Response to ADEM Evaluations of Army Responses to ADEM Comments on the Baseline Ecological Risk Assessment for the Baby Bains Gap Road Ranges, Draft, Revision 1 (dated November 2010) Fort McClellan, Alabama

Comments received from Stephen A. Cobb, Chief – Governmental Hazardous Waste Branch, in a letter dated December 9, 2011.

"The Alabama Department of Environmental Management (ADEM or the Department) has reviewed the Army's Responses to ADEM comments on the Draft, Revision 1 *Baseline Ecological Risk Assessment (BERA) for the Baby Bains Gap Road Ranges.* The following comments have been adequately addressed and will be resolved after the Department approves the revised text to be included in the finalized document, which will be modified according to the Army's responses to ADEM's respective comments:

General Comments: 1, 3, and 5
Specific Comments: 2, 9, 10, 13, 15, 17, 18, 19, 21, and 22.

Additionally, the following comments: 1, 3-7, 12, 14, 16, and 20 have been adequately addressed and resolved in the Comment-Response evaluations.

ADEM evaluations are attached for your review and response."

Informal technical evaluation of responses to comments received from Kaneshia Townsend, ADEM, via e-mail on 1/30/12.

General Comments

Comment 2: **Assessment of Potential Phytotoxicity of Barren Soils. Many areas of bare soil were reported in the habitat descriptions for Ranges 18, 20, 23, 25, and 26. Army's responses to U.S. Army Center for Health Promotion and Preventive Medicine (CHPPM) General Comment 1 and Specific Comment 3 also stated that some areas of the BBGR Ranges are "completely denuded". However, a discussion regarding the likely causes for the barren soils was not included. The Revised BERA did not evaluate contaminant levels in barren soils with regard to potential soil phytotoxicity as a possible cause of unvegetated areas. The BERA does not assess/illustrate any spatial correlation among barren soil areas, samples with maximum COPEC concentrations, potentially phytotoxic levels of COPECs in soil (i.e., metals exceeding plant ESVs), and evidence of phytotoxicity in the rye grass tests. Please identify any soil samples collected from barren areas and discuss any apparent spatial correlation between bare soils and observed or potential phytotoxicity. If barren soils were not sampled, ADEM requests that supplemental sampling be conducted to further assess potential reasons for the lack of vegetation from these large areas.**

Response 2: Barren soils at the BBGR Ranges may be the result of several factors. Native soils at FTMC are generally shallow and very low in organic nutrients. Routine maintenance activities at the BBGR Ranges involved the cutting and removal of vegetation, and the re-grading of soils periodically to reduce the density of spent bullets and bullet fragments on the soil surface. These routine maintenance activities significantly reduced the soils' ability to support vegetative communities. The steep slopes and natural erosional processes on some of the target berms also act to remove topsoil necessary for vegetation growth. Additionally, COPEC concentrations in surface soils at the locations of targets and target berms may be sufficiently high to cause phytotoxicity. However, as presented in subsequent comment responses, there does not appear to be any clear correlation between phytotoxic effects and COPEC concentrations in surface soils. Spatial correlation between COPEC concentrations and barren soil was not a DQO for this BERA.

ADEM Evaluation: *Please identify any soil samples collected from barren areas and discuss any apparent correlations between these areas and observed/potential phytotoxicity. If barren soils were not sampled, ADEM requests that supplemental sampling be conducted to evaluate potential causes for the lack of vegetation in barren areas not located in target berms.*

Response to ADEM's Evaluation of Army's Response to General Comment 2:

In order to identify soil samples that were collected from areas exhibiting barren soil, maps showing sample locations and aerial photographs were analyzed and samples that were collected from easily discernable barren areas were identified. A total of 34 surface soil samples were identified as being collected from areas exhibiting barren soils. A summary of the COPECs detected in these surface soil samples is presented in Table 1. Based on existing data from the Baby Bains Gap Road Ranges, it is impossible to make specific correlations between COPEC concentrations in soil and potential phytotoxicity. There are barren areas where COPEC concentrations do not exceed their respective apparent effects thresholds (AETs), and there are vegetated areas where COPEC concentrations exceed their respective AETs. For example, the following surface soil samples were collected from barren soil areas, but the detected COPEC concentrations were all less than their respective AETs:

Range 18:	HR-74Q-GP44
	HR-74Q-GP45
Range 20:	HR-76Q-GP05
	HR-76Q-GP06
Range 23:	HR-79Q-SS13
Range 25:	HR-83Q-GP34
Range 26:	HR-84Q-GP09
	HR-84Q-SB04
	HR-84Q-SB01

These results corroborate the results of the plant toxicity tests which showed very weak correlations between COPEC concentrations in surface soil and observed adverse effects in perennial rye grass germination and growth. As stated in the BBGR Ranges BERA and responses to previous comments, the areas of barren soil at the BBGR Ranges may be present as the result of multiple factors, including physical disturbance, lack of surface soil for plant sustainability, steep slopes subject to erosion, and COPEC concentrations at phytotoxic levels. The information provided in this response was added at the end of Section 6.1.2 of the revised BERA, along with new Table 6-7a.

ADEM Evaluation of Army's Response: Response acceptable.

Comment 4: **<u>Bioavailability Considerations for Plant and Earthworm Toxicity Test Results</u>. Because one or more COPECs in several soil samples exceeded plant and/or soil invertebrate EcoSSLs or ORNL ESVs (Efroymson et al., 1997a & b), the potential influence of bioavailability on the test results is a significant uncertainty consideration. It is noted that some of these samples had no significant effect on the test organisms. Rye grass effects occurred in some soils with COPEC exceedances of plant ESVs but not in others. Similarly, none of the soil samples had adverse effects on earthworm survival and growth, despite COPEC exceedances of soil invertebrate ESVs (e.g., antimony, copper and lead in one or more of three samples (Table 5-6). Please modify text to include information on soil pH and organic carbon content of the test samples and a discussion on the possible influence of these or other soil factors on COPEC bioavailability and toxicity test results for the rye grass and earthworms.**

Response 4: The text will be modified to include a discussion of the potential effect of pH and total organic carbon (TOC) content of the soils on the COPEC bioavailability.

ADEM Evaluation: *Please note that the Department's comment also requested that the text be modified to include a discussion of soil factors on COPEC bioavailability and toxicity test results for the rye grass and earthworms. Soil pH and total organic carbon (TOC) content represent two factors but are not inclusive of all factors that may affect bioavailability. As noted in earlier comments concerning Baby Bains Gap Road Ranges, previous studies available in the literature have demonstrated that soil properties (particularly organic carbon and cation exchange capacity) significantly affect 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 was recommended that cation exchange capacity (CEC) also be determined for each soil sample. Although the Army declined to analyze the soil samples for this parameter, the revised text should present a discussion concerning the influence of cation exchange capacity on bioavailability of metals to plants and how the absence of this factor contributes to the uncertainty of evaluating the phytotoxicity test results.*

Response to ADEM's Evaluation of Army's Response to General Comment 4:

The vast majority of the surface soil samples from the BBGR Ranges were collected and analyzed in 2002 and 2006, prior to any request for additional analyses. The ADEM-approved Remedial Investigation Work Plan and BERA Work Plan did not include cation exchange capacity as an analysis for surface soil samples. Therefore, the lack of data for this parameter remains an uncertainty. The potential influence of cation exchange capacity on bioavailability and toxicity of metals to plants was added to the existing discussion of the influence of pH and TOC on bioavailability and toxicity in the BBGR Ranges BERA.

ADEM Evaluation of Army's Response: Response acceptable.

Specific Comments

Comment 8: **Section 5.2 Results of Terrestrial Plant Chemical Analysis, page 5-3. It is noted that *"Grass species were targeted for sampling at the BBGR Ranges because the terrestrial plant toxicity tests conducted as part of this BERA utilized perennial rye grass (*Lolium perenne*) as the test species."* However, as pointed out later in this section, absence of plant tissue burden phytotoxicity thresholds undermined this rye grass testing rationale for analyzing site-derived grass tissue. Because many of the omnivorous wildlife receptors consume a higher proportion of fruits and seeds of non-grass species than foliage of grasses, please discuss the following: (a) the species and tissue types analyzed; (b) the importance of these as food items for receptors modeled; (c) how the tissue-based soil-plant BAFs compare to published BAFs (e.g., in EcoSSL guidance) for important wildlife food plant species and tissues; and (d) address the related uncertainties in the exposure dose estimate that may have resulted from using grass BAFs that differ from key plant food BAFs.**

Response 8: The rationale behind the perennial rye grass toxicity testing is sound. Plant tissue burden phytotoxicity was not a DQO for this BERA. As stated in the Problem Formulation and Study Design for the BBGR Ranges (Shaw, 2006) and reiterated in the BERA, the main DQO for the plant tissue burden analyses was to determine site-specific soil-to-plant bioaccumulation potential. Additionally, the assertion that many of the omnivorous wildlife receptors consume a higher proportion of fruits and seeds… is inaccurate. Omnivores are generally opportunistic grazers, and consume whatever is available at any given time. While omnivores may consume fruits and/or seeds preferentially when these food items are available, fruits and seeds are not available throughout the entire year and are usually only available during short periods of any given year. Therefore, omnivores' total yearly diet only consists of a small fraction of these food types when averaged over an entire year. The uncertainties associated with the site-specific soil-to-plant BAFs and their potential impact on the food web models will be discussed in the Uncertainty Analysis (Chapter 7) of the BERA. In order to maintain consistency among several BERAs previously conducted at FTMC and the derivation of Eco-RBRGs at FTMC, comparisons of site-specific BAFs and literature-derived BAFs will not be included in the BBGR BERA. Literature-derived BAFs were

specifically requested to be removed from previous FTMC reports (e.g. *Identification of Risk-Based Remedial Goals, Iron Mountain Road and Bains Gap Road Ranges* [Shaw, 2010]) and as such, will not be included in the BBGR BERA.

ADEM Evaluation: *Please note that the Department was not inquiring about the rationale behind the perennial rye grass toxicity testing. However, please provide a discussion addressing the rationale for analyzing tissues of grass species in assessing the site-specific bioaccumulation factor for plants at the BBGR rather than other vegetation that would be more likely to be consumed by omnivorous wildlife that forage at the BBGR. The revised text should provide references to support the response that omnivorous wildlife receptors consume a higher proportion of grass foliage than fruits/seeds and that only a small fraction of their diet is comprised of fruits/seeds. Depending upon the particular receptor, seeds are available and may be consumed throughout the year due to different maturation times and absence of factors necessary for germination. Grasses generally represent only a small portion of the diet for omnivorous species although they may be an important component of the diet of herbivorous species. The revised BERA should present a general discussion in the uncertainty section on how the site specific soil-to-plant bioaccumulation factors developed for the grass species analyzed may over- or underestimate potential risks to the wildlife receptors that forage at BBGR. Please address.*

Response to ADEM's Evaluation of Army's Response to Specific Comment 8:

Grass species were proposed for sampling and analysis in the BBGR Ranges Problem Formulation and Study Design (Shaw, 2006), which was reviewed and agreed to by ADEM, USEPA, and USFWS. Grass species were targeted for chemical analysis at the BBGR Ranges because the vast majority of the BBGR Ranges exhibiting site-related contamination were grass-covered throughout their active use and at the time of sampling. As such, grass species represented the most probable group of terrestrial plants that could be exposed to site-related contamination. Other types of vegetation (e.g. fruit and seed-bearing shrubs and trees) were not present at these ranges for extended periods of time, if at all, because the ranges were routinely mowed and any vegetation that could potentially obstruct targets or the line of fire were cut down and removed from the range areas as part of routine maintenance activities. Therefore, bioaccumulation of site-related contaminants in surface soil to terrestrial plant species other than grass species was largely an incomplete pathway. This rationale was added to the discussion of the results of the terrestrial plant chemical analyses and the determination of site-specific soil-to-plant bioaccumulation factors.

The BBGR Ranges BERA text does not state that omnivorous wildlife species consume a higher proportion of grass foliage than fruits/seeds; therefore, no additional references are needed.

The Uncertainty Section of the BBGR Ranges BERA currently contains a discussion of the uncertainties introduced into the terrestrial food web model from

the use of site-specific soil-to-plant bioaccumulation factors (BAFs) developed using on-site surface soil COPEC concentrations and on-site grass tissue COPEC concentrations. However, this discussion was expanded to include a discussion of how the site-specific soil-to-plant BAFs are the most appropriate BAFs for these ranges, based on the fact that the site-specific soil-to-plant BAF values were derived using on-site soil concentrations of COPECs and co-located plant tissue COPEC concentrations. The plant tissues used for the calculation of site-specific soil-to-plant BAF values were from grasses because the majority of the BBGR Ranges were covered almost exclusively with grass at the time of sampling.

ADEM Evaluation of Army's Response: Response acceptable.

Comment 11: **<u>Section 6.1.2 Terrestrial Plant Germination and Growth and Table 5-5.</u> Please include a discussion in the text regarding which, if any, of the soil samples exhibiting statistically significant effects on rye grass root or shoot growth phytotoxicity were collected from barren soil areas (e.g., LOECs for all five metals were established in sample SY0009). As requested in General Comment 2, please calculate sample-specific HQs using plant EcoSSLs and the ORNL plant ESVs (Efroymson et al, 1997a), then assess and discuss any apparent statistical correlations among growth effects and these HQs. Also, please discuss whether soil factors such as pH and carbon content may help explain the lack of growth effects of samples in terms of the relative bioavailability of COPECs that exceed plant ESVs.**

Response 11: None of the soil samples used for perennial rye grass toxicity testing were collected from barren areas. All of the soil samples for plant toxicity testing were co-located with "grass" plants that were used for plant tissue chemical analyses. Sample-specific HQs are presented in the revised Table 5-5. The correlations between phytotoxic effects and hazard quotients are the same correlations as those between phytotoxic effects and COPEC concentrations presented in Figures 6-1 through 6-15. The potential effects of soil properties such as pH and TOC on phytotoxicity are the very reason why site-specific toxicity testing is conducted, as opposed to relying on generic ecological screening values (ESVs) that do not take into account these important soil properties. Toxicity tests utilizing on-site soil incorporate all of the soil properties that affect bioavailability and subsequent toxicity of COPECs in soil and greatly reduce the uncertainty that is inherent in ESVs. The potential effects of soil pH and TOC are discussed in Section 5.3.

ADEM Evaluation: *Please see the Department's evaluation of General Comment 4.*

<u>Response to ADEM's Evaluation of Army's Response to Specific Comment 8</u>:
Please see the response to the Department's evaluation of General Comment 4.

ADEM Evaluation of Army's Response: Response acceptable.

References

ADEM 2008. Alabama Risk-Based Corrective Action Guidance. Alabama Department of Environmental Management. April.

Buchman, M.F. 2008. NOAA Screening Quick Reference Tables (SQuiRTs). NOAA Office of Response and Restoration Division, OR&R Report 08-1, Seattle, WA. 34 pp.

Efroymson, R. A., M. E. Will, G. W. Suter II, and A. C. Wooten. 1997a. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision. ORNL Report ES/ER/TM-85/R3. November 1997.

Efroymson, R. A., M. E. Will and G. W. Suter II. 1997b. Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision. ORNL Report ES/ER/TM-126/R2. November 1997.

IT Corporation (IT). 2000. Human Health and Ecological Screening Values and PAH Background Summary Report, Fort McClellan, Calhoun County, Alabama. Final, July.

MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Arch. Environ. Contam. Toxicol. 39: 20-31.

Table 1

Surface Soil Samples From Barren Soil Areas
Baby Bains Gap Road Ranges
Fort McClellan, Calhoun County, Alabama

		Sample Location																				
		Range 18								Range 20			Range 23						Range 25			
COPEC	AET (mg/kg)	HR-74Q-GP38	HR-74Q-GP42	HR-74Q-GP27	HR-74Q-GP30	HR-74Q-GP12	HR-74Q-GP09	HR-74Q-GP44	HR-74Q-GP45	HR-76Q-GP05	HR-76Q-GP06	HR-76Q-GP08	HR-79Q-GP12	HR-79Q-SS13	HR-79Q-SS14	HR-79Q-SS15	HR-79Q-SS-16	HR-79Q-SB04	HR-118Q-GP01	HR-83Q-GP33	HR-83Q-GP34	HR-83Q-GP18
		COPEC Concentrations (mg/kg)																				
Antimony	ND	NA	53.9	3.22	14.7	NA	NA	2.83	2.87	3.02	9.97	NA	NA	2.83	NA	NA	NA	NA	5.86	4.82	2.82	2.87
Beryllium	ND	NA	3.03	5.95	2.07	NA	NA	0.283	0.287	0.443	0.451	NA	NA	0.283	NA	NA	NA	NA	1.01	0.856	0.853	2.01
Copper	152	NA	1290	***39.7***	1480	NA	NA	***10.4***	***21.5***	***22.9***	***105***	NA	NA	***13.4***	NA	NA	NA	NA	***117***	***142***	***23.3***	***25.2***
Lead	146,000	***28.1***	***23300***	***213***	***8450***	***58.7***	***173***	***24.2***	***720***	***91.2***	***1230***	***1660***	***25.8***	***107***	***575***	***3850***	***1830***	***822***	***1470***	***1240***	***113***	***51.4***
Zinc	53.5	NA	348	108	399	NA	NA	***18.5***	***17.7***	***12.5***	***31***	NA	NA	***22.6***	NA	NA	NA	NA	79.6	74.9	***52.8***	58.6

		Sample Location												
		Range 26												
COPEC	AET (mg/kg)	HR-84Q-GP04	HR-84Q-GP03	HR-84Q-GP09	HR-84Q-SS13	HR-84Q-SS14	HR-84Q-SS15	HR-84Q-SS16	HR-84Q-SB04	HR-84Q-SS01	HR-84Q-SS02	HR-84Q-SS03	HR-84Q-SS04	HR-84Q-SB01
		COPEC Concentrations (mg/kg)												
Antimony	ND	NA	NA	2.77	NA	NA	NA	NA	2.72	NA	NA	NA	NA	5.48
Beryllium	ND	NA	NA	0.591	NA	NA	NA	NA	0.272	NA	NA	NA	NA	0.27
Copper	152	NA	NA	***22.9***	NA	NA	NA	NA	***21.7***	NA	NA	NA	NA	***10.6***
Lead	146,000	***44***	***51.3***	***163***	***13.8***	***54.8***	***68.1***	***3330***	***81.6***	***278***	***869***	***937***	***1140***	***113***
Zinc	53.5	NA	NA	***13.3***	NA	NA	NA	NA	***4.42***	NA	NA	NA	NA	***9.48***

Bold, italicized values indicate COPEC concentrations less than the AET.
AET - apparent effects threshold.
COPEC - constituent of potential ecological concern.
mg/kg - milligrams per kilogram.
NA - Sample not analyzed for parameter.
ND - Not determined.