0.88	0.9	5.4
B7	12/15/1994	15	15	2.4		2.37	17.4	17.4
B7	12/15/1994	20	20	2.4		2.37	22.4	22.4
B7	12/15/1994	40	40	2.4		2.37	42.4	42.4
B8	12/15/1994	10	10	1.0		1.04	11.0	11.0
B8	12/15/1994	20	20	1.0		1.04	21.0	21.0
B8	12/15/1994	40	40	1.0		1.04	41.0	41.0
LC-217	10/15/1994	0	1	1.6		1.6	1.6	2.6
LC-246	10/15/1994	0	1	1.7		1.7	1.7	2.7
LC-246	10/15/1994	2	3	1.7		1.7	3.7	4.7
LC-247	10/15/1994	0	1	1.6		1.6	1.6	2.6
LC-247	10/15/1994	2	3	1.6		1.6	3.6	4.6
LC-247	10/15/1994	4	5	1.6		1.6	5.6	6.6
LC-248	10/15/1994	0	1	1.8		1.8	1.8	2.8
LC-249	10/15/1994	0	1	1.3		1.3	1.3	2.3
LC-249	10/15/1994	2	3	1.3		1.3	3.3	4.3
LC-250	10/15/1994	0	1	1.2		1.2	1.2	2.2
LC-250	10/15/1994	2	3	1.2		1.2	3.2	4.2
LC-251	10/18/1994	0	1	1.3		1.3	1.3	2.3
LC-251	10/18/1994	2	3	1.3		1.3	3.3	4.3
LC-252	10/18/1994	0	1	1.4		1.4	1.4	2.4
LC-252	10/18/1994	2	3	1.4		1.4	3.4	4.4
LC-252	10/18/1994	4	5	1.4		1.4	5.4	6.4
LC-253	10/18/1994	0	1	1.2		1.2	1.2	2.2
LC-253	10/18/1994	2	3	1.2		1.2	3.2	4.2
LC-261	10/13/1994	1.5	2.5	2.7	1.33	4.0	5.5	6.5
LC-261	10/13/1994	3.5	4.5	2.7	1.33	4.0	7.5	8.5
LC-262	10/14/1994	1.5	2.5	2.4	0.66	3.0	4.5	5.5
LC-262	10/14/1994	3.5	4.5	2.4	0.66	3.0	6.5	7.5
LC-263	10/14/1994	1	2	2.8	0.66	3.4	4.4	5.4
LC-263	10/14/1994	3	4	2.8	0.66	3.4	6.4	7.4

Table A-1. Soil Depth Changes for Samples Collected Prior to the CBA Soil Cover

Location	Sample Date	Original D1 (ft)	Original D2 (ft)	Soil Cap Thickness (ft)	Concrete Thickness (ft)	Total Depth Change (ft)	New D1 (ft)	New D2 (ft)
LC-264	10/13/1994	0	1	2.6		2.6	2.6	3.6
LC-264	10/13/1994	2	3	2.6		2.6	4.6	5.6
LC-264	10/13/1994	3	3	2.6		2.6	5.6	5.6
LC-265	10/14/1994	0	1	2.4		2.4	2.4	3.4
LC-265	10/14/1994	2	3	2.4		2.4	4.4	5.4
LC-266	10/14/1994	0	1	1.8		1.8	1.8	2.8
LC-266	10/14/1994	2	3	1.8		1.8	3.8	4.8
LC-266	10/14/1994	4	5	1.8		1.8	5.8	6.8
LC-267	10/14/1994	0	1	2.3		2.3	2.3	3.3
LC-267	10/14/1994	2	3	2.3		2.3	4.3	5.3
LC-268	10/15/1994	0	1	2.4		2.4	2.4	3.4
LC-268	10/15/1994	2	3	2.4		2.4	4.4	5.4
LC-269	10/18/1994	0	1	1.0		1.0	1.0	2.0
LC-269	10/18/1994	2	3	1.0		1.0	3.0	4.0
LC-270	10/15/1994	0	1	2.1		2.1	2.1	3.1
LC-270	10/15/1994	2	3	2.1		2.1	4.1	5.1
LC-270	10/15/1994	4	5	2.1		2.1	6.1	7.1
LC-271	10/15/1994	0	1	1.4		1.4	1.4	2.4
LC-271	10/15/1994	2	3	1.4		1.4	3.4	4.4
LC-272	10/18/1994	1	2	2.6		2.6	3.6	4.6
LC-272	10/18/1994	3	4	2.6		2.6	5.6	6.6
LC-273	10/18/1994	1	2	2.7		2.7	3.7	4.7
LC-273	10/18/1994	3	4	2.7		2.7	5.7	6.7
LC-274	10/15/1994	0	1	0.9		0.9	0.9	1.9
LC-274	10/15/1994	2	3	0.9		0.9	2.9	3.9
LC-275	10/17/1994	0	1	2.3		2.3	2.3	3.3
LC-275	10/17/1994	2	3	2.3		2.3	4.3	5.3
LC-276	10/15/1994	0	1	1.0		1.0	1.0	2.0
LC-276	10/15/1994	2	3	1.0		1.0	3.0	4.0
LC-277	10/15/1994	0	1	0.6		0.6	0.6	1.6
LC-277	10/15/1994	2	3	0.6		0.6	2.6	3.6
LC-278	10/15/1994	0	1	0		0	0	1
LC-278	10/15/1994	2	3	0		0	2	3
LC-279	10/15/1994	0	1	0.9		0.9	0.9	1.9
LC-279	10/15/1994	2	3	0.9		0.9	2.9	3.9
LC-280	10/15/1994	0	1	2.0		2.0	2.0	3.0
LC-280	10/15/1994	2	3	2.0		2.0	4.0	5.0
LC-281	10/15/1994	1	2	1.7	1.33	3.0	4.0	5.0
LC-281	10/15/1994	3	4	1.7	1.33	3.0	6.0	7.0
LC-282	10/15/1994	0	1	1.1		1.1	1.1	2.1
LC-282	10/15/1994	2	3	1.1		1.1	3.1	4.1
LC-283	10/15/1994	0	1	1.5		1.5	1.5	2.5
LC-283	10/15/1994	2	3	1.5		1.5	3.5	4.5
LC-284	10/15/1994	0	1	2.4		2.4	2.4	3.4
LC-284	10/15/1994	2	3	2.4		2.4	4.4	5.4
LC-285	10/20/1994	0.5	1	2.3	1.33	3.6	4.1	4.6
LC-285	10/20/1994	1	2	2.3	1.33	3.6	4.6	5.6
LC-285	10/20/1994	2.5	3	2.3	1.33	3.6	6.1	6.6
LC-285	10/20/1994	3	4	2.3	1.33	3.6	6.6	7.6
LC-286	10/20/1994	0.5	1	2.2	0.66	2.9	3.4	3.9

Table A-1. Soil Depth Changes for Samples Collected Prior to the CBA Soil Cover

Location	Sample Date	Original D1 (ft)	Original D2 (ft)	Soil Cap Thickness (ft)	Concrete Thickness (ft)	Total Depth Change (ft)	New D1 (ft)	New D2 (ft)
LC-286	10/20/1994	1	2	2.2	0.66	2.9	3.9	4.9
LC-286	10/20/1994	3	4	2.2	0.66	2.9	5.9	6.9
LC-287	10/19/1994	1	2	1.9	1.33	3.2	4.2	5.2
LC-287	10/19/1994	2.5	3	1.9	1.33	3.2	5.7	6.2
LC-287	10/19/1994	3	4	1.9	1.33	3.2	6.2	7.2
LC-288	10/20/1994	1	2	2.2	1.33	3.6	4.6	5.6
LC-288	10/20/1994	2.5	3	2.2	1.33	3.6	6.1	6.6
LC-288	10/20/1994	3	4	2.2	1.33	3.6	6.6	7.6
LC-289	10/19/1994	0.5	1	1.9	1.33	3.2	3.7	4.2
LC-289	10/19/1994	1.5	2.5	1.9	1.33	3.2	4.7	5.7
LC-289	10/19/1994	3.5	4.5	1.9	1.33	3.2	6.7	7.7
LC-290	10/18/1994	0	1	2.2		2.2	2.2	3.2
LC-290	10/18/1994	2	3	2.2		2.2	4.2	5.2
LC-291	10/19/1994	0	1	2.6		2.6	2.6	3.6
LC-291	10/19/1994	2	3	2.6		2.6	4.6	5.6
LC-291	10/19/1994	4	5	2.6		2.6	6.6	7.6
LC-291	10/18/1994	0	1	2.6		2.6	2.6	3.6
LC-291	10/18/1994	2	3	2.6		2.6	4.6	5.6
LC-291	10/18/1994	4	5	2.6		2.6	6.6	7.6
LC-292	10/18/1994	0	1	2.0		2.0	2.0	3.0
LC-292	10/18/1994	2	3	2.0		2.0	4.0	5.0
LC-293	10/17/1994	0	1	1.4		1.4	1.4	2.4
LC-293	10/17/1994	2	3	1.4		1.4	3.4	4.4
LC-294	10/17/1994	0	1	0		0	0	1
LC-294	10/17/1994	2	3	0		0	2	3
LC-295	10/17/1994	0	1	1.1		1.1	1.1	2.1
LC-295	10/17/1994	2	3	1.1		1.1	3.1	4.1
LC-296	10/18/1994	0	1	1.6		1.6	1.6	2.6
LC-296	10/18/1994	2	3	1.6		1.6	3.6	4.6
LC-297	10/17/1994	0	1	2.2		2.2	2.2	3.2
LC-297	10/17/1994	2	3	2.2		2.2	4.2	5.2
LC-298	10/17/1994	0	1	1.2		1.2	1.2	2.2
LC-298	10/17/1994	2	3	1.2		1.2	3.2	4.2
LC-299	10/17/1994	0	1	2.7		2.7	2.7	3.7
LC-299	10/17/1994	2	3	2.7		2.7	4.7	5.7
LC-300	10/17/1994	0	1	1.7		1.7	1.7	2.7
LC-300	10/17/1994	2	3	1.7		1.7	3.7	4.7
LC-301	10/17/1994	0	1	2.3		2.3	2.3	3.3
LC-301	10/17/1994	2	3	2.3		2.3	4.3	5.3
LC-302	10/17/1994	0	1	1.3		1.3	1.3	2.3
LC-302	10/17/1994	2	3	1.3		1.3	3.3	4.3
LC-304	10/17/1994	0	1	0.8		0.8	0.8	1.8
LC-304	10/17/1994	2	3	0.8		0.8	2.8	3.8
LC-305	10/17/1994	0	1	1.0		1.0	1.0	2.0
LC-305	10/17/1994	2	3	1.0		1.0	3.0	4.0
LC-306	10/18/1994	0	1	1.4		1.4	1.4	2.4
LC-306	10/18/1994	2	3	1.4		1.4	3.4	4.4
LC-307	10/17/1994	0	1	1.7		1.7	1.7	2.7
LC-307	10/17/1994	2	3	1.7		1.7	3.7	4.7
SB-477	1/15/1997	22	22	2.6	0.66	3.3	25.3	25.3

Table A-1. Soil Depth Changes for Samples Collected Prior to the CBA Soil Cover

Location	Sample Date	Original D1 (ft)	Original D2 (ft)	Soil Cap Thickness (ft)	Concrete Thickness (ft)	Total Depth Change (ft)	New D1 (ft)	New D2 (ft)
SB-478	1/16/1997	16	16	2.5		2.5	18.5	18.5
SB-478	1/16/1997	17	17	2.5		2.5	19.5	19.5
SB-478	1/16/1997	23	23	2.5		2.5	25.5	25.5
SB-478	1/16/1997	37	37	2.5		2.5	39.5	39.5
SB-478	1/16/1997	42	42	2.5		2.5	44.5	44.5
SB-479	1/21/1997	10	10	2.6	0.66	3.3	13.3	13.3
SB-479	1/21/1997	17	17	2.6	0.66	3.3	20.3	20.3
SB-479	1/21/1997	30	30	2.6	0.66	3.3	33.3	33.3
SB-479	1/21/1997	35	35	2.6	0.66	3.3	38.3	38.3
SB-479	1/21/1997	37	37	2.6	0.66	3.3	40.3	40.3
SB-479	1/21/1997	42	42	2.6	0.66	3.3	45.3	45.3
SB-480	1/15/1997	5	5	2.6	0.66	3.2	8.2	8.2
SB-480	1/15/1997	11	11	2.6	0.66	3.2	14.2	14.2
SB-480	1/15/1997	17	17	2.6	0.66	3.2	20.2	20.2
SB-480	1/15/1997	30	30	2.6	0.66	3.2	33.2	33.2
SB-480	1/15/1997	35	35	2.6	0.66	3.2	38.2	38.2
SB-480	1/14/1997	5	5	2.6	0.66	3.2	8.2	8.2
SB-480	1/14/1997	11	11	2.6	0.66	3.2	14.2	14.2
SB-480	1/14/1997	17	17	2.6	0.66	3.2	20.2	20.2
SB-480	1/14/1997	30	30	2.6	0.66	3.2	33.2	33.2
SB-480	1/14/1997	35	35	2.6	0.66	3.2	38.2	38.2
SB-481	1/16/1997	7	7	2.6		2.6	9.6	9.6
SB-481	1/16/1997	14	14	2.6		2.6	16.6	16.6
SB-481	1/16/1997	20	20	2.6		2.6	22.6	22.6
SB-481	1/16/1997	24	24	2.6		2.6	26.6	26.6
SB-481	1/16/1997	37	37	2.6		2.6	39.6	39.6
SB-481	1/16/1997	42	42	2.6		2.6	44.6	44.6
SB-482	1/22/1997	8	8	2.4	0.66	3.1	11.1	11.1
SB-482	1/22/1997	16	16	2.4	0.66	3.1	19.1	19.1
SB-482	1/22/1997	19	19	2.4	0.66	3.1	22.1	22.1
SB-482	1/22/1997	24	24	2.4	0.66	3.1	27.1	27.1
SB-482	1/22/1997	28	28	2.4	0.66	3.1	31.1	31.1
SB-482	1/22/1997	32	32	2.4	0.66	3.1	35.1	35.1
SB-482	1/22/1997	37	37	2.4	0.66	3.1	40.1	40.1
SB-482	1/22/1997	44	44	2.4	0.66	3.1	47.1	47.1
SB-483	1/22/1997	12	12	2.8	1.33	4.1	16.1	16.1
SB-483	1/22/1997	23	23	2.8	1.33	4.1	27.1	27.1
SB-483	1/22/1997	33	33	2.8	1.33	4.1	37.1	37.1
SB-483	1/22/1997	43	43	2.8	1.33	4.1	47.1	47.1
SB-484	1/27/1997	5	5	2.7	1.33	4.1	9.1	9.1
SB-484	1/27/1997	15	15	2.7	1.33	4.1	19.1	19.1
SB-484	1/27/1997	27	27	2.7	1.33	4.1	31.1	31.1
SB-484	1/27/1997	29	29	2.7	1.33	4.1	33.1	33.1
SB-484	1/27/1997	31	31	2.7	1.33	4.1	35.1	35.1
SB-484	1/27/1997	37	37	2.7	1.33	4.1	41.1	41.1
SB-484	1/27/1997	39	39	2.7	1.33	4.1	43.1	43.1
SB-484	1/27/1997	42	42	2.7	1.33	4.1	46.1	46.1
SB-484	1/27/1997	53	53	2.7	1.33	4.1	57.1	57.1

Table A-2. Historical Soil Samples to be Included in OU2 HHBRA

Location	Sample ID	D1 (ft)	D2 (ft)
96249-16	96249-16	3.8	4.8
96261-08	96261-08	1.6	2.6
96262-15	96262-15	2.0	3.0
96262-16	96262-16	3.0	4.0
96262-17	96262-17	2.1	3.1
96262-18	96262-18	3.1	4.1
96262-19	96262-19	3.1	3.2
96263-SRY-01	96263-SRY-01	1.2	2.7
96263-SRY-02	96263-SRY-02	1.4	4.4
96263-SRY-03	96263-SRY-03	1.4	3.9
96312-SRY-31	96312-SRY-31	1.5	4.7
97142-M94	97142-M94	0.9	5.4
CB2-SB-1	18334-CB2-SB-1-1	4	4
IG-1	09259-SS-IG-1	0.4	2.9
IG-2	09259-SS-IG-2	0.8	3.3
IG-3	09259-SS-IG-3	1.1	3.6
IG-4	09259-SS-IG-4	1.4	3.9
IG-5	09259-SS-IG-5	1.4	3.9
IG-6	09259-SS-IG-6	1.6	4.1
IG-7	09259-SS-IG-7	1.5	4.0
IG-8	09259-SS-IG-8	1.3	3.8
LC-217	LC-217-SLA	1.6	2.6
LC-246	LC-246-SLA	1.7	2.7
LC-246	LC-246-SLB	3.7	4.7
LC-247	LC-247-SLA	1.6	2.6
LC-247	LC-247-SLB	3.6	4.6
LC-248	LC-248-SLA	1.8	2.8
LC-249	LC-249-SLA	1.3	2.3
LC-249	LC-249-SLB	3.3	4.3
LC-250	LC-250-SLA	1.2	2.2
LC-250	LC-250-SLB	3.2	4.2
LC-251	LC-251-SLA	1.3	2.3
LC-251	LC-251-SLB	3.3	4.3
LC-252	LC-252-SLA	1.4	2.4
LC-252	LC-252-SLB	3.4	4.4
LC-253	LC-253-SLA	1.2	2.2
LC-253	LC-253-SLB	3.2	4.2
LC-262	LC-262-SLA	4.5	5.5
LC-263	LC-263-SLA	4.4	5.4
LC-264	LC-264-SLA	2.6	3.6
LC-264	LC-264-SLB	4.6	5.6
LC-265	LC-265-SLA	2.4	3.4
LC-265	LC-265-SLB	4.4	5.4
LC-266	LC-266-SLA	1.8	2.8
LC-266	LC-266-SLB	3.8	4.8
LC-267	LC-267-SLA	2.3	3.3

Table A-2. Historical Soil Samples to be Included in OU2 HHBRA

Location	Sample ID	D1 (ft)	D2 (ft)
LC-267	LC-267-SLB	4.3	5.3
LC-268	LC-268-SLA	2.4	3.4
LC-268	LC-268-SLB	4.4	5.4
LC-269	LC-269-SLA	1.0	2.0
LC-269	LC-269-SLB	3.0	4.0
LC-270	LC-270-SLA	2.1	3.1
LC-270	LC-270-SLB	4.1	5.1
LC-271	LC-271-SLA	1.4	2.4
LC-271	LC-271-SLB	3.4	4.4
LC-272	LC-272-SLA	3.6	4.6
LC-273	LC-273-SLA	3.7	4.7
LC-274	LC-274-SLA	0.9	1.9
LC-274	LC-274-SLB	2.9	3.9
LC-275	LC-275-SLA	2.3	3.3
LC-275	LC-275-SLB	4.3	5.3
LC-276	LC-276-SLA	1.0	2.0
LC-276	LC-276-SLB	3.0	4.0
LC-277	LC-277-SLA	0.6	1.6
LC-277	LC-277-SLB	2.6	3.6
LC-278	LC-278-SLA	0	1
LC-278	LC-278-SLB	2	3
LC-279	LC-279-SLA	0.9	1.9
LC-279	LC-279-SLB	2.9	3.9
LC-280	LC-280-SLA	2.0	3.0
LC-280	LC-280-SLB	4.0	5.0
LC-281	LC-281-SLA	4.0	5.0
LC-282	LC-282-SLA	1.1	2.1
LC-282	LC-282-SLB	3.1	4.1
LC-283	LC-283-SLA	1.5	2.5
LC-283	LC-283-SLB	3.5	4.5
LC-284	LC-284-SLA	2.4	3.4
LC-284	LC-284-SLB	4.4	5.4
LC-285	LC-285-SLA	4.6	5.6
LC-285	LC-285-SLC	4.1	4.6
LC-286	LC-286-SLA	3.9	4.9
LC-286	LC-286-SLC	3.4	3.9
LC-287	LC-287-SLA	4.2	5.2
LC-288	LC-288-SLA	4.6	5.6
LC-289	LC-289-SLA	4.7	5.7
LC-289	LC-289-SLC	3.7	4.2
LC-290	LC-290-SLA	2.2	3.2
LC-290	LC-290-SLB	4.2	5.2
LC-291	LC-291-SLA	2.6	3.6
LC-291	LC-291-SLB	4.6	5.6
LC-292	LC-292-SLA	2.0	3.0
LC-292	LC-292-SLB	4.0	5.0

Table A-2. Historical Soil Samples to be Included in OU2 HHBRA

Location	Sample ID	D1 (ft)	D2 (ft)
LC-293	LC-293-SLA	1.4	2.4
LC-293	LC-293-SLB	3.4	4.4
LC-294	LC-294-SLA	0	1
LC-294	LC-294-SLB	2	3
LC-295	LC-295-SLA	1.1	2.1
LC-295	LC-295-SLB	3.1	4.1
LC-296	LC-296-SLA	1.6	2.6
LC-296	LC-296-SLB	3.6	4.6
LC-297	LC-297-SLA	2.2	3.2
LC-297	LC-297-SLB	4.2	5.2
LC-298	LC-298-SLA	1.2	2.2
LC-298	LC-298-SLB	3.2	4.2
LC-299	LC-299-SLA	2.7	3.7
LC-299	LC-299-SLB	4.7	5.7
LC-300	LC-300-SLA	1.7	2.7
LC-300	LC-300-SLB	3.7	4.7
LC-301	LC-301-SLA	2.3	3.3
LC-301	LC-301-SLB	4.3	5.3
LC-302	LC-302-SLA	1.3	2.3
LC-302	LC-302-SLB	3.3	4.3
LC-304	LC-304-SLA	0.8	1.8
LC-304	LC-304-SLB	2.8	3.8
LC-305	LC-305-SLA	1.0	2.0
LC-305	LC-305-SLB	3.0	4.0
LC-306	LC-306-SLA	1.4	2.4
LC-306	LC-306-SLB	3.4	4.4
LC-307	LC-307-SLA	1.7	2.7
LC-307	LC-307-SLB	3.7	4.7

ATTACHMENT B
COPC TABLES

Table B-1 Groundwater COPC Selection - Satilla Formation

Parameter	Surrogate [1]	Detection Frequency	% Detects	Min Detect (µg/L)	Max Detect (µg/L)	Min DL for ND (µg/L)	Max DL for ND (µg/L)	MCL (µg/L)	Res RSL [2] (µg/L)	# Detects > RSL	# DL [3] > RSL	# DL > MCL	COPC?	Basis
VOCs														
1,1,1,2-Tetrachloroethane		0/135	0%			0.07	140		0.57		73		Qualitative	Not detected; DLs above RSLs
1,1,1-Trichloroethane		0/135	0%			0.06	120	200	800		0	0	No	No Detects, All DL < RSL
1,1,2,2-Tetrachloroethane		3/135	2%	0.11	0.75	0.07	140		0.076	3	126		**Yes**	Detects > RSL
1,1,2-Trichloroethane		1/135	1%	22	22	0.06	120	5	0.041	1	134	8	**Yes**	Detects > RSL
1,1-Dichloroethane		31/135	23%	0.11	6.1	0.07	140		2.8	3	19		**Yes**	Detects > RSL
1,1-Dichloroethene		6/135	4%	0.09	4.8	0.06	120	7	28	0	4	5	No	Detects < RSL
1,1-Dichloropropene	1,3-Dichloropropene	2/135	1%	0.26	1.2	0.05	100		0.47	1	72		**Yes**	Detects > RSL
1,2,3-Trichloropropane		2/135	1%	0.46	1.2	0.1	200		0.00075	2	133		**Yes**	Detects > RSL
1,2,4-Trimethylbenzene		54/135	40%	0.07	570	0.06	120		5.6	20	7		**Yes**	Detects > RSL
1,2-Dibromo-3-chloropropane		1/135	1%	0.27	0.27	0.1	200	0.2	0.00033	1	134	127	**Yes**	Detects > RSL
1,2-Dibromoethane		2/135	1%	0.11	0.15	0.06	120	0.05	0.0075	2	133	133	**Yes**	Detects > RSL
1,2-Dichloroethane		3/135	2%	0.064	0.1	0.05	100	5	0.17	0	79	5	No	Detects < RSL
1,2-Dichloropropane		9/135	7%	0.13	3.6	0.06	120	5	0.82	2	37	8	**Yes**	Detects > RSL
1,3,5-Trimethylbenzene		36/135	27%	0.1	160	0.06	120		6	10	5		**Yes**	Detects > RSL
1,3-Dichloropropane		0/135	0%			0.07	140		37		2		Qualitative	Not detected; DLs above RSLs
2,2-Dichloropropane	1,3-Dichloropropane	2/135	1%	0.07	0.08	0.05	100		0.47	0	73		No	Detects < RSL
2-Butanone (MEK)		2/135	1%	4.8	17	0.6	1200		560	0	2		No	Detects < RSL
2-Chlorotoluene		6/135	4%	0.089	55	0.07	140		24	1	4		No	< 5% detect / < 5% DL >RSL
2-Hexanone		4/135	3%	0.76	15	0.6	1200		3.8	2	79		**Yes**	Detects > RSL
4-Chlorotoluene		2/135	1%	0.076	0.55	0.07	140		25	0	4		No	Detects < RSL
4-Methyl-2-pentanone		0/135	0%			0.7	1400		630		2		Qualitative	Not detected; DLs above RSLs
Acetone		55/135	41%	1.8	2100	0.9	1800		1400	1	1		**Yes**	Detects > RSL
Benzene		72/135	53%	0.08	54	0.05	100	5	0.46	55	36	5	**Yes**	Detects > RSL
Bromobenzene		0/135	0%			0.06	120		6.2		5		Qualitative	Not detected; DLs above RSLs
Bromochloromethane		0/135	0%			0.05	100		8.3		5		Qualitative	Not detected; DLs above RSLs
Bromodichloromethane		2/135	1%	0.068	0.56	0.05	100	80	0.13	1	79	2	**Yes**	Detects > RSL
Bromoform		0/135	0%			0.16	600	80	3.3		34	4	Qualitative	Not detected; DLs above RSLs
Bromomethane		0/135	0%			0.07	140		0.75		43		Qualitative	Not detected; DLs above RSLs
Carbon disulfide		78/135	58%	0.07	4.7	0.06	120		81	0	2		No	Detects < RSL
Carbon tetrachloride		0/135	0%			0.07	140	5	0.46		79	8	Qualitative	Not detected; DLs above RSLs
Chlorobenzene		41/135	30%	0.17	1400	0.06	120	100	7.8	22	5	2	**Yes**	Detects > RSL
Chloroethane		7/135	5%	0.1	5.1	0.07	140		2100	0	0		No	Detects < RSL
Chloroform		5/135	4%	0.24	1.1	0.072	180	80	0.22	5	75	2	**Yes**	Detects > RSL
Chloromethane		16/135	12%	0.08	5.3	0.06	120		19	0	4		No	Detects < RSL
cis-1,2-Dichloroethene		50/135	37%	0.07	15	0.05	100	70	3.6	5	8	2	**Yes**	Detects > RSL
cis-1,3-Dichloropropene	1,3-Dichloropropene	0/135	0%			0.05	100		0.47		79		Qualitative	Not detected; DLs above RSLs
Dibromochloromethane		0/135	0%			0.07	140	80	0.87		37	2	Qualitative	Not detected; DLs above RSLs
Dibromomethane		0/135	0%			0.06	120		0.83		37		Qualitative	Not detected; DLs above RSLs
Dichlorodifluoromethane		0/135	0%			0.05	100		20		4		Qualitative	Not detected; DLs above RSLs
Dichloromethane (Methylene chloride)		36/135	27%	0.07	20	0.07	140	5	11	1	5	7	**Yes**	Detects > RSL
Ethyl benzene		62/135	46%	0.05	680	0.05	120	700	1.5	42	17	0	**Yes**	Detects > RSL
Isopropylbenzene		68/135	50%	0.06	56	0.05	100		45	1	2		**Yes**	Detects > RSL
m&p-Xylene	(m-Xylene)	44/135	33%	0.11	1700	0.1	200		19	6	5		**Yes**	Detects > RSL

Table B-1 Groundwater COPC Selection - Satilla Formation

Parameter	Surrogate [1]	Detection Frequency	% Detects	Min Detect (µg/L)	Max Detect (µg/L)	Min DL for ND (µg/L)	Max DL for ND (µg/L)	MCL (µg/L)	Res RSL [2] (µg/L)	# Detects > RSL	# DL [3] > RSL	# DL > MCL	COPC?	Basis
n-Butylbenzene		31/135	23%	0.07	21	0.05	100		100	0	0		No	Detects < RSL
n-Propylbenzene		60/135	44%	0.06	58	0.054	120		66	0	2		No	Detects < RSL
o-Xylene		44/135	33%	0.09	170	0.05	100		19	4	4		**Yes**	Detects > RSL
p-Isopropyltoluene	Toluene	35/135	26%	0.07	19	0.05	100		110	0	0		No	Detects < RSL
sec-Butylbenzene		51/135	38%	0.062	24	0.06	120		200	0	0		No	Detects < RSL
Styrene		0/135	0%			0.05	100	100	120		0	0	No	No Detects, All DL < RSL
tert-Butylbenzene		52/135	39%	0.09	17	0.059	140		69	0	2		No	Detects < RSL
Tetrachloroethene		1/135	1%	1.1	1.1	0.06	120	5	4.1	0	8	8	No	Detects < RSL
Toluene		69/135	51%	0.07	430	0.054	140	1000	110	1	2	0	**Yes**	Detects > RSL
trans-1,2-Dichloroethene		9/135	7%	0.09	6.8	0.06	120	100	6.8	0	2	2	No	Detects < RSL
trans-1,3-Dichloropropene	1,3-Dichloropropene	0/135	0%			0.06	120		0.47		73		Qualitative	Not detected; DLs above RSLs
Trichloroethene		8/135	6%	0.11	3.7	0.06	120	5	0.28	7	77	8	**Yes**	Detects > RSL
Trichlorofluoromethane		0/135	0%			0.05	100		520		0		No	No Detects, All DL < RSL
Vinyl chloride		4/135	3%	0.24	3.1	0.075	200	2	0.019	4	131	28	**Yes**	Detects > RSL
SVOCs														
1,2,3-Trichlorobenzene		0/135	0%			0.05	100		0.7		37		Qualitative	Not detected; DLs above RSLs
1,2,4-Trichlorobenzene		13/135	10%	0.12	58	0.06	120	70	0.4	10	77	2	**Yes**	Detects > RSL
1,2-Dichlorobenzene		36/135	27%	0.21	390	0.06	120	600	30	6	2	0	**Yes**	Detects > RSL
1,3-Dichlorobenzene	1,2-Dichlorobenzene	26/135	19%	0.07	110	0.06	120		30	2	2		**Yes**	Detects > RSL
1,4-Dichlorobenzene		30/135	22%	0.2	230	0.07	140	75	0.48	28	59	2	**Yes**	Detects > RSL
1-Methyl Naphthalene		101/135	75%	0.0043	110	0.0013	0.025		1.1	50	0		**Yes**	Detects > RSL
2-Methylnaphthalene		89/135	66%	0.0026	140	0.0023	0.1		3.6	20	0		**Yes**	Detects > RSL
Acenaphthene		85/135	63%	0.012	8	0.0012	0.11		53	0	0		No	Detects < RSL
Acenaphthylene	Pyrene	39/135	29%	0.0042	0.4	0.0011	0.44		12	0	0		No	Detects < RSL
Anthracene		78/135	58%	0.0037	1	0.00082	0.05		180	0	0		No	Detects < RSL
Benzo(a)anthracene		42/135	31%	0.0024	2	0.00097	0.05		0.03	20	14		**Yes**	Detects > RSL
Benzo(a)pyrene		28/135	21%	0.0088	1	0.0011	0.05	0.2	0.025	19	14	0	**Yes**	Detects > RSL
Benzo(b)fluoranthene		41/135	30%	0.0072	0.9	0.00083	0.05		0.25	5	0		**Yes**	Detects > RSL
Benzo(g,h,i)perylene	Pyrene	28/135	21%	0.0035	0.7	0.00086	0.05		12	0	0		No	Detects < RSL
Benzo(k)fluoranthene		13/135	10%	0.0045	0.2	0.00094	0.11		2.5	0	0		No	Detects < RSL
Chrysene		28/135	21%	0.0035	2	0.00076	0.05		25	0	0		No	Detects < RSL
Dibenzo(a,h)anthracene		4/135	3%	0.003	0.2	0.0013	0.22		0.025	2	26		**Yes**	Detects > RSL
Dibenzofuran		64/135	47%	0.01	3	0.00096	0.11		0.79	5	0		**Yes**	Detects > RSL
Fluoranthene		33/135	24%	0.0046	1	0.00082	0.057		80	0	0		No	Detects < RSL
Fluorene		78/135	58%	0.01	4	0.0011	0.05		29	0	0		No	Detects < RSL
Hexachlorobutadiene		0/135	0%			0.07	140		0.14		80		Qualitative	Not detected; DLs above RSLs
Indeno(1,2,3-cd)pyrene		25/135	19%	0.0052	0.3	0.00089	0.05		0.25	1	0		**Yes**	Detects > RSL
Naphthalene		111/135	82%	0.0041	420	0.0038	0.21		0.12	90	3		**Yes**	Detects > RSL
Phenanthrene	Pyrene	53/135	39%	0.0052	6	0.005	0.2		12	0	0		No	Detects < RSL
Pyrene		56/135	41%	0.0081	6	0.001	0.05		12	0	0		No	Detects < RSL

Table B-1 Groundwater COPC Selection - Satilla Formation

Parameter	Surrogate [1]	Detection Frequency	% Detects	Min Detect (µg/L)	Max Detect (µg/L)	Min DL for ND (µg/L)	Max DL for ND (µg/L)	MCL (µg/L)	Res RSL [2] (µg/L)	# Detects > RSL	# DL [3] > RSL	# DL > MCL	COPC?	Basis
PCBs														
Aroclor-1016		0/10	0%			0.024	0.26		0.14		4		Qualitative	Not detected; DLs above RSLs
Aroclor-1221		0/10	0%			0.04	0.42		0.0047		10		Qualitative	Not detected; DLs above RSLs
Aroclor-1232		0/10	0%			0.024	0.26		0.0047		10		Qualitative	Not detected; DLs above RSLs
Aroclor-1242		0/10	0%			0.024	0.26		0.0078		10		Qualitative	Not detected; DLs above RSLs
Aroclor-1248		0/10	0%			0.024	0.26		0.0078		10		Qualitative	Not detected; DLs above RSLs
Aroclor-1254		0/10	0%			0.024	0.53		0.0078		10		Qualitative	Not detected; DLs above RSLs
Aroclor-1260		2/10	20%	0.14	0.78	0.024	0.26		0.0078	2	8		**Yes**	Detects > RSL
Aroclor-1262		0/10	0%			0.024	0.26						No	No Detects, No RSL
Aroclor-1268	(Aroclor-1254)	1/10	10%	0.073	0.073	0.024	0.26		0.0078	1	9		**Yes**	Detects > RSL
Inorganics														
Aluminum		132/145	91%	3	95000	4	390		2000	54	0		**Yes**	Detects > RSL
Antimony		30/145	21%	0.02	4.09	0.02	16	6	0.78	6	24	15	**Yes**	Detects > RSL
Arsenic		108/145	74%	0.09	153	0.08	16	10	0.052	108	37	14	**Yes**	Detects > RSL
Barium		145/145	100%	1.31	2800			2000	380	14			**Yes**	Detects > RSL
Beryllium		122/145	84%	0.004	57	0.004	2.4	4	2.5	50	0	0	**Yes**	Detects > RSL
Cadmium		29/145	20%	0.008	2.7	0.006	3	5	0.92	3	19	0	**Yes**	Detects > RSL
Calcium		145/145	100%	71	686000								No	Essential nutrient
Chromium	Chromium, III	139/145	96%	0.06	1200	0.2	1.6	100	2200	0	0	0	No	Detects < RSL
Chromium, VI [4]		3/16	19%	41	112	40	40		0.035	3	13		**Yes**	Detects > RSL
Cobalt		98/145	68%	0.007	16	0.012	3.1		0.6	45	18		**Yes**	Detects > RSL
Copper		96/145	66%	0.04	210	0.03	12	1300	80	2	0	0	**Yes**	Detects > RSL
Iron		142/145	98%	10	52100	3	56		1400	82	0		**Yes**	Detects > RSL
Lead		112/145	77%	0.005	209	0.02	7.1	15	15	21	0	0	**Yes**	Detects > RSL
Magnesium		145/145	100%	29	613000								No	Essential nutrient
Manganese		139/145	96%	1.1	1590	0.3	63		43	84	1		**Yes**	Detects > RSL
Mercury		137/145	94%	0.00016	223	0.0003	0.25	2	0.063	91	2	0	**Yes**	Detects > RSL
Methyl mercury		8/8	100%	0.00529	0.357				0.2	1			**Yes**	Detects > RSL
Nickel		102/145	70%	0.04	170	0.04	12		0.083	97	36		**Yes**	Detects > RSL
Potassium		142/145	98%	140	180000	744	1100						No	Essential nutrient
Selenium		98/145	68%	0.08	146	0.07	22.3	50	10	36	17	0	**Yes**	Detects > RSL
Silver		4/145	3%	0.005	0.46	0.005	5		9.4	0	0		No	Detects < RSL
Sodium		145/145	100%	4470	17000000								No	Essential nutrient
Thallium		19/145	13%	0.007	8.8	0.006	8.1	2	0.02	12	107	13	**Yes**	Detects > RSL
Vanadium		135/145	93%	0.6	3200	0.5	8.58		8.6	102	0		**Yes**	Detects > RSL
Zinc		91/145	63%	0.3	1390	0.2	120		600	1	0		**Yes**	Detects > RSL

1) Surrogates not in parenthases taken from the approved surrogate list included in the OU3 HHBRA.
2) Tapwater RSLs from EPA RSL Tables Nov 2020; non-carcinogens evaluated for HQ of 0.1
3) Number of non-detected results with detection limits above the RSL.
4) Hexavalent chromium results from 2012 sampling event

Table B-2 Groundwater COPC Selection - Ebenezer Formation

Parameter	Surrogate [1]	Detection Frequency	% Detects	Min Detect (µg/L)	Max Detect (µg/L)	Min DL for ND (µg/L)	Max DL for ND (µg/L)	MCL (µg/L)	Res RSL [2] (µg/L)	# Detects > RSL	# DL [3] > RSL	# DL > MCL	COPC?	Basis
VOCs														
1,1,1,2-Tetrachloroethane		0/19	0%			0.07	3.5		0.57		13		Qualitative	Not detected; DLs above RSLs
1,1,1-Trichloroethane		0/19	0%			0.06	3	200	800		0	0	No	No Detects, All DL < RSL
1,1,2,2-Tetrachloroethane		0/19	0%			0.07	3.5		0.076		16		Qualitative	Not detected; DLs above RSLs
1,1,2-Trichloroethane		0/19	0%			0.06	3	5	0.041		19	0	No	Not detected; DLs below MCL
1,1-Dichloroethane		0/19	0%			0.07	3.5		2.8		2		Qualitative	Not detected; DLs above RSLs
1,1-Dichloroethene		0/19	0%			0.06	3	7	28		0	0	No	No Detects, All DL < RSL
1,1-Dichloropropene	1,3-Dichloropropene	0/19	0%			0.05	2.5		0.47		13		Qualitative	Not detected; DLs above RSLs
1,2,3-Trichloropropane		0/19	0%			0.1	5		0.00075		19		Qualitative	Not detected; DLs above RSLs
1,2,4-Trimethylbenzene		0/19	0%			0.06	3		5.6		0		No	No Detects, All DL < RSL
1,2-Dibromo-3-chloropropane		0/19	0%			0.1	5	0.2	0.00033		19	16	Qualitative	Not detected; DLs above RSLs
1,2-Dibromoethane		0/19	0%			0.06	3	0.05	0.0075		19	19	Qualitative	Not detected; DLs above RSLs
1,2-Dichloroethane		0/19	0%			0.05	2.5	5	0.17		13	0	No	Not detected; DLs below MCL
1,2-Dichloropropane		0/19	0%			0.06	3	5	0.82		5	0	No	Not detected; DLs below MCL
1,3,5-Trimethylbenzene		0/19	0%			0.06	3		6		0		No	No Detects, All DL < RSL
1,3-Dichloropropane		0/19	0%			0.07	3.5		37		0		No	No Detects, All DL < RSL
2,2-Dichloropropane	1,3-Dichloropropane	0/19	0%			0.05	2.5		0.47		13		Qualitative	Not detected; DLs above RSLs
2-Butanone (MEK)		2/19	11%	26	32	0.6	30		560	0	0		No	Detects < RSL
2-Chlorotoluene		0/19	0%			0.07	3.5		24		0		No	No Detects, All DL < RSL
2-Hexanone		0/19	0%			0.6	30		3.8		13		Qualitative	Not detected; DLs above RSLs
4-Chlorotoluene		0/19	0%			0.07	3.5		25		0		No	No Detects, All DL < RSL
4-Methyl-2-pentanone		0/19	0%			0.7	35		630		0		No	No Detects, All DL < RSL
Acetone		6/19	32%	3.5	230	0.9	45		1400	0	0		No	Detects < RSL
Benzene		5/19	26%	0.05	2.6	0.05	2.5	5	0.46	4	10	0	**Yes**	Detects > RSL
Bromobenzene		0/19	0%			0.06	3		6.2		0		No	No Detects, All DL < RSL
Bromochloromethane		0/19	0%			0.05	2.5		8.3		0		No	No Detects, All DL < RSL
Bromodichloromethane		0/19	0%			0.05	2.5	80	0.13		13	0	No	Not detected; DLs below MCL
Bromoform		0/19	0%			0.16	15	80	3.3		5	0	No	Not detected; DLs below MCL
Bromomethane		0/19	0%			0.07	3.5		0.75		5		Qualitative	Not detected; DLs above RSLs
Carbon disulfide		8/19	42%	0.09	2.7	0.06	3		81	0	0		No	Detects < RSL
Carbon tetrachloride		0/19	0%			0.07	3.5	5	0.46		13	0	No	Not detected; DLs below MCL
Chlorobenzene		0/19	0%			0.06	3	100	7.8		0	0	No	No Detects, All DL < RSL
Chloroethane		0/19	0%			0.07	3.5		2100		0		No	No Detects, All DL < RSL
Chloroform		0/19	0%			0.072	4.5	80	0.22		13	0	No	Not detected; DLs below MCL
Chloromethane		1/19	5%	0.11	0.11	0.06	3		19	0	0		No	Detects < RSL
cis-1,2-Dichloroethene		1/19	5%	0.5	0.5	0.05	2.5	70	3.6	0	0	0	No	Detects < RSL
cis-1,3-Dichloropropene	1,3-Dichloropropene	0/19	0%			0.05	2.5		0.47		13		Qualitative	Not detected; DLs above RSLs
Dibromochloromethane		0/19	0%			0.07	3.5	80	0.87		5	0	No	Not detected; DLs below MCL
Dibromomethane		0/19	0%			0.06	3		0.83		5		Qualitative	Not detected; DLs above RSLs
Dichlorodifluoromethane		0/19	0%			0.05	2.5		20		0		No	No Detects, All DL < RSL
Dichloromethane (Methylene chloride)		2/19	11%	0.12	2	0.07	3.5	5	11	0	0	0	No	Detects < RSL
Ethyl benzene		1/19	5%	0.06	0.06	0.05	3	700	1.5	0	2	0	No	Detects < RSL

Table B-2 Groundwater COPC Selection - Ebenezer Formation

Parameter	Surrogate [1]	Detection Frequency	% Detects	Min Detect (µg/L)	Max Detect (µg/L)	Min DL for ND (µg/L)	Max DL for ND (µg/L)	MCL (µg/L)	Res RSL [2] (µg/L)	# Detects > RSL	# DL [3] > RSL	# DL > MCL	COPC?	Basis
Isopropylbenzene		0/19	0%			0.05	2.5		45		0		No	No Detects, All DL < RSL
m&p-Xylene	(m-Xylene)	0/19	0%			0.1	5		19		0		No	No Detects, All DL < RSL
n-Butylbenzene		0/19	0%			0.05	2.5		100		0		No	No Detects, All DL < RSL
n-Propylbenzene		0/19	0%			0.054	3		66		0		No	No Detects, All DL < RSL
o-Xylene		0/19	0%			0.05	2.5		19		0		No	No Detects, All DL < RSL
p-Isopropyltoluene	Toluene	0/19	0%			0.05	2.5		110		0		No	No Detects, All DL < RSL
sec-Butylbenzene		0/19	0%			0.06	3		200		0		No	No Detects, All DL < RSL
Styrene		0/19	0%			0.05	2.5	100	120		0	0	No	No Detects, All DL < RSL
tert-Butylbenzene		0/19	0%			0.059	3.5		69		0		No	No Detects, All DL < RSL
Tetrachloroethene		0/19	0%			0.06	3	5	4.1		0	0	No	No Detects, All DL < RSL
Toluene		3/19	16%	0.09	2.2	0.07	3.5	1000	110	0	0	0	No	Detects < RSL
trans-1,2-Dichloroethene		0/19	0%			0.06	3	100	36		0	0	No	No Detects, All DL < RSL
trans-1,3-Dichloropropene	1,3-Dichloropropene	0/19	0%			0.06	3		0.47		13		Qualitative	Not detected; DLs above RSLs
Trichloroethene		0/19	0%			0.06	3	5	0.28		13	0	No	Not detected; DLs below MCL
Trichlorofluoromethane		0/19	0%			0.05	2.5		520		0		No	No Detects, All DL < RSL
Vinyl chloride		0/19	0%			0.075	5	2	0.019		19	5	Qualitative	Not detected; DLs above RSLs
SVOCs														
1,2,3-Trichlorobenzene		0/19	0%			0.05	2.5		0.7		5		Qualitative	Not detected; DLs above RSLs
1,2,4-Trichlorobenzene		0/19	0%			0.06	3	70	0.4		13	0	No	Not detected; DLs below MCL
1,2-Dichlorobenzene		0/19	0%			0.06	3	600	30		0	0	No	No Detects, All DL < RSL
1,3-Dichlorobenzene	1,2-Dichlorobenzene	0/19	0%			0.06	3		30		0		No	No Detects, All DL < RSL
1,4-Dichlorobenzene		0/19	0%			0.07	3.5	75	0.48		13	0	No	Not detected; DLs below MCL
1-Methyl Naphthalene		9/19	47%	0.0042	0.7	0.0035	0.05		1.1	0	0		No	Detects < RSL
2-Methylnaphthalene		8/19	42%	0.0045	1.1	0.0023	0.1		3.6	0	0		No	Detects < RSL
Acenaphthene		0/19	0%			0.0044	0.05		53		0		No	No Detects, All DL < RSL
Acenaphthylene	Pyrene	0/19	0%			0.0034	0.05		12		0		No	No Detects, All DL < RSL
Anthracene		3/19	16%	0.031	0.032	0.0036	0.05		180	0	0		No	Detects < RSL
Benzo(a)anthracene		4/19	21%	0.0043	0.39	0.0026	0.05		0.03	1	5		**Yes**	Detects > RSL
Benzo(a)pyrene		3/19	16%	0.015	0.48	0.0043	0.05	0.2	0.025	2	5	0	**Yes**	Detects > RSL
Benzo(b)fluoranthene		3/19	16%	0.025	0.48	0.0041	0.05		0.25	1	0		**Yes**	Detects > RSL
Benzo(g,h,i)perylene	Pyrene	3/19	16%	0.015	0.54	0.0029	0.05		12	0	0		No	Detects < RSL
Benzo(k)fluoranthene		3/19	16%	0.011	0.49	0.003	0.05		2.5	0	0		No	Detects < RSL
Chrysene		3/19	16%	0.018	0.46	0.0034	0.05		25	0	0		No	Detects < RSL
Dibenzo(a,h)anthracene		1/19	5%	0.59	0.59	0.0025	0.1		0.025	1	5		**Yes**	Detects > RSL
Dibenzofuran		0/19	0%			0.0093	0.05		0.79		0		No	No Detects, All DL < RSL
Fluoranthene		4/19	21%	0.015	0.18	0.01	0.05		80	0	0		No	Detects < RSL
Fluorene		1/19	5%	0.01	0.01	0.0038	0.05		29	0	0		No	Detects < RSL
Hexachlorobutadiene		0/19	0%			0.07	3.5		0.14		13		Qualitative	Not detected; DLs above RSLs
Indeno(1,2,3-cd)pyrene		3/19	16%	0.012	0.64	0.0026	0.05		0.25	1	0		**Yes**	Detects > RSL
Naphthalene		6/19	32%	0.03	0.51	0.0038	0.2		0.12	1	5		**Yes**	Detects > RSL
Phenanthrene	Pyrene	4/19	21%	0.0089	0.062	0.005	0.2		12	0	0		No	Detects < RSL
Pyrene		4/19	21%	0.029	0.16	0.0053	0.05		12	0	0		No	Detects < RSL

Table B-2 Groundwater COPC Selection - Ebenezer Formation

Parameter	Surrogate [1]	Detection Frequency	% Detects	Min Detect (µg/L)	Max Detect (µg/L)	Min DL for ND (µg/L)	Max DL for ND (µg/L)	MCL (µg/L)	Res RSL [2] (µg/L)	# Detects > RSL	# DL [3] > RSL	# DL > MCL	COPC?	Basis
Inorganics														
Aluminum		6/19	32%	32	4560	4	390		2000	1	0		**Yes**	Detects > RSL
Antimony		1/19	5%	0.11	0.11	0.02	8.1	6	0.78	0	6	5	No	Detects < RSL
Arsenic		15/18	83%	0.06	54	14	14	10	0.052	15	3	3	**Yes**	Detects > RSL
Barium		14/19	74%	9.36	259	15	15	2000	380	0	0	0	No	Detects < RSL
Beryllium		6/19	32%	0.03	0.443	0.004	2.4	4	2.5	0	0	0	No	Detects < RSL
Cadmium		1/19	5%	0.704	0.704	0.006	3	5	0.92	0	5	0	No	Detects < RSL
Calcium		18/19	95%	2700	447000	1500	1500						No	Essential nutrient
Chromium	Chromium, III	14/18	78%	0.33	110	0.21	0.21	100	2200	0	0	0	No	Detects < RSL
Chromium, VI [4]		3/10	30%	0.35	0.99	0.05	40		0.035	3	7		**Yes**	Detects > RSL
Cobalt		10/19	53%	0.019	0.42	0.15	3.1		0.6	0	5		No	Detects < RSL
Copper		11/19	58%	0.11	28	1.01	7.2	1300	80	0	0	0	No	Detects < RSL
Iron		17/19	89%	58	14600	460	460		1400	9	0		**Yes**	Detects > RSL
Lead		6/19	32%	0.037	3.37	0.2	1.4	15	15	0	0	0	No	Detects < RSL
Magnesium		14/19	74%	713	55300	210	210						No	Essential nutrient
Manganese		13/19	68%	4.2	1120	5.06	13		43	10	0		**Yes**	Detects > RSL
Mercury		16/18	89%	0.00214	25.2	0.00083	0.00083	2	0.063	11	0	0	**Yes**	Detects > RSL
Nickel		10/19	53%	0.06	46	2	12		0.083	9	9		**Yes**	Detects > RSL
Potassium		19/19	100%	870	170000								No	Essential nutrient
Selenium		5/19	26%	1.5	57.7	0.07	22.3	50	10	4	6	0	**Yes**	Detects > RSL
Silver		0/19	0%			0.005	85		9.4		1		No	< 5% detect / < 5% DL >RSL
Sodium		19/19	100%	13700	31100000								No	Essential nutrient
Thallium		2/19	11%	0.008	0.013	0.13	2.6	2	0.02	0	17	5	No	Detects < RSL
Vanadium		13/19	68%	12	520	0.5	8.6		8.6	13	0		**Yes**	Detects > RSL
Zinc		6/19	32%	0.6	30	8.08	120		600	0	0		No	Detects < RSL

1) Surrogates not in parenthases taken from the approved surrogate list included in the OU3 HHBRA.
2) Tapwater RSLs from EPA RSL Tables Nov 2020; non-carcinogens evaluated for HQ of 0.1
3) Number of non-detected results with detection limits above the RSL.
4) Hexavalent chromium results from 2012 sampling event

Table B-3 Soil COPC Selection

Parameter	Surrogate	Detection Frequency	% Detects	Min Detect (mg/kg)	Max Detect (mg/kg)	Min DL for ND (mg/kg)	Max DL for ND (mg/kg)	Res RSL [2] (mg/kg)	# Detects > RSL	# DL [3] > RSL	COPC?	Basis
PCBs												
Aroclor-1016		0/33	0%			0.019	110	0.41		12	Qualitative	No Detects; DL > RSL
Aroclor-1221		0/33	0%			0.012	110	0.2		20	Qualitative	No Detects; DL > RSL
Aroclor-1232		0/33	0%			0.024	110	0.17		25	Qualitative	No Detects; DL > RSL
Aroclor-1242		0/33	0%			0.012	110	0.23		14	Qualitative	No Detects; DL > RSL
Aroclor-1248		0/33	0%			0.0072	110	0.23		14	Qualitative	No Detects; DL > RSL
Aroclor-1254		7/33	21%	0.14	2.8	0.0088	110	0.12	7	18	**Yes**	Detects > RSL
Aroclor-1260		6/33	18%	0.13	1.3	0.013	110	0.24	4	17	**Yes**	Detects > RSL
Aroclor-1268	(Aroclor-1254)	21/33	64%	0.047	350	0.0066	2.66	0.12	18	8	**Yes**	Detects > RSL
PAHs												
1-Methyl Naphthalene		1/3	33%	0.0084	0.0084	0.35	0.36	18	0	0	No	Detects < RSL
2-Methylnaphthalene		1/13	8%	0.013	0.013	0.35	8.9	24	0	0	No	Detects < RSL
Acenaphthene		0/13	0%			0.0053	8.9	360		0	No	No Detects, All DL < RSL
Acenaphthylene	Pyrene	0/13	0%			0.0051	8.9	180		0	No	No Detects, All DL < RSL
Anthracene		0/13	0%			0.0056	8.9	1800		0	No	No Detects, All DL < RSL
Benzo(a)anthracene		2/13	15%	0.017	0.96	0.35	8.9	1.1	0	9	No	Detects < RSL
Benzo(a)pyrene		2/13	15%	0.022	0.37	0.35	8.9	0.11	1	11	**Yes**	Detects > RSL
Benzo(b)fluoranthene		1/3	33%	0.023	0.023	0.35	0.36	1.1	0	0	No	Detects < RSL
Benzo(b/k)fluoranthene	(Benzo(b)fluoranthene)	1/10	10%	1.3	1.3	6	8.9	1.1	1	9	**Yes**	Detects > RSL
Benzo(g,h,i)perylene	Pyrene	2/13	15%	0.062	0.76	0.35	8.9	180	0	0	No	Detects < RSL
Benzo(k)fluoranthene		1/3	33%	0.015	0.015	0.35	0.36	11	0	0	No	Detects < RSL
Chrysene		1/13	8%	0.023	0.023	0.35	8.9	110	0	0	No	Detects < RSL
Dibenzo(a,h)anthracene		1/13	8%	0.012	0.012	0.35	8.9	0.11	0	12	No	Detects < RSL
Fluoranthene		2/13	15%	0.023	1.8	0.35	8.9	240	0	0	No	Detects < RSL
Fluorene		0/13	0%			0.0056	8.9	240		0	No	No Detects, All DL < RSL
Indeno(1,2,3-cd)pyrene		2/13	15%	0.02	0.38	0.35	8.9	1.1	0	10	No	Detects < RSL
Naphthalene		1/13	8%	0.0074	0.0074	0.35	8.9	2	0	10	No	Detects < RSL
Phenanthrene	Pyrene	1/13	8%	0.016	0.016	0.35	8.9	180	0	0	No	Detects < RSL
Pyrene		3/13	23%	0.028	1.8	0.35	8.9	180	0	0	No	Detects < RSL
SVOCs												
1,2,4-Trichlorobenzene		0/10	0%			6	8.9	5.8		10	Qualitative	No Detects; DL > RSL
1,2-Dichlorobenzene		0/10	0%			0.034	0.11	180		0	No	No Detects, All DL < RSL
1,3-Dichlorobenzene	1,2-Dichlorobenzene	0/10	0%			0.034	0.11	180		0	No	No Detects, All DL < RSL
1,4-Dichlorobenzene		0/10	0%			0.034	0.11	2.6		0	No	No Detects, All DL < RSL
2,2'-Chloroisopropylether		0/10	0%			6	8.9				No	No Detects, No RSL
2,3,4,6-Tetrachlorophenol		0/10	0%			6	8.9	190		0	No	No Detects, All DL < RSL
2,4,5-Trichlorophenol		0/10	0%			6	8.9	630		0	No	No Detects, All DL < RSL
2,4,6-Trichlorophenol		0/10	0%			6	8.9	6.3		9	Qualitative	No Detects; DL > RSL
2,4-Dichlorophenol		0/10	0%			6	8.9	19		0	No	No Detects, All DL < RSL
2,4-Dimethylphenol		0/10	0%			6	8.9	130		0	No	No Detects, All DL < RSL
2,4-Dinitrophenol		0/10	0%			12	18	13		9	Qualitative	No Detects; DL > RSL
2,6-Dinitrotoluene		0/10	0%			6	8.9	0.36		10	Qualitative	No Detects; DL > RSL
2-Chloronaphthalene		0/10	0%			6	8.9	480		0	No	No Detects, All DL < RSL

Table B-3 Soil COPC Selection

Parameter	Surrogate	Detection Frequency	% Detects	Min Detect (mg/kg)	Max Detect (mg/kg)	Min DL for ND (mg/kg)	Max DL for ND (mg/kg)	Res RSL [2] (mg/kg)	# Detects > RSL	# DL [3] > RSL	COPC?	Basis
2-Chlorophenol		0/10	0%			6	8.9	39		0	No	No Detects, All DL < RSL
2-Methylphenol		0/10	0%			6	8.9	320		0	No	No Detects, All DL < RSL
2-Nitroaniline		0/10	0%			6	8.9	63		0	No	No Detects, All DL < RSL
2-Nitrophenol	2,4-Dinitrophenol	0/10	0%			6	8.9	13		0	No	No Detects, All DL < RSL
3,3'-Dichlorobenzidine		0/10	0%			6	8.9	1.2		10	Qualitative	No Detects; DL > RSL
3/4-Methylphenol	3-Methylphenol	0/10	0%			6	8.9	320		0	No	No Detects, All DL < RSL
3-Nitroaniline		0/10	0%			6	8.9				No	No Detects, No RSL
4,6-Dinitro-2-methylphenol		0/10	0%			12	18	0.51		10	Qualitative	No Detects; DL > RSL
4-Bromophenyl-phenylether		0/10	0%			6	8.9				No	No Detects, No RSL
4-Chloro-3-methylphenol		0/10	0%			6	8.9	630		0	No	No Detects, All DL < RSL
4-Chloroaniline		0/10	0%			6	8.9	2.7		10	Qualitative	No Detects; DL > RSL
4-Chlorophenyl-phenylether	Methoxychlor	0/10	0%			6	8.9	32		0	No	No Detects, All DL < RSL
4-Nitroaniline		0/10	0%			6	8.9	25		0	No	No Detects, All DL < RSL
4-Nitrophenol	2,4-Dinitrophenol	0/10	0%			12	18	13		9	Qualitative	No Detects; DL > RSL
bis(2-Chloroethoxy) methane		0/10	0%			6	8.9	19		0	No	No Detects, All DL < RSL
bis(2-Chloroethyl) ether		0/10	0%			6	8.9	0.23		10	Qualitative	No Detects; DL > RSL
bis(2-Ethylhexyl) phthalate		0/10	0%			6	8.9	39		0	No	No Detects, All DL < RSL
Butylbenzylphthalate		0/10	0%			6	8.9	290		0	No	No Detects, All DL < RSL
Carbazole		0/10	0%			6	8.9				No	No Detects, No RSL
Cyclohexanone		0/9	0%			6	8.9	2800		0	No	No Detects, All DL < RSL
Dibenzofuran		0/11	0%			0.0026	8.9	7.8		4	Qualitative	No Detects; DL > RSL
Diethylphthalate		0/10	0%			6	8.9	5100		0	No	No Detects, All DL < RSL
Dimethylphthalate	<<subchronic>>	0/10	0%			6	8.9				No	No Detects, No RSL
Di-n-butylphthalate		0/10	0%			6	8.9	630		0	No	No Detects, All DL < RSL
Di-n-octylphthalate		0/10	0%			6	8.9	63		0	No	No Detects, All DL < RSL
Hexachlorobenzene		0/10	0%			6	8.9	0.21		10	Qualitative	No Detects; DL > RSL
Hexachlorobutadiene		0/10	0%			6	8.9	1.2		10	Qualitative	No Detects; DL > RSL
Hexachlorocyclopentadiene		0/10	0%			6	8.9	0.18		10	Qualitative	No Detects; DL > RSL
Hexachloroethane		0/10	0%			6	8.9	1.8		10	Qualitative	No Detects; DL > RSL
Isophorone		0/10	0%			6	8.9	570		0	No	No Detects, All DL < RSL
Nitrobenzene		0/10	0%			6	8.9	5.1		10	Qualitative	No Detects; DL > RSL
N-Nitroso-di-n-propylamine		0/10	0%			6	8.9	0.078		10	Qualitative	No Detects; DL > RSL
N-Nitrosodiphenylamine/Diphenylamine		0/10	0%			6	8.9	110		0	No	No Detects, All DL < RSL
Pentachlorophenol		0/10	0%			12	18	1		10	Qualitative	No Detects; DL > RSL
Phenol		0/10	0%			6	8.9	1900		0	No	No Detects, All DL < RSL
Pyridine		0/9	0%			6	8.9	7.8		4	Qualitative	No Detects; DL > RSL
VOCs												
1,1,1,2-Tetrachloroethane		0/2	0%			0.034	0.064	2		0	No	No Detects, All DL < RSL
1,1,1-Trichloroethane		0/10	0%			0.034	0.11	810		0	No	No Detects, All DL < RSL
1,1,2,2-Tetrachloroethane		0/10	0%			0.034	0.11	0.6		0	No	No Detects, All DL < RSL
1,1,2-Trichloroethane		0/10	0%			0.034	0.11	0.15		0	No	No Detects, All DL < RSL
1,1-Dichloroethane		0/10	0%			0.034	0.11	3.6		0	No	No Detects, All DL < RSL
1,1-Dichloroethene		0/10	0%			0.034	0.11	23		0	No	No Detects, All DL < RSL

Table B-3 Soil COPC Selection

Parameter	Surrogate	Detection Frequency	% Detects	Min Detect (mg/kg)	Max Detect (mg/kg)	Min DL for ND (mg/kg)	Max DL for ND (mg/kg)	Res RSL [2] (mg/kg)	# Detects > RSL	# DL [3] > RSL	COPC?	Basis
1,1-Dichloropropene	1,3-Dichloropropene	0/9	0%			0.034	0.11	1.8		0	No	No Detects, All DL < RSL
1,2,3-Trichloropropane		0/9	0%			0.034	0.11	0.0051		9	Qualitative	No Detects; DL > RSL
1,2,4-Trimethylbenzene		0/1	0%			0.06	0.06	30		0	No	No Detects, All DL < RSL
1,2-Dichloroethane		0/10	0%			0.034	0.11	0.46		0	No	No Detects, All DL < RSL
1,2-Dichloropropane		0/10	0%			0.034	0.11	1.6		0	No	No Detects, All DL < RSL
1,3,5-Trimethylbenzene		0/1	0%			0.06	0.06	27		0	No	No Detects, All DL < RSL
1,3-Dichloropropane		0/9	0%			0.034	0.11	160		0	No	No Detects, All DL < RSL
2,2-Dichloropropane	1,3-Dichloropropane	0/9	0%			0.034	0.11	160		0	No	No Detects, All DL < RSL
2-Butanone (MEK)		0/9	0%			0.34	1.1	2700		0	No	No Detects, All DL < RSL
2-Chloroethyl vinyl ether		0/1	0%			0.06	0.06				No	No Detects, No RSL
2-Chlorotoluene		0/9	0%			0.034	0.11	160		0	No	No Detects, All DL < RSL
2-Hexanone		0/9	0%			0.085	0.27	20		0	No	No Detects, All DL < RSL
4-Chlorotoluene		0/9	0%			0.034	0.11	160		0	No	No Detects, All DL < RSL
4-Methyl-2-pentanone		0/9	0%			0.085	0.27	3300		0	No	No Detects, All DL < RSL
Acetone		1/9	11%	0.35	0.35	0.34	1.1	6100	0	0	No	Detects < RSL
Benzene		0/10	0%			0.034	0.11	1.2		0	No	No Detects, All DL < RSL
Bromobenzene		0/9	0%			0.034	0.11	29		0	No	No Detects, All DL < RSL
Bromochloromethane		0/9	0%			0.034	0.11	15		0	No	No Detects, All DL < RSL
Bromodichloromethane		0/10	0%			0.034	0.11	0.29		0	No	No Detects, All DL < RSL
Bromoform		0/10	0%			0.034	0.11	19		0	No	No Detects, All DL < RSL
Bromomethane		0/10	0%			0.034	0.11	0.68		0	No	No Detects, All DL < RSL
Carbon disulfide		0/9	0%			0.085	0.27	77		0	No	No Detects, All DL < RSL
Carbon tetrachloride		0/10	0%			0.034	0.11	0.65		0	No	No Detects, All DL < RSL
Chlorobenzene		0/10	0%			0.034	0.11	28		0	No	No Detects, All DL < RSL
Chloroethane		0/10	0%			0.034	0.11	1400		0	No	No Detects, All DL < RSL
Chloroform		0/10	0%			0.034	0.11	0.32		0	No	No Detects, All DL < RSL
Chloromethane		0/10	0%			0.034	0.11	11		0	No	No Detects, All DL < RSL
cis-1,2-Dichloroethene		0/10	0%			0.034	0.11	16		0	No	No Detects, All DL < RSL
cis-1,3-Dichloropropene	1,3-Dichloropropene	0/10	0%			0.034	0.11	1.8		0	No	No Detects, All DL < RSL
Dibromochloromethane		0/10	0%			0.034	0.11	8.3		0	No	No Detects, All DL < RSL
Dibromomethane		0/9	0%			0.034	0.11	2.4		0	No	No Detects, All DL < RSL
Dichlorodifluoromethane		0/1	0%			0.06	0.06	8.7		0	No	No Detects, All DL < RSL
Dichloromethane (Methylene chloride)		0/10	0%			0.034	0.18	35		0	No	No Detects, All DL < RSL
Ethyl benzene		0/10	0%			0.034	0.11	5.8		0	No	No Detects, All DL < RSL
Isopropylbenzene		1/2	50%	0.0094	0.0094	0.06	0.06	190	0	0	No	Detects < RSL
m&p-Xylene	(m-Xylene)	0/1	0%			0.06	0.06	55		0	No	No Detects, All DL < RSL
n-Butylbenzene		0/1	0%			0.06	0.06	390		0	No	No Detects, All DL < RSL
n-Propylbenzene		0/1	0%			0.06	0.06	380		0	No	No Detects, All DL < RSL
o-Xylene		0/10	0%			0.034	0.11	65		0	No	No Detects, All DL < RSL
p-Isopropyltoluene	Toluene	0/1	0%			0.06	0.06	490		0	No	No Detects, All DL < RSL
sec-Butylbenzene		0/1	0%			0.06	0.06	780		0	No	No Detects, All DL < RSL
Styrene		0/10	0%			0.034	0.11	600		0	No	No Detects, All DL < RSL
tert-Butylbenzene		0/1	0%			0.06	0.06	780		0	No	No Detects, All DL < RSL

Table B-3 Soil COPC Selection

Parameter	Surrogate	Detection Frequency	% Detects	Min Detect (mg/kg)	Max Detect (mg/kg)	Min DL for ND (mg/kg)	Max DL for ND (mg/kg)	Res RSL [2] (mg/kg)	# Detects > RSL	# DL [3] > RSL	COPC?	Basis
Tetrachloroethene		0/10	0%			0.034	0.11	8.1		0	No	No Detects, All DL < RSL
Toluene		0/10	0%			0.034	0.11	490		0	No	No Detects, All DL < RSL
trans-1,2-Dichloroethene		0/10	0%			0.034	0.11	7		0	No	No Detects, All DL < RSL
trans-1,3-Dichloropropene	1,3-Dichloropropene	0/10	0%			0.034	0.11	1.8		0	No	No Detects, All DL < RSL
Trichloroethene		0/10	0%			0.034	0.11	0.41		0	No	No Detects, All DL < RSL
Trichlorofluoromethane		0/10	0%			0.034	0.11	2300		0	No	No Detects, All DL < RSL
Vinyl chloride		0/10	0%			0.034	0.11	0.059		6	Qualitative	No Detects; DL > RSL
Xylenes (unspecified)		0/9	0%			0.034	0.11	58		0	No	No Detects, All DL < RSL
Metals												
Aluminum		2/2	100%	1680	2200			7700	0		No	Detects < RSL
Antimony		0/2	0%			0.149	6	3.1		1	Qualitative	No Detects; DL > RSL
Arsenic		0/10	0%			0.445	6	0.68		9	Qualitative	No Detects; DL > RSL
Barium		10/10	100%	4.9	14			1500	0		No	Detects < RSL
Beryllium		0/2	0%			0.235	1	16		0	No	No Detects, All DL < RSL
Cadmium		0/10	0%			0.09	1	7.1		0	No	No Detects, All DL < RSL
Calcium		2/2	100%	387	15000						No	Essential Nutrient
Chromium	Chromium, III	10/10	100%	2.6	5.5			12000	0		No	Detects < RSL
Chromium	Chromium, VI	10/10	100%	2.6	5.5			0.3	10		**Yes**	Detects > RSL
Cobalt		1/2	50%	0.185	0.185	2	2	2.3	0	0	No	Detects < RSL
Copper		2/2	100%	6.47	8.7			310	0		No	Detects < RSL
Iron		2/2	100%	689	13000			5500	1		**Yes**	Detects > RSL
lead		22/22	100%	2.5	407			400	1		**Yes**	Detects > RSL
Magnesium		2/2	100%	94.9	790						No	Essential Nutrient
Manganese		2/2	100%	6.86	69			180	0		No	Detects < RSL
Mercury		118/120	98%	0.02	3700	0.6	0.66	1.1	101	0	**Yes**	Detects > RSL
Molybdenum		0/1	0%			2	2	39		0	No	No Detects, All DL < RSL
Nickel		2/2	100%	1.31	4.1			0.76	2		**Yes**	Detects > RSL
Potassium		1/2	50%	87.7	87.7	400	400				No	Essential Nutrient
Selenium		0/10	0%			0.302	8	39		0	No	No Detects, All DL < RSL
Silver		1/10	10%	0.194	0.194	0.5	2	39	0	0	No	Detects < RSL
Sodium		2/2	100%	64	1300						No	Essential Nutrient
Strontium		1/1	100%	250	250			4700	0		No	Detects < RSL
Tellurium		0/1	0%			10	10				No	No Detects, No RSL
Thallium		0/2	0%			0.12	20	0.078		2	Qualitative	No Detects; DL > RSL
Tin		0/1	0%			6	6	4700		0	No	No Detects, All DL < RSL
Titanium		1/1	100%	63	63						No	No RSL, 2 or Fewer Samples
Vanadium		2/2	100%	1.31	8.9			39	0		No	Detects < RSL
Yttrium		0/1	0%			2	2				No	No Detects, No RSL
Zinc		2/2	100%	9.15	100			2300	0		No	Detects < RSL

1) Surrogates not in parenthases taken from the approved surrogate list included in the OU3 HHBRA.
2) Residential RSLs from EPA RSL Tables Nov 2020; non-carcinogens evaluated for HQ of 0.1
3) Number of non-detected results with detection limits above the RSL.

ATTACHMENT C
CONCEPTUAL SITE MODELS

Figure 6
Human Health Conceptual Site Model - OU2 Groundwater

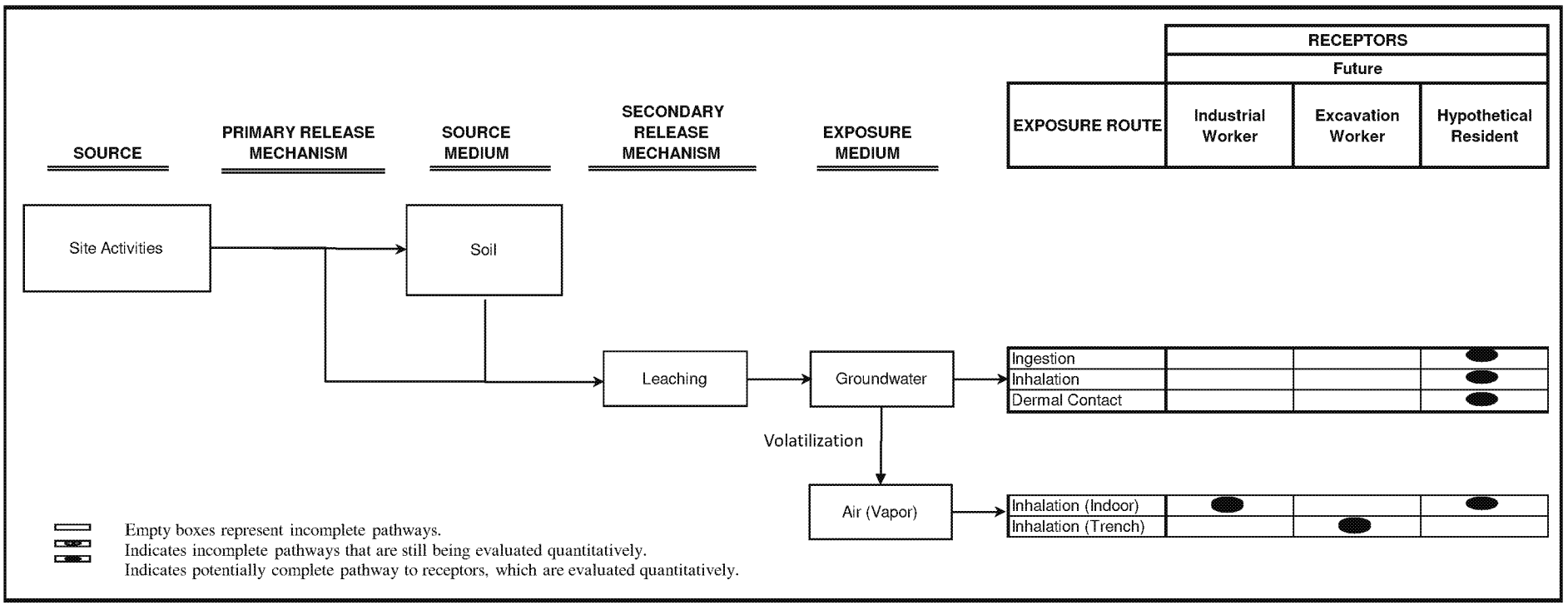
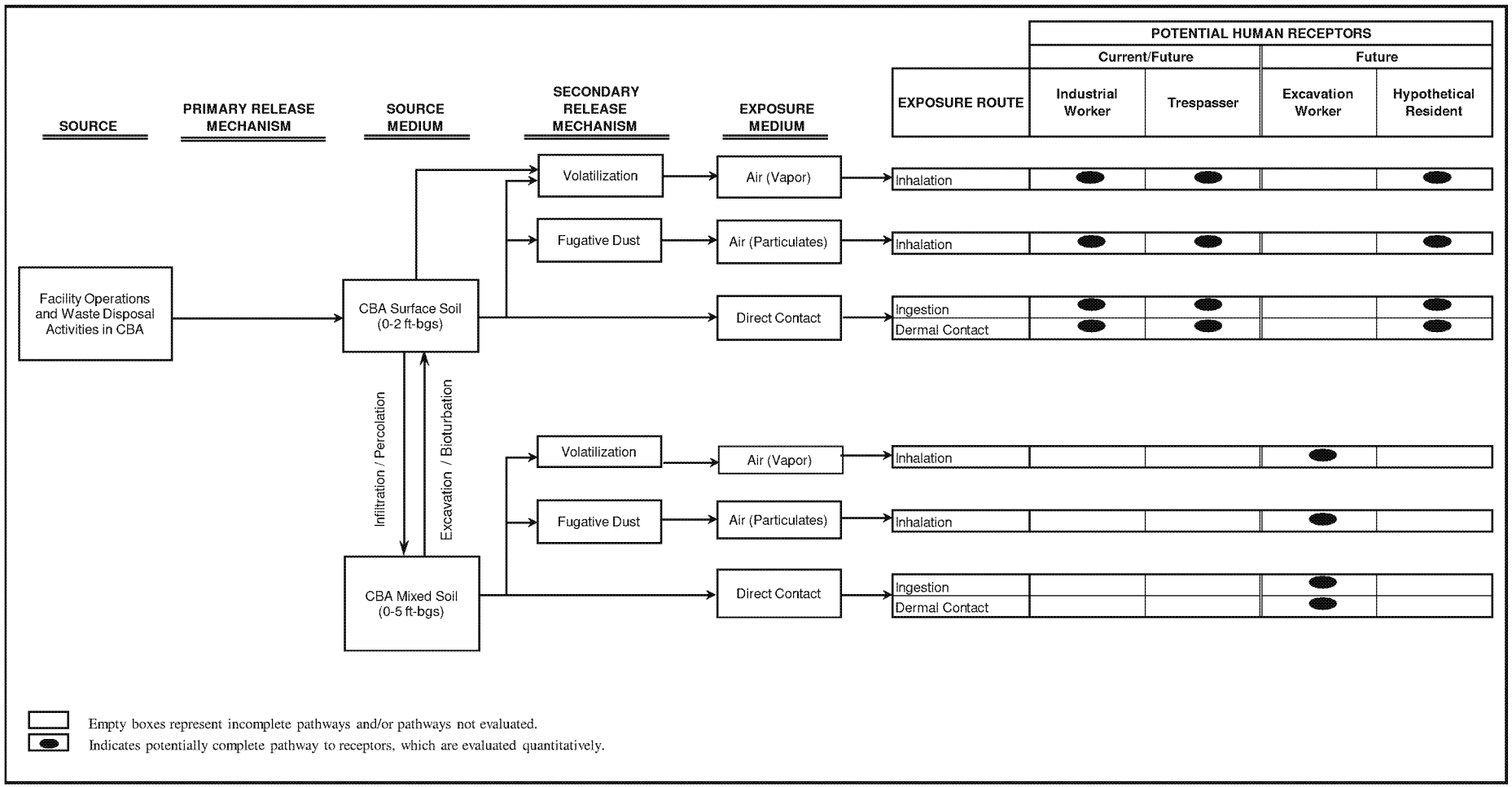


Figure 7
Human Health Conceptual Site Model - CBA Soil



ATTACHMENT D
EXPOSURE FACTORS AND EQUATIONS

Table D-1A. Receptor Exposure Factors and Intake Equations - Soil Industrial Worker (RME)

Parameter	Symbol	(units)	Current/Future Industrial Worker	Source
Average Daily Dose (noncancer)	ADD	(mg/kg-d)	eqn below	n/a
Lifetime Average Daily Dose (cancer)	LADD	(mg/kg-d)	eqn below	n/a
Concentration in Soil	CS (i.e., EPC)	(mg/kg)	chem-specific	n/a
Relative Bioavailability	RBA	(unitless)	chem-specific	n/a
Volatilization Factor	VF	(m^3/kg)	chem-specific	n/a
GI Tract Absorption	GIABS	(unitless)	chem-specific	n/a
Particulate Emission Factor	PEF	(m^3/kg)	1.36E+09	OU3
Body Weight	BW	(kg)	80	RSL
Exposure Frequency	EF	(days/year)	225	OU3
Exposure Duration	ED	(years)	25	RSL
Exposure Time	ET	(hr/dy)	8	RSL
Surface Area	SA	(cm^2)	3,527	RSL
Adherence Factor	AF	(mg/cm^2)	0.12	RSL
Conversion Factor	CF	(kg/mg)	1E-06	n/a
Conversion Factor Inh	CF_Inh	(dy/hr)	0.042	n/a
Conversion Factor Inh Carc	CF_InhC	(ug/mg)	1000	n/a
Soil Ingestion Rate	IR_S	(mg/dy)	100	RSL
Avg Time (non-cancer)	AT nc	(d)	9125	RSL
Avg Time (cancer)	AT c	(d)	25550	RSL

OU3: Value used in OU3 HHBRA (EPS, 2012)

RSL: EPA's Regional Screening Levels (RSLs) - User's Guide (Nov 2020)

n/a: Not applicable

Ingestion Noncancer

$$ADD = \frac{CS \times IRs \times CF \times EF \times ED \times RBA}{BW \times ATnc}$$

Ingestion Cancer - NonResident

$$LADD = \frac{CS \times EF \times ED \times IR \times CF \times RBA}{BW \times ATc}$$

Noncancer ADD = CS x RBA x 7.71E-07

Cancer LADD = CS x RBA x 2.75E-07

Inhalation Noncancer

$$ADD = \frac{CS \times CF_Inh \times EF \times ED \times ET \times (1/VF + 1/PEF)}{ATnc}$$

Inhalation Cancer

$$LADD = \frac{CS \times CF_Inh \times CF_InhC \times EF \times ED \times ET \times (1/VF + 1/PEF)}{ATc}$$

Note: VF not used if constituent is not volatile

Noncancer ADD = CS x (1/VF + 1/PEF) x 2.05E-01

Cancer LADD = CS x (1/VF + 1/PEF) x 7.34E+01

Dermal Noncancer

$$ADD = \frac{CS \times CF \times EF \times ED \times SA \times AF \times ABS}{BW \times ATnc \times GIABS}$$

Dermal Cancer

$$LADD = \frac{CS \times CF \times EF \times ED \times SA \times AF \times ABS}{BW \times ATc \times GIABS}$$

Noncancer ADD = (CS x ABS / GIABS) x 3.26E-06

Cancer LADD = CS x ABS / GIABS x 1.16E-06

Table D-1B. Receptor Exposure Factors and Intake Equations - Soil Industrial Worker (CTE)

Parameter	Symbol	(units)	Current/Future Industrial Worker	Source
Average Daily Dose (noncancer)	ADD	(mg/kg-d)	eqn below	n/a
Lifetime Average Daily Dose (cancer)	LADD	(mg/kg-d)	eqn below	n/a
Concentration in Soil	CS (i.e., EPC)	(mg/kg)	chem-specific	n/a
Relative Bioavailability	RBA	(unitless)	chem-specific	n/a
Volatilization Factor	VF	(m^3/kg)	chem-specific	n/a
GI Tract Absorption	GIABS	(unitless)	chem-specific	n/a
Particulate Emission Factor	PEF	(m^3/kg)	1.36E+09	OU3
Body Weight	BW	(kg)	80	RSL
Exposure Frequency	EF	(days/year)	219	OU3
Exposure Duration	ED	(years)	9	OU3
Exposure Time	ET	(hr/dy)	8	RSL
Surface Area	SA	(cm^2)	3,527	RSL
Adherence Factor	AF	(mg/cm^2)	0.02	OU3
Conversion Factor	CF	(kg/mg)	1E-06	n/a
Conversion Factor Inh	CF_Inh	(dy/hr)	0.042	n/a
Conversion Factor Inh Carc	CF_InhC	(ug/mg)	1000	n/a
Soil Ingestion Rate	IR_S	(mg/dy)	25	OU3
Avg Time (non-cancer)	AT nc	(d)	3285	RSL
Avg Time (cancer)	AT c	(d)	25550	RSL

OU3: Value used in OU3 HHBRA (EPS, 2012)

RSL: EPA's Regional Screening Levels (RSLs) - User's Guide (Nov 2020)

n/a: Not applicable

Ingestion Noncancer

$$ADD = \frac{CS \times IRs \times CF \times EF \times ED \times RBA}{BW \times ATnc}$$

Ingestion Cancer - NonResident

$$LADD = \frac{CS \times EF \times ED \times IR \times CF \times RBA}{BW \times ATc}$$

Noncancer ADD = CS x RBA x 1.88E-07

Cancer LADD = CS x RBA x 2.41E-08

Inhalation Noncancer

$$ADD = \frac{CS \times CF_Inh \times EF \times ED \times ET \times (1/VF + 1/PEF)}{ATnc}$$

Inhalation Cancer

$$LADD = \frac{CS \times CF_Inh \times CF_InhC \times EF \times ED \times ET \times (1/VF + 1/PEF)}{ATc}$$

Note: VF not used if constituent is not volatile

Noncancer ADD = CS x (1/VF + 1/PEF) x 2.00E-01

Cancer LADD = CS x (1/VF + 1/PEF) x 2.57E+01

Dermal Noncancer

$$ADD = \frac{CS \times CF \times EF \times ED \times SA \times AF \times ABS}{BW \times ATnc \times GIABS}$$

Dermal Cancer

$$LADD = \frac{CS \times CF \times EF \times ED \times SA \times AF \times ABS}{BW \times ATc \times GIABS}$$

Noncancer ADD = (CS x ABS / GIABS) x 5.29E-07

Cancer LADD = CS x ABS / GIABS x 6.80E-08

Table D-2A. Receptor Exposure Factors and Intake Equations - Soil Excavation Worker (RME)

Parameter	Symbol	(units)	Future Excavation Worker	Source
Average Daily Dose (noncancer)	ADD	(mg/kg-d)	eqn below	n/a
Lifetime Average Daily Dose (cancer)	LADD	(mg/kg-d)	eqn below	n/a
Concentration in Soil	CS (i.e., EPC)	(mg/kg)	chem-specific	n/a
Relative Bioavailability	RBA	(unitless)	chem-specific	n/a
Volatilization Factor*	VF	(m^3/kg)	chem-specific	n/a
Particulate Emission Factor	PEF	(m^3/kg)	1.06E+06	NCDEQ
GI Tract Absorption	GIABS	(unitless)	chem-specific	n/a
Body Weight	BW	(kg)	80	RSL
Exposure Frequency	EF	(days/year)	260	OU3
Weeks Work	EW	(wk/yr)	26	OU3
Exposure Duration	ED	(years)	1	RSL
Exposure Time	ET	(hr/dy)	8	RSL
Conversion Factor	CF	(kg/mg)	1E-06	n/a
Conversion Factor Inh	CF_Inh	(dy/hr)	0.042	n/a
Conversion Factor Inh Carc	CF_InhC	(ug/mg)	1000	n/a
Soil Ingestion Rate	IR_S	(mg/dy)	330	RSL
Surface Area	SA	(cm^2)	3,527	RSL
Adherence Factor	AF	(mg/cm^2)	0.3	RSL
Avg Time (non-cancer)=EWx7d/wxED	AT nc	(d)	182	RSL
Avg Time (cancer)	AT c	(d)	25550	RSL

OU3: Value used in OU3 HHBRA (EPS, 2012)

RSL: EPA's Regional Screening Levels (RSLs) - User's Guide (Nov 2020)

NCDEQ: North Carolina Department of Environmental Quality Risk Evaluation Equations and Calculations (https://files.nc.gov/ncdeq/Waste%20Management/DWM/SF/RiskBasedRemediation/20171024_RiskEvalEqnsandCalcs.pdf)

*For construction worker, use sub-chronic toxicity values where available and VFcw

n/a: Not applicable

Ingestion Noncancer

$$ADD = \frac{CS \times IRs \times CF \times EF \times ED \times RBA}{BW \times ATnc}$$

Ingestion Cancer

$$LADD = \frac{CS \times EF \times ED \times IR \times CF \times RBA}{BW \times ATc}$$

	Excav Worker
Noncancer ADD = CS x RBA x	5.89E-06
Cancer LADD = CS x RBA x	4.20E-08

Inhalation Noncancer

$$ADD = \frac{CS \times CF_Inh \times EF \times ED \times ET \times (1/VF + 1/PEF)}{ATnc}$$

Inhalation Cancer

$$LADD = \frac{CS \times CF_Inh \times CF_InhC \times EF \times ED \times ET \times (1/VF + 1/PEF)}{ATc}$$

Note: VF not used if constituent is not volatile

	Excav Worker
Noncancer ADD = CS x (1/VF + 1/PEF) x	4.76E-01
Cancer LADD = CS x (1/VF + 1/PEF) x	3.39E+00

Dermal Noncancer

$$ADD = \frac{CS \times CF \times EF \times ED \times SA \times AF \times ABS}{BW \times ATnc \times GIABS}$$

Dermal Cancer

$$LADD = \frac{CS \times CF \times EF \times ED \times SA \times AF \times ABS}{BW \times ATc \times GIABS}$$

	Excav Worker
Noncancer ADD = (CS x ABS / GIABS) x	1.89E-05
Cancer LADD = CS x ABS / GIABS x	1.35E-07

Table D-2B. Receptor Exposure Factors and Intake Equations - Soil Excavation Worker (CTE)

Parameter	Symbol	(units)	Future Excavation Worker	Source
Average Daily Dose (noncancer)	ADD	(mg/kg-d)	eqn below	n/a
Lifetime Average Daily Dose (cancer)	LADD	(mg/kg-d)	eqn below	n/a
Concentration in Soil	CS (i.e., EPC)	(mg/kg)	chem-specific	n/a
Relative Bioavailability	RBA	(unitless)	chem-specific	n/a
Volatilization Factor*	VF	(m^3/kg)	chem-specific	n/a
Particulate Emission Factor	PEF	(m^3/kg)	1.06E+06	NCDEQ
GI Tract Absorption	GIABS	(unitless)	chem-specific	n/a
Body Weight	BW	(kg)	80	RSL
Exposure Frequency	EF	(days/year)	260	OU3
Weeks Work	EW	(wk/yr)	12	OU3
Exposure Duration	ED	(years)	1	OU3
Exposure Time	ET	(hr/dy)	8	RSL
Conversion Factor	CF	(kg/mg)	1E-06	n/a
Conversion Factor Inh	CF_Inh	(dy/hr)	0.042	n/a
Conversion Factor Inh Carc	CF_InhC	(ug/mg)	1000	n/a
Soil Ingestion Rate	IR_S	(mg/dy)	100	OU3
Surface Area	SA	(cm^2)	1,900	OU3
Adherence Factor	AF	(mg/cm^2)	0.1	OU3
Avg Time (non-cancer)=EWx7d/wxED	AT nc	(d)	84	RSL
Avg Time (cancer)	AT c	(d)	25550	RSL

OU3: Value used in OU3 HHBRA (EPS, 2012)

RSL: EPA's Regional Screening Levels (RSLs) - User's Guide (Nov 2020)

NCDEQ: North Carolina Department of Environmental Quality Risk Evaluation Equations and Calculations (https://files.nc.gov/ncdeq/Waste%20Management/DWM/SF/RiskBasedRemediation/20171024_RiskEvalEqnsandCalcs.pdf)

*For construction worker, use sub-chronic toxicity values where available and VFcw

n/a: Not applicable

Ingestion Noncancer

$$ADD = \frac{CS \times IRs \times CF \times EF \times ED \times RBA}{BW \times ATnc}$$

Ingestion Cancer

$$LADD = \frac{CS \times EF \times ED \times IR \times CF \times RBA}{BW \times ATc}$$

	Excav Worker
Noncancer ADD = CS x RBA x	3.87E-06
Cancer LADD = CS x RBA x	1.27E-08

Inhalation Noncancer

$$ADD = \frac{CS \times CF_Inh \times EF \times ED \times ET \times (1/VF + 1/PEF)}{ATnc}$$

Inhalation Cancer

$$LADD = \frac{CS \times CF_Inh \times CF_InhC \times EF \times ED \times ET \times (1/VF + 1/PEF)}{ATc}$$

Note: VF not used if constituent is not volatile

	Excav Worker
Noncancer ADD = CS x (1/VF + 1/PEF) x	1.03E+00
Cancer LADD = CS x (1/VF + 1/PEF) x	3.39E+00

Dermal Noncancer

$$ADD = \frac{CS \times CF \times EF \times ED \times SA \times AF \times ABS}{BW \times ATnc \times GIABS}$$

Dermal Cancer

$$LADD = \frac{CS \times CF \times EF \times ED \times SA \times AF \times ABS}{BW \times ATc \times GIABS}$$

	Excav Worker
Noncancer ADD = (CS x ABS / GIABS) x	7.35E-06
Cancer LADD = CS x ABS / GIABS x	2.42E-08

Table D-3A. Receptor Exposure Factors and Intake Equations - Soil Adolescent Trespasser (RME)

Parameter	Symbol	(units)	Current Adolescent Trespasser	Future Adolescent Trespasser	Source
Average Daily Dose (noncancer)	ADD	(mg/kg-d)	eqn below	eqn below	n/a
Lifetime Average Daily Dose (cancer)	LADD	(mg/kg-d)	eqn below	eqn below	n/a
Concentration in Soil	CS (i.e., EPC)	(mg/kg)	chem-specific	chem-specific	n/a
Relative Bioavailability	RBA	(unitless)	chem-specific	chem-specific	n/a
Volatilization Factor	VF	(m^3/kg)	chem-specific	chem-specific	n/a
Particulate Emission Factor	PEF	(m^3/kg)	1.36E+09	1.36E+09	OU3
GI Tract Absorption	GIABS	(unitless)	chem-specific	chem-specific	n/a
Body Weight	BW	(kg)	45	45	OU3, R4
Exposure Frequency	EF	(days/year)	24	52	OU3
Exposure Duration	ED	(years)	10	10	OU3, R4
Exposure Time	ET	(hr/dy)	4	4	prof judg
Conversion Factor	CF	(kg/mg)	1E-06	1E-06	n/a
Conversion Factor Inh	CF_Inh	(dy/hr)	0.042	0.042	n/a
Conversion Factor Inh Carc	CF_InhC	(ug/mg)	1000	1000	n/a
Soil Ingestion Rate	IR_S	(mg/dy)	50	50	OU3
Surface Area	SA	(cm^2)	3,940	3,940	OU3
Adherence Factor	AF	(mg/cm^2)	0.2	0.2	OU3
Avg Time (non-cancer)	AT nc	(d)	3650	3650	RSL
Avg Time (cancer)	AT c	(d)	25550	25550	RSL

OU3: Value used in OU3 HHBRA (EPS, 2012)

RSL: EPA's Regional Screening Levels (RSLs) - User's Guide (Nov 2020)

R4: EPA Region 4 Guidance

n/a: Not applicable

Ingestion Noncancer

$$ADD = \frac{CS \times IRs \times CF \times EF \times ED \times RBA}{BW \times ATnc}$$

Ingestion Cancer

$$LADD = \frac{CS \times EF \times ED \times IR \times CF \times RBA}{BW \times ATc}$$

	Current	Future
Noncancer ADD = CS x RBA x	7.31E-08	1.58E-07
Cancer LADD = CS x RBA x	1.04E-08	2.26E-08

Inhalation Noncancer

$$ADD = \frac{CS \times CF_Inh \times EF \times ED \times ET \times (1/VF + 1/PEF)}{ATnc}$$

Inhalation Cancer

$$LADD = \frac{CS \times CF_Inh \times CF_InhC \times EF \times ED \times ET \times (1/VF + 1/PEF)}{ATc}$$

Note: VF not used if constituent is not volatile

	Current	Future
Noncancer ADD = CS x (1/VF + 1/PEF) x	1.10E-02	2.37E-02
Cancer LADD = CS x (1/VF + 1/PEF) x	1.57E+00	3.39E+00

Dermal Noncancer

$$ADD = \frac{CS \times CF \times EF \times ED \times SA \times AF \times ABS}{BW \times ATnc \times GIABS}$$

Dermal Cancer

$$LADD = \frac{CS \times CF \times EF \times ED \times SA \times AF \times ABS}{BW \times ATc \times GIABS}$$

	Current	Future
Noncancer ADD = (CS x ABS / GIABS) x	1.15E-06	2.49E-06
Cancer LADD = CS x ABS / GIABS x	1.64E-07	3.56E-07

Table D-3B. Receptor Exposure Factors and Intake Equations - Soil Adolescent Trespasser (CTE)

Parameter	Symbol	(units)	Current Adolescent Trespasser	Future Adolescent Trespasser	Source
Average Daily Dose (noncancer)	ADD	(mg/kg-d)	eqn below	eqn below	n/a
Lifetime Average Daily Dose (cancer)	LADD	(mg/kg-d)	eqn below	eqn below	n/a
Concentration in Soil	CS (i.e., EPC)	(mg/kg)	chem-specific	chem-specific	n/a
Relative Bioavailability	RBA	(unitless)	chem-specific	chem-specific	n/a
Volatilization Factor	VF	(m^3/kg)	chem-specific	chem-specific	n/a
Particulate Emission Factor	PEF	(m^3/kg)	1.36E+09	1.36E+09	OU3
GI Tract Absorption	GIABS	(unitless)	chem-specific	chem-specific	n/a
Body Weight	BW	(kg)	45	45	OU3, R4
Exposure Frequency	EF	(days/year)	6	6	OU3
Exposure Duration	ED	(years)	10	10	OU3, R4
Exposure Time	ET	(hr/dy)	4	4	prof judg
Conversion Factor	CF	(kg/mg)	1E-06	1E-06	n/a
Conversion Factor Inh	CF_Inh	(dy/hr)	0.042	0.042	n/a
Conversion Factor Inh Carc	CF_InhC	(ug/mg)	1000	1000	n/a
Soil Ingestion Rate	IR_S	(mg/dy)	10	10	OU3
Surface Area	SA	(cm^2)	2,750	2,750	OU3
Adherence Factor	AF	(mg/cm^2)	0.1	0.1	OU3
Avg Time (non-cancer)	AT nc	(d)	3650	3650	RSL
Avg Time (cancer)	AT c	(d)	25550	25550	RSL

OU3: Value used in OU3 HHBRA (EPS, 2012)

RSL: EPA's Regional Screening Levels (RSLs) - User's Guide (Nov 2020)

R4: EPA Region 4 Guidance

n/a: Not applicable

Ingestion Noncancer

$$ADD = \frac{CS \times IRs \times CF \times EF \times ED \times RBA}{BW \times ATnc}$$

Ingestion Cancer

$$LADD = \frac{CS \times EF \times ED \times IR \times CF \times RBA}{BW \times ATc}$$

	Current	Future
Noncancer ADD = CS x RBA x	3.65E-09	3.65E-09
Cancer LADD = CS x RBA x	5.22E-10	5.22E-10

Inhalation Noncancer

$$ADD = \frac{CS \times CF_Inh \times EF \times ED \times ET \times (1/VF + 1/PEF)}{ATnc}$$

Inhalation Cancer

$$LADD = \frac{CS \times CF_Inh \times CF_InhC \times EF \times ED \times ET \times (1/VF + 1/PEF)}{ATc}$$

Note: VF not used if constituent is not volatile

	Current	Future
Noncancer ADD = CS x (1/VF + 1/PEF) x	2.74E-03	2.74E-03
Cancer LADD = CS x (1/VF + 1/PEF) x	3.91E-01	3.91E-01

Dermal Noncancer

$$ADD = \frac{CS \times CF \times EF \times ED \times SA \times AF \times ABS}{BW \times ATnc \times GIABS}$$

Dermal Cancer

$$LADD = \frac{CS \times CF \times EF \times ED \times SA \times AF \times ABS}{BW \times ATc \times GIABS}$$

	Current	Future
Noncancer ADD = (CS x ABS / GIABS) x	1.00E-07	1.00E-07
Cancer LADD = CS x ABS / GIABS x	1.44E-08	1.44E-08

Table D-4A. Receptor Exposure Factors and Intake Equations - Soil Hypothetical Residents (RME)

Parameter	Symbol	(units)	Hypothetical Child Resident	Hypothetical Adult Resident	Hypothetical Resident-Adjusted	Source
Average Daily Dose (noncancer)	ADD	(mg/kg-d)	eqn below	eqn below	eqn below	n/a
Lifetime Average Daily Dose (cancer)	LADD	(mg/kg-d)	eqn below	eqn below	eqn below	n/a
Concentration in Soil	CS (i.e., EPC)	(mg/kg)	chem-specific	chem-specific	chem-specific	n/a
Relative Bioavailability	RBA	(unitless)	chem-specific	chem-specific	chem-specific	n/a
Volatilization Factor	VF	(m^3/kg)	chem-specific	chem-specific	chem-specific	n/a
Particulate Emission Factor	PEF	(m^3/kg)	1.36E+09	1.36E+09	1.36E+09	OU3
GI Tract Absorption	GIABS	(unitless)	chem-specific	chem-specific	chem-specific	n/a
Body Weight	BW	(kg)	15	80	n/a	RSL
Exposure Frequency	EF	(days/year)	350	350	350	RSL
Exposure Duration	ED	(years)	6	26	26	RSL
Exposure Time	ET	(hr/dy)	24	24	24	RSL
Conversion Factor	CF	(kg/mg)	1E-06	1E-06	1E-06	n/a
Conversion Factor Inh	CF_Inh	(dy/hr)	0.042	0.042	0.042	n/a
Conversion Factor Inh Carc	CF_InhC	(ug/mg)	1000	1000	1000	n/a
Soil Ingestion Rate	IR_S	(mg/dy)	200	100	n/a	RSL
Age Adjusted Ingestion Rate	IFs	(mg/kg)	n/a	n/a	36,750	RSL
Age Adjusted Ingestion Rate - Mutagenic	IFsm	(mg/kg)	n/a	n/a	166833	RSL
Surface Area	SA	(cm^2)	2,373	6,032	n/a	RSL
Age Adjusted Dermal Contact Factor	DFS	(mg/kg)	n/a	n/a	103,390	RSL
Age Adjusted Dermal Contact Factor - Mutagenic	DFSm	(mg/kg)	n/a	n/a	428,260	RSL
Inhalation Mutagenic Exposure	EXm	(days)	n/a	n/a	25,200	RSL
Adherence Factor	AF	(mg/cm^2)	0.2	0.07	n/a	RSL
Avg Time (non-cancer)	AT nc	(d)	2190	9490	9490	RSL
Avg Time (cancer)	AT c	(d)	25550	25550	25550	RSL

OU3: Value used in OU3 HHBRA (EPS, 2012)

RSL: EPA's Regional Screening Levels (RSLs) - User's Guide (Nov 2020)

n/a: Not applicable

Ingestion Noncancer

$$ADD = \frac{CS \times IRs \times CF \times EF \times ED \times RBA}{BW \times ATnc}$$

Ingestion Cancer Adj

$$LADD = \frac{CS \times IFs \times CF \times RBA}{ATc}$$

Ingestion - Mutagenic

$$\frac{CS \times IFsm \times CF \times RBA}{ATc}$$

	Child	Adult	Res-Adj
Noncancer ADD = CS x RBA x	1.28E-05	1.20E-06	NA
Cancer LADD = CS x RBA x	NA	NA	1.44E-06
Mutagenic Cancer LADD = CS x RBA x	NA	NA	6.53E-06

Note: EPA RSL equations for TCE and vinyl chloride will be used if COPCs

Inhalation Noncancer

$$ADD = \frac{CS \times CF_Inh \times EF \times ED \times ET \times (1/VF + 1/PEF)}{ATnc}$$

Inhalation Cancer

$$LADD = \frac{CS \times CF_Inh \times CF_InhC \times EF \times ED \times ET \times (1/VF + 1/PEF)}{ATc}$$

Inhalation Cancer - Mutagenic

$$\frac{CS \times CF_InhC \times EXm \times (1/VF + 1/PEF)}{ATc}$$

Note: VF not used if constituent is not volatile

Exm =∑ (ET x EF x ED x CF_Inh x Factor

	Child	Adult	Res-Adj
Noncancer ADD = CS x (1/VF + 1/PEF) x	9.59E-01	9.59E-01	NA
Cancer LADD = CS x (1/VF + 1/PEF) x	NA	NA	3.56E+02
Mutagenic Cancer LADD = CS x (1/VF + 1/PEF) x	NA	NA	9.86E+02

Note: EPA RSL equations for TCE and vinyl chloride will be used if COPCs

Dermal Noncancer

$$ADD = \frac{CS \times CF \times EF \times ED \times SA \times AF \times ABS}{BW \times ATnc \times GIABS}$$

Dermal Cancer - Resident -Adjusted

$$LADD = \frac{CS \times CF \times DFS \times ABS}{ATc \times GIABS}$$

Dermal Cancer - Res. Mutagenic

$$\frac{CS \times CF \times DFSm \times ABS}{ATc \times GIABS}$$

	Child	Adult	Res-Adj
Noncancer ADD = (CS x ABS / GIABS) x	3.03E-05	5.06E-06	NA
Cancer LADD = CS x ABS / GIABS x	NA	NA	4.05E-06
Mutagenic Cancer LADD = CS x SFo / GIABS x	NA	NA	1.68E-05

Note: EPA RSL equations for TCE and vinyl chloride will be used if COPCs

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Table D-4B. Receptor Exposure Factors and Intake Equations - Soil Hypothetical Residents (CTE)

Parameter	Symbol	(units)	Hypothetical Child Resident	Hypothetical Adult Resident	Hypothetical Resident-Adjusted	Source
Average Daily Dose (noncancer)	ADD	(mg/kg-d)	eqn below	eqn below	eqn below	n/a
Lifetime Average Daily Dose (cancer)	LADD	(mg/kg-d)	eqn below	eqn below	eqn below	n/a
Concentration in Soil	CS (i.e., EPC)	(mg/kg)	chem-specific	chem-specific	chem-specific	n/a
Relative Bioavailability	RBA	(unitless)	chem-specific	chem-specific	chem-specific	n/a
Volatilization Factor	VF	(m^3/kg)	chem-specific	chem-specific	chem-specific	n/a
Particulate Emission Factor	PEF	(m^3/kg)	1.36E+09	1.36E+09	1.36E+09	OU3
GI Tract Absorption	GIABS	(unitless)	chem-specific	chem-specific	chem-specific	n/a
Body Weight	BW	(kg)	15	80	n/a	RSL
Exposure Frequency	EF	(days/year)	350	350	350	RSL
Exposure Duration	ED	(years)	2	9	9	OU3
Exposure Time	ET	(hr/dy)	24	24	24	RSL
Conversion Factor	CF	(kg/mg)	1E-06	1E-06	1E-06	n/a
Conversion Factor Inh	CF_Inh	(dy/hr)	0.042	0.042	0.042	n/a
Conversion Factor Inh Carc	CF_InhC	(ug/mg)	1000	1000	1000	n/a
Soil Ingestion Rate	IR_S	(mg/dy)	100	50	n/a	OU3
Age Adjusted Ingestion Rate	IFs	(mg/kg)	n/a	n/a	36,750	RSL
Age Adjusted Ingestion Rate - Mutagenic	IFsm	(mg/kg)	n/a	n/a	166833	RSL
Surface Area	SA	(cm^2)	1,800	4,800	n/a	OU3
Age Adjusted Dermal Contact Factor	DFS	(mg/kg)	n/a	n/a	103,390	RSL
Age Adjusted Dermal Contact Factor - Mutagenic	DFSm	(mg/kg)	n/a	n/a	428,260	RSL
Inhalation Mutagenic Exposure	EXm	(days)	n/a	n/a	25,200	RSL
Adherence Factor	AF	(mg/cm^2)	0.2	0.07	n/a	RSL
Avg Time (non-cancer)	AT nc	(d)	730	3285	3285	RSL
Avg Time (cancer)	AT c	(d)	25550	25550	25550	RSL

OU3: Value used in OU3 HHBRA (EPS, 2012)

RSL: EPA's Regional Screening Levels (RSLs) - User's Guide (Nov 2020)

n/a: Not applicable

Ingestion Noncancer

$$ADD = \frac{CS \times IRs \times CF \times EF \times ED \times RBA}{BW \times ATnc}$$

Ingestion Cancer Adj

$$LADD = \frac{CS \times IFs \times CF \times RBA}{ATc}$$

Ingestion - Mutagenic

$$\frac{CS \times IFsm \times CF \times RBA}{ATc}$$

	Child	Adult	Res-Adj
Noncancer ADD = CS x RBA x	6.39E-06	5.99E-07	NA
Cancer LADD = CS x RBA x	NA	NA	1.44E-06
Mutagenic Cancer LADD = CS x RBA x	NA	NA	6.53E-06

Note: EPA RSL equations for TCE and vinyl chloride will be used if COPCs

Inhalation Noncancer

$$ADD = \frac{CS \times CF_Inh \times EF \times ED \times ET \times (1/VF + 1/PEF)}{ATnc}$$

Inhalation Cancer

$$LADD = \frac{CS \times CF_Inh \times CF_InhC \times EF \times ED \times ET \times (1/VF + 1/PEF)}{ATc}$$

Inhalation Cancer - Mutagenic

$$\frac{CS \times CF_InhC \times EXm \times (1/VF + 1/PEF)}{ATc}$$

Note: VF not used if constituent is not volatile

Exm =∑ (ET x EF x ED x CF_Inh x Factor

	Child	Adult	Res-Adj
Noncancer ADD = CS x (1/VF + 1/PEF) x	9.59E-01	9.59E-01	NA
Cancer LADD = CS x (1/VF + 1/PEF) x	NA	NA	1.23E+02
Mutagenic Cancer LADD = CS x (1/VF + 1/PEF) x	NA	NA	9.86E+02

Note: EPA RSL equations for TCE and vinyl chloride will be used if COPCs

Dermal Noncancer

$$ADD = \frac{CS \times CF \times EF \times ED \times SA \times AF \times ABS}{BW \times ATnc \times GIABS}$$

Dermal Cancer - Resident -Adjusted

$$LADD = \frac{CS \times CF \times DFS \times ABS}{ATc \times GIABS}$$

Dermal Cancer - Res. Mutagenic

$$\frac{CS \times CF \times DFSm \times ABS}{ATc \times GIABS}$$

	Child	Adult	Res-Adj
Noncancer ADD = (CS x ABS / GIABS) x	2.30E-05	4.03E-06	NA
Cancer LADD = CS x ABS / GIABS x	NA	NA	4.05E-06
Mutagenic Cancer LADD = CS x SFo / GIABS x	NA	NA	1.68E-05

Note: EPA RSL equations for TCE and vinyl chloride will be used if COPCs

Table D-5A. Receptor Exposure Factors and Intake Equations - Groundwater Hypothetical Residents (RME)

Parameter	Symbol	(units)	Hypothetical Child Resident	Hypothetical Adult Resident	Hypothetical Resident-Adjusted	Source
Concentration in GW	CW (i.e., EPC)	(µg/L)	chem-specific	chem-specific	chem-specific	n/a
DA event	DA_event	(µg/cm^2-ev)	chem-specific	chem-specific	chem-specific	n/a
GI Tract Absorption	GIABS	(unitless)	chem-specific	chem-specific	chem-specific	n/a
Andleman Vol Factor	K	(L/m^3)	0.5	0.5	0.5	RSL
Body Weight	BW	(kg)	15	80	n/a	RSL
Event Frequency	EvF	(events/day)	1	1	1	RSL
Exposure Frequency	EF	(days/year)	350	350	350	OU3
Exposure Duration	ED	(years)	6	26	26	RSL
Exposure Time	ET	(hr/day)	24	24	24	RSL
Exposure Time GW	ETev	(hr/event)	0.54	0.71	n/a	RSL
Exposure Time Dermal/Water - Age-adjusted	tevent-adj	(hr/event)	n/a	n/a	0.68	RSL
Water Ingestion Rate - Age-adjusted	IFW	(L/kg)	n/a	n/a	394	RSL
Water Ingestion Rate - Mutagenic	IFWm	(L/kg)	n/a	n/a	1020	RSL
Water dermal contact factor - Age-adjusted	DFW	(cm2-ev/kg)	n/a	n/a	1989015	RSL eqn
Water dermal contact factor - Mutagenic	DFWm	(cm2-ev/kg)	n/a	n/a	6441633	RSL eqn
Inhalation Mutagenic Exposure	EXm	(days)	n/a	n/a	25200	RSL
Conversion Factor	CF	(mg/ug)	1.00E-03	1.00E-03	1.00E-03	n/a
Conversion Factor Inh	CF_Inh	(dy/hr)	0.0417	0.0417	0.0417	n/a
Water Ingestion Rate	IR_w	(L/dy)	0.78	2.5	n/a	RSL
Skin Surface Area	SA	(cm^2)	6,365	9,652	n/a	RSL
Avg Time (non-cancer)	AT nc	(d)	2190	9490	n/a	RSL
Avg Time (cancer)	AT c	(d)	25550	25550	25550	RSL

OU3: Value used in OU3 HHBRA (EPS, 2012)

RSL: EPA's Regional Screening Levels (RSLs) - User's Guide (Nov 2020)

n/a: Not applicable

Ingestion Noncancer

$$ADD = \frac{CW \times IR \times CF \times EF \times ED \times RBA}{BW \times ATnc}$$

Ingestion Cancer -Adj

$$LADD = \frac{Cw \times IFW \times CF \times RBA}{Atc}$$

Ingestion Cancer - Mutagenic

$$\frac{Cw \times IFWm \times CF \times RBA}{Atc}$$

	Child	Adult	Resident-Adj
Noncancer ADD = CW x RBA x	4.99E-05	3.00E-05	NA
Cancer LADD = CW x RBA x	NA	NA	1.54E-05
Mutagenic Cancer LADD = CW x RBA x	NA	NA	3.99E-05

Note: EPA RSL equations for TCE and vinyl chloride will be used if COPCs

Inhalation Noncancer

$$ADD = \frac{CW \times K \times ET \times CF_Inh \times CF \times EF \times ED}{ATnc \times RfC}$$

Inhalation Cancer - Adj

$$LADD = \frac{CW \times K \times ET \times CF_Inh \times EF \times (ED)}{ATc}$$

Inhalation Cancer - Mutagenic

$$\frac{CW \times K \times Exm}{ATc}$$

$$EXm = \sum (ET \times EF \times ED \times CF_Inh \times Factor)$$

	Child	Adult	Resident-Adj
Noncancer ADD = CW x	4.79E-04	4.79E-04	NA
Cancer LADD = CW x	NA	NA	1.78E-01
Mutagenic Cancer LADD = CW x	NA	NA	4.93E-01

Note: EPA RSL equations for TCE and vinyl chloride will be used if COPCs

Dermal Noncancer

$$ADD = \frac{DAev \times SA \times EvF \times EF \times ED \times CF}{BW \times ATnc \times GIABS}$$

Dermal Cancer -Adj

$$LADD = \frac{DAev \times DFW \times CF}{ATc \times GIABS}$$

Dermal Cancer - Mutagenic

$$\frac{DAevt \times DFWm \times CF}{ATc \times GIABS}$$

	Child	Adult	Resident-Adj
Noncancer ADD = DAev / GIABS x	4.07E-01	1.16E-01	NA
Cancer LADD = DAev / GIABS x	NA	NA	7.78E-02
Mutagenic Cancer LADD = DAev / GIABS x	NA	NA	2.52E-01

Note: EPA RSL equations for TCE and vinyl chloride will be used if COPCs

$$IFW = \frac{EFc \times EDc \times IRWc}{BWc} + \frac{Efa \times Eda \times IRWa}{Bwa}$$

$$DFW\ (ev\text{-}cm2/kg) = \frac{EFc \times EVc \times EDc \times SAc}{BWc} + \frac{EFa \times EVa \times EDa \times SAa}{Bwa}$$

$$t_{event\text{-}adj} = \frac{t_{event\text{-}c} \times EDc + t_{event\text{-}a} * EDa}{EDc + EDa}$$

Table D-5B. Receptor Exposure Factors and Intake Equations - Groundwater Hypothetical Residents (CTE)

Parameter	Symbol	(units)	Hypothetical Child Resident	Hypothetical Adult Resident	Hypothetical Resident-Adjusted	Source
Concentration in GW	CW (i.e., EPC)	(µg/L)	chem-specific	chem-specific	chem-specific	n/a
DA event	DA_event	(µg/cm^2-ev)	chem-specific	chem-specific	chem-specific	n/a
GI Tract Absorption	GIABS	(unitless)	chem-specific	chem-specific	chem-specific	n/a
Andleman Vol Factor	K	(L/m^3)	0.5	0.5	0.5	RSL
Body Weight	BW	(kg)	15	80	n/a	RSL
Event Frequency	EvF	(events/day)	1	1	1	RSL
Exposure Frequency	EF	(days/year)	350	350	350	OU3
Exposure Duration	ED	(years)	2	9	9	OU3
Exposure Time	ET	(hr/day)	24	24	24	RSL
Exposure Time GW	ETev	(hr/event)	0.33	0.25	n/a	RAGSE
Exposure Time Dermal/Water - Age-adjusted	tevent-adj	(hr/event)	n/a	n/a	0.26	RSL eqn
Water Ingestion Rate - Age-adjusted	IFW	(L/kg)	n/a	n/a	68	RSL eqn
Water Ingestion Rate - Mutagenic	IFWm	(L/kg)	n/a	n/a	546	RSL eqn
Water dermal contact factor - Age-adjusted	DFW	(cm2-ev/kg)	n/a	n/a	677081	RSL eqn
Water dermal contact factor - Mutagenic	DFWm	(cm2-ev/kg)	n/a	n/a	6441633	RSL eqn
Inhalation Mutagenic Exposure	EXm	(days)	n/a	n/a	25200	RSL eqn
Conversion Factor	CF	(mg/ug)	1.00E-03	1.00E-03	1.00E-03	n/a
Conversion Factor Inh	CF_Inh	(dy/hr)	0.0417	0.0417	0.0417	n/a
Water Ingestion Rate	IR_w	(L/dy)	0.45	1.2	n/a	EFH
Skin Surface Area	SA	(cm^2)	6,365	9,652	n/a	RSL
Avg Time (non-cancer)	AT nc	(d)	730	3285	n/a	RSL
Avg Time (cancer)	AT c	(d)	25550	25550	25550	RSL

OU3: Value used in OU3 HHBRA (EPS, 2012)

RSL: EPA's Regional Screening Levels (RSLs) - User's Guide (Nov 2020)

EFH: Exposure Factors Handbook (EPA, 2011)

a) Weighted mean of consumer-only ingestion of drinking water (Table 3-1)

b) Average residential occupancy period (Table 16-5). Assume 3 as a child and 9 as an adult.

RAGSE: Risk Assessment Guidance for Superfund: Part E (EPA, 2004)

n/a: Not applicable

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Ingestion Noncancer

$$ADD = \frac{CW \times IR \times CF \times EF \times ED \times RBA}{BW \times ATnc}$$

Ingestion Cancer -Adj

$$LADD = \frac{Cw \times IFW \times CF \times RBA}{Atc}$$

Ingestion Cancer - Mutagenic

$$\frac{Cw \times IFWm \times CF \times RBA}{Atc}$$

	Child	Adult	Resident-Adj
Noncancer ADD = CW x RBA x	2.88E-05	1.44E-05	NA
Cancer LADD = CW x RBA x	NA	NA	2.67E-06
Mutagenic Cancer LADD = CW x RBA x	NA	NA	2.14E-05

Note: EPA RSL equations for TCE and vinyl chloride will be used if COPCs

Inhalation Noncancer

$$ADD = \frac{CW \times K \times ET \times CF_Inh \times CF \times EF \times ED}{ATnc \times RfC}$$

Inhalation Cancer - Adj

$$LADD = \frac{CW \times K \times ET \times CF_Inh \times EF \times (ED)}{ATc}$$

Inhalation Cancer - Mutagenic

$$\frac{CW \times K \times Exm}{ATc}$$

$$EXm = \sum (ET \times EF \times ED \times CF_Inh \times Factor)$$

	Child	Adult	Resident-Adj
Noncancer ADD = CW x	4.79E-04	4.79E-04	NA
Cancer LADD = CW x	NA	NA	6.16E-02
Mutagenic Cancer LADD = CW x	NA	NA	4.93E-01

Note: EPA RSL equations for TCE and vinyl chloride will be used if COPCs

Dermal Noncancer

$$ADD = \frac{DAev \times SA \times EvF \times EF \times ED \times CF}{BW \times ATnc \times GIABS}$$

Dermal Cancer -Adj

$$LADD = \frac{DAev \times DFW \times CF}{ATc \times GIABS}$$

Dermal Cancer - Mutagenic

$$\frac{DAevt \times DFWm \times CF}{ATc \times GIABS}$$

	Child	Adult	Resident-Adj
Noncancer ADD = DAev / GIABS x	4.07E-01	1.16E-01	NA
Cancer LADD = DAev / GIABS x	NA	NA	2.65E-02
Mutagenic Cancer LADD = DAev / GIABS x	NA	NA	2.52E-01

Note: EPA RSL equations for TCE and vinyl chloride will be used if COPCs

$$IFW = \frac{EFc \times EDc \times IRWc}{BWc} + \frac{Efa \times Eda \times IRWa}{Bwa}$$

$$DFW\ (ev\text{-}cm2/kg) = \frac{EFc \times EVc \times EDc \times SAc}{BWc} + \frac{EFa \times EVa \times EDa \times SAa}{Bwa}$$

$$t_{event\text{-}adj} = \frac{t_{event\text{-}c} \times EDc + t_{event\text{-}a} * EDa}{EDc + EDa}$$

Table D-6A. Receptor Exposure Factors and Intake Equations - Excavation Worker - Trench Vapors (RME)

Parameter	Symbol	(units)	Excavation Worker	Source
Concentration in Air in Trench	Ct	($\mu g/m^3$)	chem-specific; eqn below	n/a
Concentration in Groundwater	CW	(µg/L)	chem-specific	n/a
Volitilization Factor	VF	(L/m^3)	chem-specific; eqn below	n/a
Trench Length	TL	(m)	2.44	VADEQ
Trench Depth	TD	(m)	1.524	OU3 (5 ft)
Trench Width	TW	(m)	0.91	VADEQ
Trench Area (L x W)	A	(m^2)	2.2204	n/a
Trench Volume (L x W x D)	TV	(m^3)	3.38	n/a
Trench Fraction of Floor for Entry	F	n/a	1	VADEQ
Trench Air Changes per Hour	ACH	(h^{-1})	2	VADEQ
Ideal Gas Constant	R	(atm-m^3/mol-K)	8.2E-05	VADEQ
Average System Absolute Temperature	T	(K)	298	VADEQ
Henry's Law Constant	Hi	(atm-m^3/mol)	chem-specific	n/a
Molecular Weight of H2O	MW_{H2O}	(g/mol)	18	VADEQ
Molecular Weight of O2	MW_{O2}	(g/mol)	32	VADEQ
Molecular Weight of Constituent	MWi	(g/mol)	chem-specific	n/a
Liquid-phase Mass Transfer Coefficient of Oxygen	k_{LO2}	(cm/s)	0.002	VADEQ
Gas-phase Mass Transfer Coefficient of Oxygen	k_{GO2}	(cm/s)	0.8333	VADEQ
Exposure Duration	ED	(yrs)	1	RSL
Exposure Frequency	EF	(days/year)	260	OU3
Exposure Frequency Trench = 20% x EF	EFt	(days/year)	130	prof judg
Weeks Worked	EW	(weeks/yr)	26	OU3
Exposure Time	ET	(hr/day)	8	RSL
Exposure Time Trench = 1/2 ET	ETt	(hr/day)	4	VADEQ
Conversion Factor	CF	(mg/ug)	1.00E-03	n/a
Conversion Factor Inh	CF_Inh	(dy/hr)	0.0417	n/a
Averaging Time Noncancer = EW x 7 x ED	ATnc	(days)	182	RSL
Avg Time (cancer)	AT c	(d)	25550	RSL

OU3: Value used in OU3 HHBRA (EPS, 2012)

RSL: EPA's Regional Screening Levels (RSLs) - User's Guide (Nov 2020)

VADEQ: Virginia Unified Risk Assessment Model - VURAM User Guide (VADEQ, 2018)

Note: Risks to Industrial Workers and Residents will be calculated using the VISL calculator and the above site-specific exposure factors utilized for other media.

$$ADD = \frac{Ct \times ETt \times CF_Inh \times CF \times EFt \times ED}{Atnc} \qquad LADD = \frac{Ct \times ETt \times CF_Inh \times EFt \times ED}{ATc}$$

Noncancer ADD = Ct x 1.19E-04

Cancer LADD = Ct x 8.48E-04

Ctrench = CW x VF

Due to shallow groundwater table (less than 15ft), assume groundwater pooling in the trench (VADEQ)

VF (Equation 2-4 from VADEQ)

$$VF = \frac{(Ki \times A \times F \times 10^{-3}\ L/cm^3 \times 10^4\ cm^2/m^2 \times 3600\ s/hr)}{ACH \times V}$$

$$Ki = \frac{1}{[(1/k_{iL}) + [(R*T)/(Hi * k_{iG})]]}$$ Overall Mass Transfer Coefficient (cm/s)

$$k_{iL} = MW_{O2}/MWi)^{0.5} * (T/298) * K_{LO2}$$ Liquid-phase Mass Transfer Coefficient (cm/s)

$$k_{iG} = (MW_{H2O}/MWi)^{0.335} * (T/298)^{1.005} \times K_{gH2O}$$ Gas-phase Mass Transfer Coefficient (cm/s)

Table D-6B. Receptor Exposure Factors and Intake Equations - Excavation Worker - Trench Vapors (CTE)

Parameter	Symbol	(units)	Excavation Worker	Source
Concentration in Air in Trench	Ct	($\mu g/m^3$)	chem-specific; eqn below	n/a
Concentration in Groundwater	CW	(µg/L)	chem-specific	n/a
Volitilization Factor	VF	(L/m^3)	chem-specific; eqn below	n/a
Trench Length	TL	(m)	2.44	VADEQ
Trench Depth	TD	(m)	1.524	OU3 (5 ft)
Trench Width	TW	(m)	0.91	VADEQ
Trench Area (L x W)	A	(m^2)	2.2204	n/a
Trench Volume (L x W x D)	TV	(m^3)	3.38	n/a
Trench Fraction of Floor for Entry	F	n/a	1	VADEQ
Trench Air Changes per Hour	ACH	(h^{-1})	2	VADEQ
Ideal Gas Constant	R	(atm-m^3/mol-K)	8.2E-05	VADEQ
Average System Absolute Temperature	T	(K)	298	VADEQ
Henry's Law Constant	Hi	(atm-m^3/mol)	chem-specific	n/a
Molecular Weight of H2O	MW_{H2O}	(g/mol)	18	VADEQ
Molecular Weight of O2	MW_{O2}	(g/mol)	32	VADEQ
Molecular Weight of Constituent	MWi	(g/mol)	chem-specific	n/a
Liquid-phase Mass Transfer Coefficient of Oxygen	k_{LO2}	(cm/s)	0.002	VADEQ
Gas-phase Mass Transfer Coefficient of Oxygen	k_{GO2}	(cm/s)	0.8333	VADEQ
Exposure Duration	ED	(yrs)	1	RSL
Exposure Frequency	EF	(days/year)	260	OU3
Exposure Frequency Trench = 20% x EF	EFt	(days/year)	130	prof judg
Weeks Worked	EW	(weeks/yr)	12	OU3
Exposure Time	ET	(hr/day)	8	RSL
Exposure Time Trench = 1/2 ET	ETt	(hr/day)	4	VADEQ
Conversion Factor	CF	(mg/ug)	1.00E-03	n/a
Conversion Factor Inh	CF_Inh	(dy/hr)	0.0417	n/a
Averaging Time Noncancer = EW x 7 x ED	ATnc	(days)	84	RSL
Avg Time (cancer)	AT c	(d)	25550	RSL

OU3: Value used in OU3 HHBRA (EPS, 2012)

RSL: EPA's Regional Screening Levels (RSLs) - User's Guide (Nov 2020)

VADEQ: Virginia Unified Risk Assessment Model - VURAM User Guide (VADEQ, 2018)

Note: Risks to Industrial Workers and Residents will be calculated using the VISL calculator and the above site-specific exposure factors utilized for other media.

$$ADD = \frac{Ct \times ETt \times CF_Inh \times CF \times EFt \times ED}{Atnc} \qquad LADD = \frac{Ct \times ETt \times CF_Inh \times EFt \times ED}{ATc}$$

Noncancer ADD = Ct x 2.58E-04

Cancer LADD = Ct x 8.48E-04

Ctrench = CW x VF

Due to shallow groundwater table (less than 15ft), assume groundwater pooling in the trench (VADEQ)

VF (Equation 2-4 from VADEQ)

$$VF = \frac{(Ki \times A \times F \times 10^{-3}\ L/cm^3 \times 10^4\ cm^2/m^2 \times 3600\ s/hr)}{ACH \times V}$$

$$Ki = \frac{1}{[(1/k_{iL}) + [(R*T)/(Hi * k_{iG})]]}$$ Overall Mass Transfer Coefficient (cm/s)

$$k_{iL} = MW_{O2}/MWi)^{0.5} * (T/298) * K_{LO2}$$ Liquid-phase Mass Transfer Coefficient (cm/s)

$$k_{iG} = (MW_{H2O}/MWi)^{0.335} * (T/298)^{1.005} \times K_{gH2O}$$ Gas-phase Mass Transfer Coefficient (cm/s)