RESPONSE TO COMMENTS

ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT COMMENTS

Response to Alabama Department of Environmental Management Comments
Draft Baseline Ecological Risk Assessment Problem Formulation and Study Design for Baby Bains Gap Road Ranges
Fort McClellan, Alabama (dated January 2006)

Comments from Stephen A. Cobb, ADEM Chief – Governmental Hazardous Waste Branch, Land Division, dated May 26, 2006.

GENERAL COMMENTS

Comment 1: **The document does not mention the large range receptor scenario. Due to the complexity of the sites and their proximity to other environmental suspect areas, the Department recommends that the large range receptor scenario be evaluated.**

Response 1: The "large range receptor scenario" is not explicitly assessed in the Baby Bains Gap Road Ranges Problem Formulation and Study Design report because the receptor groups that will be assessed in the BERA represent the ecological communities, populations, and feeding guilds that are potentially maximally exposed to site-related COPECs. All other receptor groups (including the "large range receptor scenario"), while potentially exposed to COPECs, would be expected to be exposed to a lesser degree than those assessed in the subject report. Although large range receptors could potentially be exposed to COPECs from a number of contaminated sites at FTMC, they also could be exposed to large swaths of un-impacted areas, thus lessening their total exposure potential. In fact, because large areas of un-impacted habitat exist at FTMC, an argument can be made that "large range receptors" could selectively avoid the "impacted" areas at FTMC, thus further reducing their exposure potential. The "large range receptor scenario" is not assessed because it does not represent any of the potentially maximally exposed receptor groups at FTMC.

Comment 2: **Use of the Slippage Test and Wilcoxon Rank Sum Test may not be appropriate as a screening tool. The Department has previously noted these evaluations used as a weight of evidence tool in risk management. Please address.**

Response 2: The Slippage Test and Wilcoxon Rank Sum Test were used as tier 2 of the three-tier background screening process that was negotiated and agreed upon with the BCT, and has been in use for a number of years at FTMC. The three-tier background screening process continues to evolve and was again revised during the most recent BCT meeting (February 2006) and the Slippage Test is no longer in use and has been replaced by the Hot Measurement Test. Site-to-background comparisons are currently being conducted at FTMC using the agreed upon methodology outlined in the meeting minutes from the February 2006 BCT meeting.

Comment 3: **In order to evaluate the effects of Constituents of Potential Ecological Concern (COPECs) on terrestrial plants, a 28-day toxicity test (germination, growth, biomass) is proposed with perennial ryegrass (*Loliumperenne*) from nine soil samples that contain varying concentrations of lead (as well as a reference location). Previous studies have demonstrated that soil properties (particularly organic carbon and cation exchange capacity) significantly effect lead and copper phytoavailability and phytotoxicity. In order to accurately interpret toxicity test results and assess risk to vegetation from metal COPECs (especially copper and lead), it is recommended that cation exchange capacity (CEC) also be determined for each soil sample (organic carbon is already proposed to be measured). Please address.**

Response 3: Plant toxicity tests, by their very nature, take into account the total organic carbon content, cation exchange capacity, and every other soil property relevant to plant uptake and toxicity. That is what makes toxicity testing using site-specific environmental media so valuable in ecological risk assessment. The toxicity tests incorporate all of the soil properties and all of the plant susceptibilities into a single test. It isn't necessarily important from a risk assessment perspective what controls the bioavailability of a given COPEC in soil, only whether the COPEC causes adverse effects at a given concentration or not. Various soil properties governing the bioavailability, mobility, etc. of the COPECs in soil are more appropriately addressed in the feasibility study, if one is warranted at a given site.

Comment 4: **In order to assess contamination effects on terrestrial invertebrates, a 28-day toxicity test is proposed using earthworms (Eisenia fetida) as the test species. Surviving worms will subsequently be analyzed to determine COPEC concentrations within invertebrates that may be consumed by insectivorous/omnivorous birds and mammals. The applicability of using a 28-day exposure period to assess bioaccumulation within terrestrial invertebrates that may be exposed for a considerably longer duration needs additional justification. Although the bioaccumulation testing will indicate whether bioaccumulation of metals from soil to invertebrates is occurring, the detected levels may not be indicative of actual exposure levels by foraging birds and mammals at the ranges. Sampling and analysis of invertebrates (e.g., earthworms) within soils at the ranges would appear to be a more accurate representation of actual exposure by foraging insectivores and omnivores. It is recommended that either such sampling be conducted or conservative, literature-based soil to invertebrate Bioaccumulation Factors (BAFs) be used (Sample et al., 1998 - Development and Validation of Bioaccumulation Models for Earthworms). Conversely, additional justification could be provided (if available) to support the contention that a**

28-day exposure period is sufficient for metals to reach equilibrium between earthworm tissue and the soil. Please provide necessary justification.

Response 4: Standard USEPA (1996) and ASTM (1998) toxicity testing and bioaccumulation protocols prescribe a 28-day exposure period for assessing chronic effects and bioaccumulation in earthworms. In order to reduce uncertainties and increase standardization, these widely accepted test protocols were proposed for use at the Baby Bains Gap Road ranges at FTMC. Additionally, these same test protocols were used in the BERA for the IMR and BGR ranges at FTMC. The 28-day exposure period has been shown to be a sufficient period of time for earthworm tissue concentrations of COPECs to reach equilibrium with the surrounding soil. In a study of the bioaccumulation of hydrophobic chemicals in earthworms, steady state was reached within days of test initiation and was maintained for the duration of the test (100 days) (Belfroid, et al., 1995).

The use of literature-based BAFs is not appropriate at the BERA stage of the risk assessment process because the overall premise of the BERA is to reduce uncertainties in the risk assessment process by determining site-specific toxic responses and bioavailabilities of COPECs, not introduce additional uncertainties.

Comment 5: In order to assess contamination effects on aquatic invertebrates, an acute 10-day survival and growth toxicity test is proposed using a midge species (*Chironomus riparius*). The proposed acute toxicity test will not be adequate to determine whether sediment COPECs may exert chronic affects to benthic invertebrates. Ideally, chronic toxicity tests should be conducted with one or preferably two test organisms (e.g., *Chironomus sp., Hyalella azteca*). Exposure periods should be a minimum of 42 days for the test organisms in order to be representative of chronic exposure. It is recommended that a chronic exposure test be conducted with *Hyalella azteca* as this species is generally considered to be more sensitive to metal contaminants than *Chironomus*. Please address.

Response 5: The assessment of aquatic invertebrates specifically, and the sediment in the creeks at the Baby Bains Gap Road ranges in general, will be accomplished using several assessment techniques, not only toxicity testing. Benthic community structure will be assessed using RBPII methodologies which take into account long-term, chronic effects of contaminants and physical structure of the aquatic environment. Toxicity testing will assess the potential effects of sediment COPECs on the survival and growth of the benthic midge *Chironomus riparius*. Additionally, chironomid tissues from the toxicity tests will be analyzed for COPECs to determine the potential for bioaccumulation of sediment COPECs into emergent benthic invertebrates. The ten-day chironomid survival and growth test was proposed for the Baby Bains Gap Road Range BERA because the test needed to serve several purposes. The test was designed to measure the endpoints of mortality and growth in order to assess the potential for toxic effects in benthic invertebrates from exposure to COPECs in sediment. The chironomid test was also designed to determine the potential for bioaccumulation of COPECs in emergent benthic invertebrate tissues. Emergent benthic invertebrate accumulation of COPECs is an important measurement endpoint for the riparian food web because it provides the critical link between COPECs in sediment and food web transfer to invertivorous mammals and birds that feed on the emergent benthic invertebrates. Assessment of non-emergent benthic invertebrates (i.e. *Hyalella azteca*) for bioaccumulation would not be appropriate for this assessment since the assessment endpoint of interest is the "survival, growth, and reproduction of riparian invertivorous small mammals and birds at the BBGR ranges." The invertivorous mammals and birds of interest at the BBGR ranges were assumed to feed only on emergent benthic invertebrates and not on invertebrates that remain in the sediment. The combination of assessment and measurement endpoints proposed for the assessment of sediment in the creeks at the Baby Bains Gap Road ranges will adequately address both acute and chronic effects potentially posed by COPECs in sediment.

Comment 6: Surviving chironomids are subsequently proposed to be analyzed to determine COPEC concentrations within aquatic invertebrates that may be consumed by birds and mammals foraging along the streams associated with the Baby Bain Gap ranges. There are several concerns with this proposed bioaccumulation test. First, the mass of *Chironomus riparius* generated by each replicate is unlikely to be adequate for determining COPEC concentrations. Secondly, the applicability of using a 10-day exposure period to assess bioaccumulation within aquatic invertebrates that may be exposed for a considerably longer duration needs additional justification. Although the bioaccumulation testing will indicate whether bioaccumulation of COPECs from sediment to aquatic invertebrates is occurring, the detected levels are unlikely to be indicative of actual COPEC levels present within invertebrates within contaminated portions of the streams. Sampling and analysis of aquatic invertebrates (e.g., mayflies, caddisflies) within the stream sampling locations would appear to be a more accurate representation of actual exposure by insectivorous birds and mammals that forage on emerging aquatic invertebrates. It is recommended that either such sampling be conducted or conservative, literature-based sediment to invertebrate BAFs be used (ORNL, 1998 - *Biota Sediment Accumulation Factors for Invertebrates: Review and Recommendations for the Oak Ridge Reservation*). Please address.

Response 6: Chironomid tissue analysis was conducted for the BERA for the Bains Gap Road and Iron Mountain Road ranges at FTMC. Sufficient tissue mass was generated for chemical analysis. Since similar analyses are proposed for the BBGR ranges, it is assumed that sufficient tissue mass will also be generated for this assessment.

ASTM E-1688-00 Standard Guide for Determination of the Bioaccumulation of Sediment-Associated Contaminants by Benthic Invertebrates provides information of percent of steady-state reported for benthic invertebrates at 10 and 28 days. For copper and lead, steady state of 75% and 81% for, respectively, at 10 days and 100% for both after 28 days. It further states that "for data to be acceptable in quantitative risk assessment, the resulting tissue residues should be within 80% of the steady-state tissue concentrations."

SPECIFIC COMMENTS

Comment 1: **Page 2-10, ¶6, Section 2.1.5. Pentachlorophenol is incorrectly identified as a polycyclic aromatic hydrocarbon (PAH). Please correct the text.**

Response 1: Pentachlorophenol will be referred to as a semi-volatile organic compound.

Comment 2: **Page 2-11, ¶7, Section 2.2. The text states that constituents were not detected at elevated concentrations from the South Branch of Cane Creek or Ingram Creek tributaries. However, based on the surface water sampling results presented in Tables 2-7 and 2-8, several constituents were detected at concentrations greater than ecological screening values and/or background threshold values. The inconsistencies should be corrected in the revised document. Additional discussion regarding the elimination of surface water COPECs should be provided in the text. In addition, the text should clarify whether metal concentrations represent total recoverable or dissolved concentrations. Please correct and clarify as necessary.**

Response 2: The reviewer is referred to the SLERA for the Baby Bains Gap Road Ranges presented in the *Remedial Investigation Report Baby Bains Gap Road Ranges* (Shaw, 2004). The SLERA discusses in detail the selection of COPECs in each environmental medium and the rationale for selection or elimination. As presented in the SLERA and summarized in Tables 2-7 and 2-8 of the *Baseline Ecological Risk Assessment Problem Formulation and Study Design for the Baby Bains Gap Road Ranges* report (Shaw, 2006), all of the constituents detected in surface water were eliminated from consideration as COPECs for one or more of the following reasons:

1. Maximum detected concentration is less than ESV;
2. Essential macro-nutrient;
3. Maximum detected concentration is less than background threshold value;
4. Statistical comparison indicates that detected concentrations are similar to background concentrations; and
5. Geochemical evaluation indicates that constituent is naturally occurring.

Based on the information presented in the SLERA and summarized in the Problem Formulation and Study Design report, there are no inconsistencies relative to the selection of COPECs. Furthermore, the information presented in Tables 2-7 and 2-8 of the Problem Formulation and Study Design report are consistent with the text and additional discussion is not warranted.

All inorganic constituent concentrations in surface water are total recoverable concentrations.

Comment 3: **<u>Page 2-12, ¶1, Section 2.3.</u> No constituents were retained as COPECs for the South Branch of Cane Creek tributaries. However, lead was detected at elevated concentrations above the ecological screening benchmark and the background threshold value. Please identify lead as a COPEC in the revised text.**

Response 3: Because lead in sediment from the South Branch of Cane Creek was determined to be statistically similar to background concentrations of lead in sediment at FTMC, lead was not specifically identified as a COPEC in sediment from the South Branch of Cane Creek (Table 2-9). However, lead was identified as a COPEC in sediment from the Ingram Creek tributaries; therefore, it was included in all of the analyses and tests involving sediment from both the Ingram Creek tributaries and the South Branch of Cane Creek tributaries.

Comment 4: **<u>Pages 4-4, ¶4 and 4-5, ¶1.</u>**

- **Please provide literature reference sources for the information fate and transport properties of antimony.**

- **Bodek *et al.* (1988) indicates that antimony oxides are highly soluble, which suggests environmental mobility. Callahan *et al.* (1979) indicates that antimony may have an affinity for clay and other mineral surfaces, consistent with what is asserted in the text; however; Bodek *et al.* (1988) indicates that quantitative data on sorption of antimony is lacking. Callahan *et al.* (1979) also indicate that the confidence in the sorption data is low, as well as for other potentially important fate processes. The text should note the uncertainty in the understanding of fate mechanisms for antimony. Please address.**

- **Agency for Toxic Substance and Disease Registry (ATSDR) (1992) also notes that little is known of the adsorptive behavior of antimony, its compounds, and ions. Some studies suggest that antimony is fairly mobile under diverse environmental conditions, while others suggest that it is strongly adsorbed to soil. The text should emphasize the uncertainty in the understanding of fate mechanisms for antimony. Please modify the text.**

- **ATSDR (1992) notes that antimony has an anionic character and it is consequently expected to have little affinity for organic carbon. Please address.**

Response 4: References will be added for the information presented in the fate and transport section for antimony.

Text will be added regarding the uncertainty of the fate mechanisms for antimony.

Comment 5: Page 4-5, ¶1.

- **ATSDR (1 992) indicates that antimony does not appear to bioconcentrate appreciably in fish and aquatic organisms. Bioconcentration factors for antimony ranged from 0.15 to 390. Please include additional information on the bio-uptake potential for antimony in the text.**

- **Please address the uncertainty in the understanding of antimony fate mechanisms in the text. According to ATSDR (1992), the chemical and biochemical transformations of antimony in natural waters are not well understood. There are only a few studies that describe the antimony species present in various systems and their transformations. Information concerning the behavior of antimony in sediment is extremely limited. Data concerning antimony fate processes in soil are similarly limited.**

Response 5: Information regarding the bio-uptake of antimony will be included in the fate and transport section for antimony.

Text will be added regarding the uncertainty of the fate mechanisms for antimony.

Comment 6: Page 4-5, ¶3.

- **Please clarify the range of distribution coefficients (Kd) for beryllium to help illustrate the limited mobility of beryllium in the text.**

- **Please note the uncertainty in the understanding of sorption as a fate mechanism for beryllium given the limited available data on sorption constants in the text.**

Response 6: Additional information regarding the fate and transport of beryllium will be included in the text.

Comment 7: <u>Page 4-5, ¶5.</u> **In the text, please clarify that beryllium in natural water systems is found predominantly in particulate rather than dissolved form (Callahan et al. 1979).**

Response 7: The text will be modified to include a statement about beryllium being found predominantly in the particulate rather than dissolved form in natural waters.

Comment 8: <u>Page 4-6, ¶1.</u>

- **Please note that sorption is probably the most important controlling mechanism in determining copper mobility in the environment.**
- **The text should clarify the role of pH, if any, on sorption tendencies in soil and sediment. Please clarify.**
- **Please clarify the range of partition coefficients for copper to help illustrate the limited mobility of copper relative to various environmental materials (organic material, iron hydroxides, etc.).**

Response 8: Text will be added to the fate and transport section for copper to note the importance of sorption in copper mobility in the environment and the role of pH in controlling sorption. Copper partition coefficients will also be discussed.

Comment 9: <u>Page 4-6, ¶3.</u> **ATSDR (2004) reports that the Bioconcentration Factor (BCF) in fish obtained in field studies ranges from 10 to 667. While still indicating a low potential for bioconcentration, information from the updated ATSDR profile should be incorporated into the text of the revised document. Please include this information.**

Response 9: BCF information from the updated toxicological profile for copper (ATSDR, 2004) will be incorporated into the fate and transport section for copper.

Comment 10: <u>Pages 4-6, ¶4 and 4-7 ¶1.</u> **Please discuss in the text the potential for copper to adsorb to colloidal matter and the associated impact on mobility in aqueous media.**

Response 10: A discussion will be added to the text regarding adsorption of copper to colloidal matter.

Comment 11: <u>Page 4-7, ¶4.</u> **ATSDR (2005) indicates that the downward movement of elemental lead and inorganic lead compounds from soil to groundwater by leaching is very slow under most natural conditions except for highly acidic situations. The conditions that induce leaching are the presence of lead in soil at concentrations that either approach or exceed the Cation Exchange Capacity (CEC) of the soil, the presence of materials in soil that are capable of forming soluble chelates with lead, and a decrease in the pH of the**

leaching solution (e.g., acid rain). Please acknowledge the conditions under which lead could be mobilized from site soil in the text.

Response 11: Conditions conducive to lead leaching from soil to groundwater will be discussed in the fate and transport section for lead.

Comment 12: **<u>Page 4-7, ¶5.</u> ATSDR (2005) indicates that plants and animals may bioconcentrate lead, but biomagnification is not expected. ATSDR (2005) notes that the highest lead concentrations are found in aquatic and terrestrial organisms with habitats near lead mining, smelting, and refining facilities; storage battery recycling plants; areas affected by high automobile and truck traffic; sewage sludge and spoil disposal areas; sites where dredging has occurred; *areas of heavy hunting and fishing (lead from spent shot or sinkers*) [emphasis added]; and in urban and industrialized areas. Bioavailability of lead in soil to plants is limited because of the strong adsorption of lead to soil organic matter, but the bioavailability increases as the pH and the organic matter content of the soil are reduced. Plants grown in lead-contaminated soils were shown to accumulate low levels of lead in the edible portions of the plant from adherence of dusts and translocation into the tissues. Please edit the text to elaborate on the potential for bio-uptake of lead.**

Response 12: Bio-uptake of lead will be discussed in the fate and transport section for lead.

Comment 13: **<u>Page 4-8, ¶2 and 3.</u> The text should note the distribution constants (Kd values) for zinc in soil range widely from 0.1 to 8,000 L/kg. In addition, zinc in a soluble form (e.g., zinc sulfate) is moderately mobile in most soils. However, relatively little land-disposed zinc at waste sites is in the soluble form. Thus, mobility is limited by a slow rate of dissolution. Consequently, movement towards groundwater is expected to be slow unless zinc is applied to soil in soluble form (such as in agricultural applications) or accompanied by corrosive substances (such as in mine tailings). Soil conditions not suitable for zinc sorption may lead to leaching. Low pH (pH<7) and high ionic strength of the leaching solution favor desorption (ATSDR, 2005b). Please clarify.**

Response 13: The mobility of zinc in soil will be discussed in the fate and transport section for zinc.

Comment 14: **<u>Page 7-9, ¶1, Section 7.2.1.</u> The concentrations of COPECs within terrestrial plants will be estimated using plant BCFs available in the literature. It is unclear why COPEC concentrations within the perennial ryegrass toxicity test are not proposed to be determined by analyzing seedling tissues after the toxicity test has concluded. Please provide the rationale for using the literature-based values rather than analyzing the**

perennial ryegrass or actually collecting plant samples from the ranges to more accurately determine COPEC concentrations.

Response 14: Based on comments received from USEPA Region 4, chemical analysis of terrestrial plants collected from on-site locations and a reference location will be conducted to determine soil-to-plant BAFs and also for use as input to the terrestrial food web model.

Comment 15: **Page 7-11, ¶3, Section 7.2.1. Please see General Comment #3 regarding the applicability of using a 28-day exposure period to represent bioaccumulation rates within terrestrial invertebrates.**

Response 15: General Comment No. 3 refers to terrestrial plant toxicity tests, not terrestrial invertebrates. Please see response to General Comment No. 4 with regard to toxicity testing and bioaccumulation tests with terrestrial invertebrates.

Comment 16: **Page 7-11, ¶6, Section 7.2.2. The benthic invertebrate community structure within samples located within the South Branch of Cane Creek and Ingram Creek (and their tributaries) will be compared to non-impacted reference stream. Please identify the location of the reference stream sampling station(s). In addition, please clarify whether the reference stream community will include both perennial and intermittent sampling stations or just an intermittent stream sample.**

Response 16: The reference stream will be located after reconnaissance conducted during the sampling of South Branch of Cane Creek and Ingram Creek and their tributaries at the Baby Bains Gap Road Ranges. It is likely that the reference stream will be the same stream used for the IMR and BGR range BERA sampling which is a tributary to Choccolocco Creek that flows in an easterly direction along Bains Gap Road, immediately east of the Bains Gap gate to the Main Post.

Since benthic communities within the South Branch of Cane Creek and Ingram Creek and their tributaries will only be assessed at locations where these streams are perennial in nature, the reference stream will also be perennial.

Comment 17: **Page 7-13, ¶2, Section 7.2.2. Please see General Comment #4 regarding the applicability of using an acute exposure period to represent bioaccumulation rates within aquatic invertebrates.**

Response 17: General Comment No. 4 refers to toxicity tests using terrestrial invertebrates, not aquatic invertebrates. Please see response to General Comment No. 5 with regard to aquatic invertebrate toxicity testing.

Comment 18: **Page 7-14, ¶4, Section 7.3.1. The proposed study to quantify COPEC concentrations within earthworms does not represent a measurement**

endpoint for evaluating the assessment endpoint of survival/growth of the terrestrial invertebrate community. If the measured levels of COPECs within the earthworm tissues are compared to invertebrate tissue thresholds associated with adverse effects or no adverse effects then it would represent a measurement endpoint. Otherwise, it simply represents a method to estimate exposure to the assessment endpoint of survival, growth and reproduction of insectivorous small mammals and birds. Please correct the text to reflect this important distinction.

Response 18: Strictly speaking, the reviewer is correct. The quantification of COPEC concentrations in earthworm tissues would more accurately address the assessment endpoint of "survival, growth, and reproduction of terrestrial invertivorous small mammals and birds at the BBGR ranges." COPEC concentrations in earthworm tissues provide important input to the calculation of soil-to-terrestrial invertebrate BAFs and also to the terrestrial food web model used to assess terrestrial invertivorous small mammals and birds.

Comment 19: **Page 7-15, ¶3, Section 7.3.2. Similarly to the preceding comment, the proposed study to quantify COPEC concentrations within chironomids does not represent a measurement endpoint for evaluating the assessment endpoint of survival/growth/reproduction of the benthic terrestrial invertebrate community. If the measured levels of COPECs within the chironomid tissues are compared to invertebrate tissue thresholds associated with adverse effects or no adverse effects then it would represent a measurement endpoint. Otherwise, it simply represents a method to estimate exposure to the assessment endpoint of survival, growth and reproduction of insectivorous small mammals and birds. Please correct the text.**

Response 19: Agreed. Similar to the response to Specific Comment No. 18, the quantification of COPEC concentrations in chironomid tissues would more accurately address the assessment endpoint of "survival, growth, and reproduction of riparian invertivorous small mammals and birds at the BBGR ranges." COPEC concentrations in chironomid tissues provide important input to the calculation of sediment-to-benthic invertebrate BAFs and also to the riparian food web model used to assess riparian invertivorous small mammals and birds.

Comment 20: **Page 8-3, Bullet 5, Section 8.3. Revise the typographical error of alpha-chlordane to gamma-chlordane.**

Response 20: Agreed. Alpha-chlordane will be revised to gamma-chlordane in the fifth bullet on page 8-3.

Comment 21: **<u>Page 9-3, ¶6, Section 9.1.3.</u> The text incorrectly states that the perennial ryegrass test is for 21 days. Please correct the exposure duration to 28 days as specified in Appendix A.**

Response 21: The text will be revised to indicate 28 days.

Comment 22: **<u>Page 9-5, ¶3, Section 9.3.</u> Please see General Comment #4 regarding the applicability of using an acute exposure period to assess potential impacts to aquatic invertebrates.**

Response 22: General Comment No. 4 refers to terrestrial invertebrates, not aquatic invertebrates. Please see response to General Comment No. 5 with regard to aquatic invertebrate toxicity testing.

Comment 23: **<u>Page 9-9, ¶4, Section 9.3.</u> A Biological Condition Category will be assigned to each benthic invertebrate sampling station based on a comparison with the reference station score. It is unclear whether the proposed sampling locations are located within stream sections containing intermittent or perennial surface water flows. It is important that the reference station have similar hydrological conditions as the proposed sampling stations within the South Branch and Ingrams Creek tributaries. Please provide additional text that clarifies sampling location conditions between site sampling stations and the reference sampling station(s).**

Response 23: The commenter is correct in stating that it is critical that the reference station have similar hydrological conditions as the site sampling stations. The fourth paragraph in Section 9.3 stresses this point. All of the sampling locations (both reference and on-site) will be on sections of Ingram Creek and South Branch of Cane Creek (and their tributaries) that are perennial in nature. This will be added to the text.

Comment 24: **<u>Page 9-9, ¶1, Section 9.3.</u> The Family Biotic Index (FBI) results presented in the text table only refers to organic pollution. Please provide additional text that discusses how the FBI relates to contamination by metals.**

Response 24: The Family Biotic Index (FBI), or Hilsenhoff Biotic Index (HBI), was originally developed by Hilsenhoff to ascertain the tolerance of benthic arthropods to organic pollutants and was not specifically developed for metals. However, the FBI has applicability to inorganic pollutants as it has been used successfully to indicate other forms of pollution (Resh and Jackson, 1993). The California Department of Fish and Game, in reference to the FBI, states that the FBI was originally designed to serve as a measure of community tolerance to organic pollution in Wisconsin streams, but is commonly used as a general index of pollution tolerance. Furthermore, Barbour, et al.(1995) state that "tolerance is generally non-specific to the type of stressor." The FBI has a long history of use as an indicator of both organic and inorganic pollution and is an appropriate metric for use at FTMC in combination with the other metrics proposed for use in the RBPII assessment.

Comment 25: <u>Page 10-1, Section 10.1.</u> **This section must include details on the data validation which will be performed, as indicated in the section title, Data Analysis and Validation. Currently, the section only addresses data analysis. Please address.**

Response 25: A statement will be included in Section 10.1 indicating that data validation will be conducted in accordance with the Installation Wide Sampling and Analysis Plan (IT, 2002).

Comment 26: <u>Page 10-1, ¶4, Section 10.1.</u> **Please see General Comment #2 regarding lead and phytotoxicity. The Department recommends that sample data regarding soil organic matter and cation exchange capacity also be collected and used in the comparison of toxicity results (e.g., correlation analysis). Please address.**

Response 26: General Comment No. 2 refers to the statistical tests used in background comparisons, not lead phytotoxicity. Please see response to General Comment No. 3 regarding soil properties and their affects on plant toxicity test results.

Comment 27: <u>Appendix A, Page A-3, Section 3.4.</u> **It is unclear if the field and analytical Quality Assurance/Quality Control (QA/QC) which will be associated with the Target Analyte List (TAL) metals analyses of earthworm tissue was addressed in the installation-wide sampling and analysis plan as it was for chemical analyses of soil samples. If not addressed in this document, please address the required quantitation limits, criteria for all field and laboratory QC measurements, and required analytical methods for the earthworm samples in this Appendix.**

Response 27: The field and analytical Quality Assurance/Quality Control (QA/QC) associated with earthworm tissue samples is identical to the QA/QC for soil samples presented in the Installation Wide Sampling and Analysis Plan (IT, 2002).

Comment 28: <u>Appendix B, Table B-2.</u> **It is unclear if the field and analytical QA/QC which will be associated with the TAL metals and pesticide analyses of chironomid tissue was addressed in the installation-wide sampling and analysis plan as it was for chemical analyses of sediment samples. If not addressed in this document, please address the required quantitation limits, criteria for all field and laboratory QC measurements, and required analytical methods for the chironomid tissue samples in this Appendix.**

Response 28: The field and analytical Quality Assurance/Quality Control (QA/QC) associated with chironomid tissue samples is identical to the QA/QC for sediment samples presented in the Installation Wide Sampling and Analysis Plan (IT, 2002).

Comment 29: **<u>Appendix A, Table A-1.</u> The table states that Polychlorinated biphenyls (PCBs) will be analyzed by method 8082. However, method 8082 covers the analysis of PCB Aroclors or PCB congeners. Please clarify the required analyte list for PCBs. If PCB Aroclor analysis is being used, please justify based on the age of the contamination and potential weathering effects.**

Response 29: PCBs have not been detected at the BBGR ranges and have not been identified as COPECs at the BBGR ranges; therefore, the chemical analysis of soils will not include the analysis of PCBs. Table A-1 will be revised accordingly.

Comment 30: **<u>Appendix B, Table B-1.</u> The table states that PCBs will be analyzed by method 8082. However, method 8082 covers the analysis of PCB Aroclors or PCB congeners. Please clarify the required analyte list for PCBs. If PCB Aroclor analysis is being used, please justify based on the age of the contamination and potential weathering effects.**

Response 30: PCBs have not been detected at the BBGR ranges and have not been identified as COPECs at the BBGR ranges; therefore, the chemical analysis of sediments will not include the analysis of PCBs. Table B-1 will be revised accordingly.

References

ASTM, 1998. Standard Guide for Conducting Laboratory Soil Toxicity or Bioaccumulation Tests with the Lumbricid Earthworm *Eisenia fetida*. ***American Society for Testing and Materials***, West Conshohocken, PA.

Belfroid, A., M. Van Den Berg, W. Seinen, J. Hermens, and K. Van Gestel, 1995. Uptake, Bioavailability, and Elimination of Hydrophobic Compounds in Earthworms (*Eisenia andrei*) in Field-Contaminated Soil. ***Environmental Toxicology and Chemistry***, Vol. 14, No. 4, pp. 605-612.

USEPA, 1996. Ecological Effects Test Guidelines. OPPTS 850.6200 Earthworm Subchronic Toxicity Test. Office of Prevention, Pesticides, and Toxic Substances, Washington, DC. EPA 712-C-96-167.

U.S. ENVIRONMENTAL PROTECTION AGENCY COMMENTS

Response To Environmental Protection Agency Comments on the Draft Baseline Ecological Risk Assessment Problem Formulation and Study Design for Baby Bains Gap Road Ranges

Comments from Doyle Brittain, Remedial Project Manager, dated May 4, 2006.

GENERAL COMMENTS

Comment 1: **The Baseline Problem Formulation (BRF) began with the refinement of COPECs. EPA agrees with the conclusions of the COPEC refinement. Moreover, the text provided a thorough rationale for decisions. Overall, this was an excellent report.**

Response 1: The Army appreciates EPA's comment. No response is necessary.

Comment 2. **The assessment endpoints, measurement endpoints, and risk questions are adequate. We might consider adding questions regarding comparison of media concentrations with benchmarks, such as:**

1. **Are the levels of contaminants in surface soil from the Baby Bains Gap Road Ranges greater than benchmarks for the survival or growth of terrestrial plants or terrestrial invertebrates?**

2. **Are the levels of contaminants in sediments from South Branch of Cane Creek and Ingram Creek greater than benchmarks for the survival, growth, or reproduction of aquatic invertebrates?**

3. **Soil and sediment chemistry data will be collected in conjunction with the toxicity tests. That data could be screened, not so much for the purpose of determining COPECs but to use the concentration relative to benchmark as a guide in interpreting the toxicity test results. This information might help identify a toxic constituent within a mixture.**

Response 2: Additional risk hypotheses and measurement endpoints will be added to the revised Problem Formulation and Study Design report to include comparisons of measured concentrations of COPECs in soil and sediment to applicable screening criteria.

Comment 3: **The literature estimates of COPEC accumulation into vegetation can be conservative. Consider collection of site vegetation for analysis of metals to get a site-specific estimate of metals accumulation. Past experience with the RI Report for the Iron Mountain Road Ranges has indicated the following ecologically-driven cleanup goals for surface soil. (See table below.) EPA has made a column next to each acceptable soil concentration to indicate the percentage of the risk that was due to the**

assumed exposure to COPECs in vegetation for herbivores and omnivores. It might be assumed that the cleanup goal could be affected by a better estimate of accumulation in plants for those COPECs having high percentages. The sampling could be designed on a concentration gradient.

Adapted from Table on Page 7-10 of Draft RI Report for Iron Mountain Road Ranges, April 2004.

	Acceptable Soil Concentration Based on NOAEL TRV (mg/kg)	**Acceptable Soil Concentration Based on LOAEL TRV (mg/kg)**	**Percentage of Risk Attributed to Terrestrial Vegetation**
White-Footed Mouse:			
Antimony	5.07	50.7	89
Copper	265	340	96
Lead	1,405	14,050	86
Zinc	3,000	92,000	17
American Robin:			
Antimony	4.08	20.4	62
Copper	1,150	1,515	83
Lead	539	1,585	54
Zinc	12,200	122,000	4
Short-tailed Shrew:			
Antimony	6.07	60.7	11
Copper	770	987	28
Lead	2,190	21,900	14
Zinc	564	17,350	<1
American Woodcock:			
Antimony	13.2	66	19
Copper	6,280	8,260	44
Lead	2,210	6,470	21
Zinc	19,200	192,000	1

Response 3: Analysis of plant tissues will be added to the revised Problem Formulation and Study Design report. Plants will be collected from the same locations as the

soil samples used for earthworm and plant toxicity testing. Collecting plants from the same locations as the soil samples will ensure that a broad spectrum of COPEC soil concentrations will be assessed and incorporated into the analysis. Only the above-ground portions of the plants will be sampled since most herbivores and omnivores only eat the above-ground portion of the plant. An attempt will be made to collect grass species since the toxicity testing will be conducted with a grass species, and collecting a similar species will allow for inferences to be made regarding plant bioaccumulation and potential toxic responses.

SPECIFIC COMMENTS

Comment 4: *Section 2.0, Identification of Constituents of Potential Concern, Page 2-2.* **Text refers to the slippage test. Since the project team has discontinued use of the slippage test and is now using the hot measurement test, please provide clarification and changes to text as necessary.**

Response 4: The SLERA for the BBGR ranges was completed in August 2004. At that time, the slippage test was one of the statistical tests (in conjunction with the WRS test) used in the second tier of the three-tiered background comparison protocol. In March 2005 the slippage test was eliminated and replaced by the hot measurement test in the second tier of the background screening protocol. Because the SLERA for the BBGR ranges was completed before the background screening protocol was revised, the background screening for the BBGR range SLERA was not revised retrospectively. A qualitative assessment of the data indicates that use of the hot measurement test in lieu of the slippage test in the background screening protocol would not affect the identification of COPECs at the BBGR ranges. Therefore, no changes will be made to the SLERA or the Problem Formulation and Study Design report with regard to COPEC identification.

Comment 5: *Section 7.3.2, Aquatic Measurement Endpoints, Page 7-16.* **The comparison of calculated daily doses for the riparian insectivorous mammal and invertivorous bird are planned to use modeled tissue concentrations of COPECs in emergent benthic invertebrates. Since the tissues of chironomids exposed to site sediments will be analyzed for COPECs, why not to use those concentrations in the evaluation of the riparian insectivorous mammal and invertivorous bird instead of modeled concentrations? The modeled concentrations might be conservative relative to site-specific information. The chironomids from the laboratory test will not be the same as emergent insects, who shed an exoskeleton; but they might be more realistic for this site. At least the two estimates could be compared.**

Response 5: As presented in the Problem Formulation and Study Design report, the measured COPEC concentrations in chironomid tissues and in whole sediment samples will be used to estimate biota-to-sediment accumulation factors (BSAF) to be used in the riparian food web model. The text will be revised to indicate that measured COPEC concentrations in chironomid tissues will also be used as input to the riparian food web model to provide a comparison of modeled versus measured emergent benthic invertebrate tissue concentrations and their effects on the total dosage of COPECs potentially received by the riparian feeding guilds assessed in the food web model.

Comment 6: **Appendix A, Field Sampling and Analysis Plan for Surface Soil at the Baby Bains Gap Road Ranges, Page A-4. According to the text the earthworm test will have five replicates. Using the past experience with conducting this test at Bains Gap and Iron Mountain Road Ranges, are five replicates enough? Please use the past performance of the test to estimate the number of replicates to achieve the power of 80 percent (beta=0.2) and alpha = 0.05. Please check the estimated number of replicates needed to achieve power against the five planned using formulas in the appendix to EPA's Data Quality Objectives Guidance (USEPA 2000).**

Response 6: The planned earthworm toxicity test data for the Baby Bains Gap Road ranges will be compared to reference data via comparison of means. Evaluation of the existing 28-day earthworm survival and weight-change data from the Bains Gap Road and Iron Mountan Road ranges BERA data sets suggests that five replicates are sufficient for this purpose. The valid number of replicates was calculated using the following equation (Provost, 1984):

$$n = \left(\frac{Z_p^2 \, S^2}{E^2} \right)$$

where:

n = Number of samples required to accurately calculate the mean;
Z_p = Percentile of the standard normal distribution at the confidence level of interest. For an upper one-sided 95 percent confidence level (α = 0.05), Z_p = 1.645;
S = Standard deviation of each set of replicates; and
E = Allowable uncertainty that can be tolerated in the calculation of the mean. E is provided in the same units as S.

The appropriate number of samples (replicates) is a function of the desired level of confidence, the extent of allowable uncertainty, and the variability of the population being sampled. The higher the level of confidence and the higher the variability of the population being sampled, the larger the required sample size. The lower the level of uncertainty that can be tolerated, the higher the number of samples. The allowable uncertainty is a function of the difference between the sample results and the reference results. If the sample results are very close to the reference results, then a high degree of certainty (low value of *E*) is required to confidently determine if the site results are above or below the reference results. Alternatively, if the site results are distinctly different than the reference results, then a higher degree of uncertainty is allowable (higher value of *E*) while maintaining the ability to confidently determine if the site results are the same as or different from the reference results. The uncertainty used in this evaluation is based on the difference between the site and reference means.

The reference data for weight change and survival are provided in Tables 1 and 2, respectively, and the existing site weight-change data and site survival data are provided in Tables 3 and 4. Applying the survivability data to the above equation (at a significance level of 0.05) results in a range of valid *n*, depending on the difference between the site sample results versus the reference samples. For instance, site sample RW0002 had a zero percent survival rate, compared to a reference rate of 99.2. With such a clear difference between results, very few replicates are required. Application of the above equation yielded a valid *n* of 1, so no additional replicates are needed to confidently conclude that the site and reference results are significantly different.

In samples where the site results approach the reference results, a few more replicates are required. For instance, for site sample RW0017, the survival rate was 65.6 (+/- 39.1) percent. A comparison of these results with the reference survival rate requires four replicates to confidently conclude that the results are significantly different at a confidence level of 95 percent.

If the site results are very close to the reference results, then from a purely statistical standpoint, the valid *n* can reach a very high value because the *E* term in the above equation (calculated as the difference between the average site and reference result) is squared. An example of this is site sample RW0014, which has a mean survival rate of 98 (+/- 4.47) compared with a reference survival rate of 99.2 percent. Application of the above equation to these results yields a valid *n* of 38. However, an examination of these results along with their uncertainties concludes that there is no significant difference between the site and reference survivabilities, and additional replicates would probably not change this conclusion.

For the full set of results, applying the above equation (significance level of 0.05) to the weight-change data results in a median *n* of 2 and mean *n* of 8 (Table 3). Applying the survival data to the above equation results in a median *n* of 1 and mean *n* of 9 (Table 4). The five replicates proposed in the sampling and analysis plan in most cases exceed this range of valid replicates and are therefore determined to be sufficient for detecting differences between the site and reference data.

Reference

Provost, L., 1984, "Statistical Methods in Environmental Sampling," in *Environmental Sampling for Hazardous Wastes*, Edited by G. E. Schweitzer and J. A. Santolucito, ACS Symposium Series No. 267, American Chemical Society, Washington, D.C.

Table 1. Reference Data for Earthworm Weight Change (grams)

Sample ID	Replicate 1	Replicate 2	Replicate 3	Replicate 4	Replicate 5	Mean
RW0007ref	0.139	0.124	0.183	0.198	0.791	0.287
RW0008ref	0.428	0.541	0.388	0.563	0.031	0.390
RW0009ref	0.541	0.750	0.824	1.275	0.752	0.828
RW0016ref	0.642	0.723	0.452	0.777	0.643	0.647
RW0023ref	0.692	0.647	0.690	0.336	0.574	0.588
					Mean of Reference Samples =	**0.548**

Table 2. Reference Data for Earthworm Survival (percent)

Sample ID	Replicate 1	Replicate 2	Replicate 3	Replicate 4	Replicate 5	Mean
RW0007ref	100	100	100	100	90	98
RW0008ref	100	100	100	100	100	100
RW0009ref	100	100	100	100	100	100
RW0016ref	100	90	100	100	100	98
RW0023ref	100	100	100	100	100	100
					Mean of Reference Samples =	**99.2**

Table 3. Valid *n* Based on Earthworm Weight Change (grams)

Sample ID	Replicate 1	Replicate 2	Replicate 3	Replicate 4	Replicate 5	S	Mean	Reference Mean	E	Valid *n*
RW0001	3.111	3.335	2.891	3.518	3.959	0.408	3.363	0.548	-2.81	1
RW0004	2.117	2.110	1.896	1.497	1.865	0.252	1.897	0.548	-1.35	1
RW0005	2.253	1.974	1.588	1.674	2.474	0.376	1.993	0.548	-1.44	1
RW0006	0.809	0.820	0.843	0.966	0.828	0.064	0.853	0.548	-0.31	1
RW0014	0.337	0.508	0.525	1.241	1.125	0.407	0.747	0.548	-0.20	12
RW0015	0.911	0.469	0.675	0.948	1.102	0.249	0.821	0.548	-0.27	3
RW0017	4.245	1.388	1.971	3.315	1.741	1.204	2.532	0.548	-1.98	1
RW0021	1.937	1.219	0.969	1.429	1.362	0.356	1.383	0.548	-0.84	1
RW0022	0.773	0.378	0.615	0.308	0.981	0.278	0.611	0.548	-0.06	53
RW0024	0.872	0.629	0.848	0.656	0.609	0.127	0.723	0.548	-0.17	2
RW0025	0.318	0.485	0.926	0.782	0.773	0.248	0.657	0.548	-0.11	15
RW0026	0.818	0.969	0.388	0.831	0.658	0.222	0.733	0.548	-0.18	4

Mean Valid *n* = 8
Median Valid *n* = 2

Table 4. Valid *n* Based on Earthworm Survival (percent)

Sample ID	Replicate 1	Replicate 2	Replicate 3	Replicate 4	Replicate 5	S	Mean	Reference Mean	E	Valid *n*
RW0001	40	40	30	10	0	18.2	24	99.2	75.2	1
RW0002	0	0	0	0	0	0	0	99.2	99.2	1
RW0004	100	90	90	100	100	5.48	96	99.2	3.2	8
RW0005	80	70	90	100	70	13.0	82	99.2	17.2	2
RW0006	100	100	100	100	100	0	100	99.2	-0.8	1
RW0010	0	0	0	0	0	0	0	99.2	99.2	1
RW0012	0	0	0	10	0	4.47	2	99.2	97.2	1
RW0013	0	0	0	0	0	0	0	99.2	99.2	1
RW0014	100	100	100	90	100	4.47	98	99.2	1.2	38
RW0015	100	100	100	100	100	0	100	99.2	-0.8	1
RW0017	18	100	80	30	100	39.1	65.6	99.2	33.6	4
RW0018	0	0	0	0	0	0	0	99.2	99.2	1
RW0019	0	0	0	0	8	3.58	1.6	99.2	97.6	1
RW0021	90	100	100	90	100	5.48	96	99.2	3.2	8
RW0022	100	90	100	100	91	5.22	96.2	99.2	3.0	9
RW0024	90	100	100	100	100	4.47	98	99.2	1.2	38
RW0025	100	100	100	100	100	0	100	99.2	-0.8	1
RW0026	100	90	100	100	100	4.47	98	99.2	1.2	38

Mean Valid *n* = 9
Median Valid *n* = 1

REFERENCE:

USEPA 2000. Guidance for the Data Quality Objectives Process
EPA QA/G-4, U.S. Environmental Protection Agency, Office of Environmental Information, Washington DC. EPA/600/R-96/055. August 2000.

U.S. FISH AND WILDLIFE SERVICE COMMENTS

Response To U.S. Fish and Wildlife Service Comments on the Baseline Ecological Risk Assessment Problem Formulation and Study Design for the Baby Bains Gap Road Ranges

General Comments

Comment 1: **Overall, the BERA is well reasoned and well constructed. We compliment you on a job well done.**

While we recognize that the BERA is designed to identify and characterize ecological risk, we are also concerned about future liability that the Fish and Wildlife Service could assume in regard to contamination at this and other sites. We, therefore, ask that potential long-term liability to the Service be considered in subsequent remedial planning documents in cases where ecological risk does not merit further remediation, but other State or Federal regulatory requirement might require future corrective action.

The degradation of downstream water bodies resulting from the transport and deposition of site contaminants is a concern. The mobilization and transport of such contaminant would likely occur during heavy rains and runoff events. We recommend an evaluation of contaminant transport potential in the revised BERA or subsequent remedial planning documents.

The BERA does not appear to appropriately consider ecological risk associated with the ingestion of lead fragments. We recognize that risks associated with lead fragment ingestion have been considered in other Ft. McClellan remedial documents. We assume that remedial criteria for lead fragments will be applied to the Baby Bains Gap Road Ranges.

Response 1: Potential fate and transport mechanisms are discussed qualitatively in the *Draft Problem Formulation and Study Design for the Baby Bains Gap Road Ranges* (Shaw, January 2006). Additionally, surface water and sediment samples were collected both upstream and downstream of the BBGR Ranges as part of the remedial investigation at the BBGR Ranges. These surface water and sediment samples were located to determine if site-related constituents have been transported from the ranges to the nearby surface water bodies. Based on the results of the remedial investigation, localized transport of several constituents into nearby water bodies may have occurred, but widespread contamination of the local water bodies is not evident. The studies described in the *Draft Problem Formulation and Study Design for the Baby Bains Gap Road Ranges* (Shaw, January 2006) have been designed to assess the potential impacts to the local aquatic and riparian communities due to the presence of these localized areas of sediment contamination.

Ingestion of lead fragments by birds is not addressed in the *Draft Problem Formulation and Study Design for the Baby Bains Gap Road Ranges* (Shaw, January 2006) because no new studies are being conducted specifically at the BBGR Ranges. Ingestion of lead fragments by birds will be addressed in the BERA by utilizing the soil particle size data collected at the Iron Mountain Road (IMR) and Bains Gap Road (BGR) Ranges and the actual areas of the BBGR Ranges to estimate potential risks to birds and also estimate protective levels of lead particles in soil.

Specific Comments

Comment 2: **2.1 COPECs in Surface Soil. We support the selection or COPECs for soil.**

Response 2: Comment noted.

Comment 3: **COPECs in Surface Water. This section indicates that no COPECs were detected at elevated concentrations in surface water from the South Branch of Cane Creek or Ingram Creek tributaries. However, Table 2-7 indicates that only one water sample was collected. No information is given on the conditions under which the sample was collected. We recommend expanding this section to include a brief discussion of whether sample collection was sufficient to identify potential risks to the perennial creek on Range 23 or downstream perennial streams. The potential for future violations of water quality standards should also be addressed.**

Response 3: One surface water sample was collected from the South Branch of Cane Creek and its tributaries (Table 2-7 in the *Draft Problem Formulation and Study Design for the Baby Bains Gap Road Ranges*) and nine surface water samples were collected from Ingram Creek and its tributaries (Table 2-8 in the *Draft Problem Formulation and Study Design for the Baby Bains Gap Road Ranges*). One sediment sample was collected from the South Branch of Cane Creek and its tributaries (Table 2-9 in the *Draft Problem Formulation and Study Design for the Baby Bains Gap Road Ranges*) and nine sediment samples were collected from Ingram Creek and its tributaries (Table 2-10 in the *Draft Problem Formulation and Study Design for the Baby Bains Gap Road Ranges*). Specifically, six surface water and six sediment samples were collected on or adjacent to Range 23. No COPECs were identified in any of the surface water samples collected in conjunction with the RI at the BBGR Ranges. Since COPECs were identified in sediment samples collected in conjunction with the RI at the BBGR Ranges, additional analyses will be conducted on sediment and benthic invertebrates in the BERA as discussed in the *Draft Problem Formulation and Study Design for the Baby Bains Gap Road Ranges* (Shaw, January 2006). Since no COPECs were identified in surface water at the BBGR Ranges, no future violations of water quality standards are anticipated.

Comment 4: **<u>2.3 COPECs in Sediment</u>. We support the selection of COPECs for sediment.**

Response 4: Comment noted.

Comment 5: **<u>2.3 COPECs in Groundwater</u>. We agree that organic constituents detected at concentrations of concern in groundwater are unlikely to represent ecological risk. However, the detection of these constituents in one well demonstrates localized groundwater contamination. Because these constituents have a low solubility in water, groundwater contamination may suggest localized soil contamination. As addressed in the general comments, we are concerned about future liability of contaminated groundwater and possibly subsurface soil. We, therefore, ask that potential long-term liability to the Service be considered in subsequent remedial planning documents.**

Response 5: The subject document (*Draft Problem Formulation and Study Design for the Baby Bains Gap Road Ranges* [Shaw, January 2006]) addresses potential ecological risks only. Ecological exposures to subsurface soil are generally considered incomplete and are not addressed in this document or most other ecological risk assessments. Although ecological exposures to groundwater are also generally considered incomplete, the potential exists that groundwater could discharge to surface water bodies and ecological exposures could occur at the groundwater-surface water interface. For this reason, groundwater was addressed in the SLERA for the BBGR Ranges (Shaw, August 2004). No COPECs were identified in the groundwater at the BBGR Ranges; therefore, no further ecological assessment of groundwater is warranted. If remedial action is warranted for subsurface soil or groundwater at the BBGR ranges, long-term impacts of contaminants in subsurface soil and/or groundwater will be considered in the feasibility study.

Comment 6: **<u>4.3 Fate and Transport in Sediment</u>. This section indicates a high potential for sediment entering the ephemeral streams to be mobilized and transported off site. We are concerned with potential risks to aquatic exosystems occurring downstream of the ranges. We recommend expanding this section to include an evaluation of contaminant transport under various stream flow and runoff conditions. If available, information on downstream water, sediment, and habitat quality that may have been collected for remedial investigations at other Ft. McClellan sites downstream of the Baby Bains Gap Road Ranges could be useful in this evaluation.**

Response 6: Please see response to Specific Comment 2.2, COPECs in Surface Water.

Comment 7: **<u>6.0 Complete Exposure Pathways</u>. We agree with the assessment of completed exposure pathways. However, we remain concerned about the ingestion of lead fragments represents a significant risk to birds. As indicated above, we recognize your efforts to address the risks associated**

with lead fragment ingestion. We assume that this pathway and measures to reduce associated risks will be appropriately considered in subsequent remedial planning documents.

Response 7: Please see response to General Comments.

Comment 8: **7.1.1 Terrestrial Assessment Endpoints. We concur with the selection of terrestrial assessment endpoints.**

Response 8: Comment noted.

Comment 9: **7.1.2 Aquatic Assessment Endpoint. Due to the limited perennial aquatic habitat on the ranges, we agree with the selection of aquatic assessment endpoints. However, as indicated previously, we are also concerned with potential for downstream contaminant transport to contribute to risks to aquatic ecosystems downstream of the ranges. Have previous BRAC assessment efforts evaluated water, sediment, and habitat quality in perennial reaches of Cane and Ingram Creeks downstream of the ranges? If not, are there plans to assess these areas?**

Response 9: Cane Creek and Ingram Creek have been investigated extensively in conjunction with numerous other site investigation and remedial investigation efforts at FTMC. Potential ecological risks associated with constituents detected in surface water and/or sediment at these other parcels have been evaluated and discussed in relation to the specific parcels with which they are associated and the associated risks have been presented in the respective site investigation or remedial investigation reports. Potential risks from sediment COPECs at the BBGR ranges will be evaluated as described in the *Draft Problem Formulation and Study Design for the Baby Bains Gap Road Ranges* (Shaw, January 2006).

Comment 10: **7.2 Risk Hypothesis. We concur with the selection of terrestrial and aquatic risk hypotheses.**

Response 10: Comment noted.

Comment 11: **7.3.1 Terrestrial Measurement Endpoints. The proposed plant toxicity testing (i.e., comparison of germination success, biomass, root length, etc.) focuses on perennial ryegrass as a test species. Please provide a discussion of how applicable the result of this testing will be to desired native plant communities (longleaf pine forests)?**

Response 11: Perennial ryegrass (*Lolium perenne*) was selected as the terrestrial plant test species because it has been used extensively in the past for this purpose and there is a relatively robust database for toxic effects on ryegrass caused by different toxicants. The test methods for perennial ryegrass have been calibrated and standardized. Most test species routinely used for plant toxicity testing are limited to agronomic plants. The use of native species (e.g.

longleaf pine) in a plant toxicity test rather than commercially selected plants introduces a considerable amount of uncertainty into the test due to the fact that native seeds need to be sized and sorted after collection, native seed germination rates are highly variable, the point during the growing season during which the native seeds were collected affects the germination rate, and a number of other factors. In ecological and human health risk assessment, it is routinely accepted that surrogate species are used to assess the potential risks to other, similar target species. In human health risk assessment, toxic responses to chemicals observed in mice and rats are routinely used to derive carcinogenic slope factors and non-carcinogenic reference doses which are applied to human exposures. Likewise, in ecological risk assessment, toxic responses measured in a certain species (e.g. rat) are used to assess exposures to all similar species (e.g. all small mammals). The use of perennial ryegrass as a surrogate species for all terrestrial plant species has significant precedent in ecological risk assessment and is a common practice for assessing risks to terrestrial plants. Although the relative sensitivities of ryegrass and longleaf pine to the COPECs at the BBGR Ranges is unknown, the results of the plant toxicity test will provide an indication of whether the COPECs in soil have the potential to pose adverse effects to terrestrial plants at the BBGR Ranges.

Comment 12: **7.3.2 Aquatic Measurement Endpoints. We recommend adding a fourth measurement endpoint that compares contaminant concentrations in site sediment to appropriate sediment quality guidelines.**

Response 12: The following measurement endpoint has been added to the *Draft Problem Formulation and Study Design for the Baby Bains Gap Road Ranges*:

"Comparison of COPEC concentrations in sediment from the South Branch of Cane Creek and Ingram Creek and their tributaries at the BBGR Ranges to ecological benchmarks for the survival or growth of aquatic benthic invertebrates."

Comment 13: **9.2 Aquatic Study Design. The section indicates that a sediment sample collected from a stream outside the influence of the BBGR Ranges will be used as a reference in toxicity testing. We strongly encourage selection of a reference stream that outside of the influence of other potentially contaminated sites on Ft. McClellan.**

Response 13: The reference stream will be located outside the influence of the BBGR Ranges and other site-related contaminant sources at FTMC.